FLORA AGARICINA NEERLANDICA

Critical monographs on families of agarics and boleti occurring in the Netherlands

Edited by

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With assistance of

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A. General part

B. Taxonomic part

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A
General part

CHAPTER 1

Scope, methods and presentation

C. BAS

Scope

The 'Flora agaricina neerlandica' contains keys to, correct names of, concise synonymies for, descriptions and illustrations of, and distributional data on agarics and boleti (Agaricales sensu lato and Russulales) occurring in the Netherlands. For practical reasons, the genera of so-called cyphelloid fungi are excluded.

Extralimital taxa of which occurrence in the Netherlands can be expected on account of their ecology and/or geographical distribution are included in the keys whereas a concise synonymy, references to selected descriptions and illustrations, and a short diagnostic description are given in the textual part. For various reasons a number of taxa less likely to be encountered in the Netherlands are included only in the keys merely with their author citation and one reference to the literature.

Fungi that spontaneously establish themselves in the Netherlands after human intervention (e.g. mycorrhizal symbionts of the introduced *Larix* species as *Suillus grevillei*) are considered indigenous. Hothouse fungi are not treated except some species of *Leucocoprinus* frequently found in flowerpots in houses. A strongly simplified map of the Netherlands is given in Figure 1.

Introductory chapters

For chapters on the history of agaricology in the Netherlands, ecology and distribution of agarics and boleti in the Netherlands, specific and infraspecific delimitation, generic concepts, orders and families of the agarics and boleti, and nomenclature the reader is referred to Chapters 1-6 in Volume 1 of this flora.

Descriptions

In principle all descriptions are based on observations referring to material from the Netherlands. In cases where this material is not representative, however, observations on other collections from northwestern Europe are sometimes included. Collections revised for this flora have been marked with special labels added to them.

If authentic observations, particularly on macroscopic characters are lacking, data are taken from literature, but this is then explicitly indicated with reference to the sources of information.

Spore print colours are preferably recorded with colour code notations. Unfortunately such precise records are still lacking for many taxa. Colour indications without quotation marks have been extracted from the field-notes of the collections studied; those between quotation marks are taken from literature or are based on general consensus.

Sizes of spores am measured in tenths of a µm but rounded off to halves of µm. Sizes of basidia, cystidia, and other microscopical elements are measured and given in µm, unless they are narrower or smaller than 10 µm, in which case they are treated as the spores.

Ecological and distributional data

Extensive notes on ecology and geographical distribution both within and outside the Netherlands, are given but distribution maps are not included.

Only in the cases of very rare species (five or fewer localities known in the Netherlands) are individual localities enumerated.

Frequency classes (extremely rare, very rare, rare, rather rare, moderately common, rather common, common, very common) are estimated from the number of collections from the Netherlands studied and the number of reliable references in literature.

A guidance for the estimation of the frequency classes is found in Arnolds et al. (Overzicht van de paddestoelen in Nederland. 1995, reprint 1999) and is based on numbers of quadrants of 5 × 5 km on topographic maps in which the taxa have been found.

extremely rare: 1-2 quadrants.
very rare: 3-6 quadrants.
rare: 7-17 quadrants.
rather rare: 1847 quadrants.
moderately common: 48-113 quadrants.
rather common: 114-246 quadrants.
common: 247-426 quadrants.
very common: more than 426 quadrants.

Illustrations

All species are illustrated by line-drawings of basidiocarps, spores and cystidia (if present), if necessary complemented by drawings of other microscopical characters. The magnifications of these drawings are:

basidiocarps × 1 (unless indicated otherwise)
spores × 1500
cystidia and basidia × 1000 (unless indicated otherwise)
tissues × 500 (unless indicated otherwise).

Widely dotted areas indicate the presence of a gelatinous substance. For the abbreviations used in the illustrations, see the list of abbreviations at the end of this chapter.

Formulae

For formulae of chemical reagents and stains, the reader is referred to current mycological literature (e.g. Kühner & Romagnesi, Fl. anal. Champ. sup., 1953; Moser, Röhrlinge-Blätterpilze, 5. Aufl., 1983; Singer, Agaricales mod. Taxon., Ed. 4, 1986).

Nomenclature

In nomenclatural matters, close adherence to the latest edition of the 'International Code of Botanical Nomenclature' is aimed at. For the procedures followed in cases in which the Code is not perfectly clear, particularly in connection with sanctioned names, see Vol. 1, Chapter 6.

Synonymy is not complete, but restricted to synonyms that have appeared in modern monographs, well-known floras, Dutch mycological logical literature, and popular books with a wide distribution. A similar selection is made from the misapplied and excluded names.

Fig. 1. Topographical map of the Netherlands(1-12: provinces; 1 = Groningen, 2 = Friesland, 3 = Drenthe, 4 = Overijssel, 5 = Flevoland, 6,= Gelderland, 7 = Utrecht, 8 = Noord-Holland, 9 = Zuid-Holland, 10 = Zeeland, 11 = Noord-Brabant, 12 = Limburg).

Names of pteridophytes and phanerogams mentioned are in accordance with Heukels/Van der Meiden (1996), Flora van Nederland, 22nd ed., Groningen.

New names and new taxa

New names found to be required and new taxa discovered in the course of the investigations carried out for this flora, are not published in the flora itself, but in a series of separate notes titled 'Notulae ad Floram agaricinam neerlandicam' appearing in the journal Persoonia. In these Notulae the more lengthy discussions on taxonomic and nomenclatural problems are also placed.

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LIST OF ABBREVIATIONS IN TEXT AND DRAWINGS

ad int. – ad interim
auct. – auctores (= authors)
auct. eur. – auctores europaei (= European authors)
auct. neerl. – auctores neerlandici (= Dutch authors)
Aug. – August
av. – average
cc – caulocystidia
cf. – confer(= compare)
ch – cheilocystidia
Dec. – December
descr. – description
diagn. – diagnosis
dpt. – département
emend. – emendatus (= corrected)
et al. – et alii
excl. – excluded
f. – forma
Feb. – February
Fig., fig. – Figure, figure
Figs., figs. – Figures, figures
illegit. – illegitimate
Jan. – January
K. & W. – Kornerup, A. & Wanscher, J.H., Methuen handbook of colour; Farver i farver.
l – number of lamellulae between two lamellae
L – number of lamellae
lit. – literature
loc. cit. – loco citato (= in the passage already quoted)
misappl. – misapplied
Mu. – Munsell soil color charts
nom.conserv. – nomen conservandum
nom.nud. – nomen nudum
not val. publ. – not validly published
Nov. – November
Oct. – October
pc – pileus covering
pl – pleurocystidia
pl. – plate
pp – pileipellis or elements of pileipellis
p.p. – pro parte
p.p.maj. – pro parte majore (= for the greater part)
p.p.min. – pro parte minore (for the minor part)
prov. – province
Romagn. – Romagnesi, Les Russules d'Europe (colour chart)
Q – quotient of length and width or breadth
Qav – average quotient
sect. – section
sel. – selected
sensu auct. maj. – sensu auctores majores
Sept. – September
s.l. – sensu lato (= in a wide sense)
s.str. – sensu stricto (= in a restricted sense)
subgen. – subgenus
subsect. – subsection
subsp. – subspecies
subvar. – subvariety
trib. – tribus
var. – variety
vern. – vernacular

CHAPTER 2

Glossary

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abrupt papilla – (on pileus) (Vol. 1, Fig. 29.30).
abruptly bulbous – (base of stipe) (Vol. 1, Fig. 31.18).
acanthocyte – globose, spiny element produced on the basal mycelium of some Strophariaceae.
acrophysalidic – (tissue) consisting of connective hyphae and abundant, large, terminal, inflated elements ('acrophysalides').
acuminate – (cystidia) tapering from inwardly curved sides off to a point (Vol. 1, Fig. 34.39).
acute – (cystidia) tapering off to a sharp point (Vol. 1, Fig. 34.40); – (spore apex) pointed (Vol. 1, Fig. 33.30).
acute papilla – (on pileus) (Vol. 1, Fig. 29.31).
adnate – (lamellae) broadly attached to stipe (Vol. 1, Fig. 30.21), see also narrowly adnate.
adnexed – (lamellae) rounded towards stipe (Vol. 1, Fig. 30.19).
aeriferous – (pileus and stipe surfaces) with silvery shine because of air present among superficial hyphae.
allantoid – (spores) with adaxial side concave and parallel to abaxial side (Vol. 1, Fig. 33.21).
amygdaliform – (spores) with adaxial side straight or less convex than abaxial side (Vol. 1, Figs. 33.18, 33.19).
amyloid – (spore wall, spore ornamentation, hyphal walls), staining greyish to blackish blue in Melzer's reagent.
anastomosing – (lamellae) provided with irregular transverse connections (Vol. 1, Fig. 30.4).
angiocarpy – a type of development of the basidiocarp in which at some stages the developing hymenium is situated in a closed cavity; see also primary and secondary angiocarpy.
annular belt – (stipe) remnants of partial veil in form of a girdle round (upper half of) stipe.
annulus – (stipe) ring-like structure round (apex of) stipe, formed by partial veil.
apex – (of spores) summit (Vol. 1, Fig. 32.4A).
apical – (spores) situated at the tip.
appendage – (of spores) see hilar appendage.
appendiculate – (margin of pileus) with small appendages (Vol. 1, Fig. 29.48).
applanate – (pileus) flattened, flat (Vol. 1, Figs. 29.7, 29.19).
arachnoid – (pileus and stipe surfaces or velum) cobwebby.
arcuate – (lamellae) with concave lamella edge (Vol. 1, Figs. 30.15, 30.16).
areolate-rimose – (pileus surface) marked with numerous superficial clefts or cracks forming angular patches.
ascending – (hyphae) curving upward.
aseptate – (hyphae) without septa.
auriscalpioid – (habit) shaped like *Auriscalpium* spp.: with vertical eccentric stipe and horizontal pileus.
bacilliform – (spores) Q > 3.0 (Vol. 1, Fig. 33.7).
ballistosporic basidium – a basidium that actively discharges its spores.
basidiocarp – fruitbody producing spores on basidia.
basidiole – immature basidium.
bilateral – see divergent.
binding hyphae – branching, rarely septate, thick-walled, narrow hyphae binding the other elements of a tissue together.
binucleate – with two nuclei.
bivelangiocarpy – a type of angiocarpic development of the basidiocarp in which partial and universal veil participate.
breadth – (of spore) largest distance between sides as seen from frontal view (Vol. 1, Fig. 32.2).
brevipes-type – see urticiform.
broadly clavate – (cystidia) clavate with Q < 1.5 (Vol. 1, Fig. 34.14).
broadly conical – (pileus) (Vol. 1, Fig. 29.13), see also truncately broadly conical; – (cystidia) conical with Q < 1.5 (Vol. 1, Fig. 34.18).
broadly cylindrical – (cystidia) cylindrical, with Q < 2 (Vol. 1, Fig. 34.11).
broadly ellipsoid – (spores) Q = 1.15-1.3 (Vol. 1, Fig. 33.3); (cystidia) Q = 1.15-1.3 (Vol. 1, Fig. 34.3).
broadly fistulose – (stipe) with very wide tube (Vol. 1, Fig. 31.12).
broadly fusiform – (spores) fusiform with Q = 1.5-2.0 (Vol. 1, Fig. 33.12); – (cystidia) fusiform with Q = 1.5-2.0 (Vol. 1, Fig. 34.21), see also very broadly fusiform.
broadly lageniform – (cystidia) (Vol. 1, Fig. 34.26).
broadly utriform – (cystidia) (Vol. 1, Fig. 34.29).
broadly ventricose – (lamellae) (Vol. 1, Fig. 30.14).
broom-cells – elements in pileipellis or hymenium consisting of a more or less clavate or spheropedunculate body, bearing few to numerous warts of finger-like appendages in upper half. Two types are distinguished: Rotalis-type with rounded-warty appendages (Vol. 3, Fig. 139), and Siccus-type with elongate, finger-like appendages (Vol. 3, Fig. 154).
brosse – see en brosse.
bulbangiocarpy – a type of angiocarpic development of the basidiocarp in which the basidiocarp is initiated in a cavity of the primordial bulb.
bulbous – (base of stipe) enlarged (Vol. 1, Fig. 31.17), see also abruptly bulbous and marginately bulbous.
campanulate – (pileus) bell-shaped (Vol. 1, Fig. 29.12).
canaliculate – (stipe) (= channelled) with a longitudinal groove or channel.
cantharelloid – (basidiocarp) with decurrent obtuse rib- or vein-like lamellae.
capitate – (apex of cystidia) having a distinct and abrupt knob (Vol. 1, Fig. 34.44).
cartilaginous – (stipe) cartilage-like, flexible but tough.
catenate – (of cheilocystidia) united as in a chain.
catenulate – (elements) united or linked as in a chain.
caulocystidium – cystidium situated on surface of stipe.
central – (stipe) attached to centre of pileus (Vol. 1, Fig. 31.1); – (germ pore) situated at the central tip of the spore (Vol. 1, Fig. 33.27).
chambered – (stipe) with several cavities (Vol. 1, Fig. 31.13).
cheilocystidium – cystidium situated on edge of lamella or tube.
cheiloleptocystidium – thin-walled cystidium situated on edge of

lamellae (only used when confusion with cheilochrysocystidia may occur).

cheilochrysocystidium – chrysocystidium situated on edge of lamellae.

chrysocystidium – cystidium with yellow amorphous body or bodies in contents after treatment with ammonia or KOH.

circular – (pileus) round (Vol. 1, Fig. 29.1).

clavate – (stipe) club-shaped (Vol. 1, Fig. 31.8); – (cystidia, basidia), Q = 1.5-4 (Vol. 1, Fig. 34.13), see also narrowly, and very narrowly clavate, and broadly clavate.

clitocyboid – see omphalioid.

collarium – a tube around, but free from, the apex of the stipe to which the lamellae are attached (Vol. 1, Fig. 30.5).

colliculose – (pileus surface) covered with hillock-like elevations.

collybioid – (habit) characterized by pileus neither umbilicate, nor conical; lamellae free or adnate; context tough; context of pileus continuous with context of stipe (Vol. 1, Figs. 28.2, 28.3).

concave – (pileus) (Vol. 1. Fig. 29.21).

congophilous – (spore wall) accumulating Congo red.

conical – (pileus) cone-shaped (Vol. 1, Fig. 29.14), see also broadly conical and narrowly conical, truncately broadly conical, truncately conical, and obtusely conical; – (cystidia) Q = 1.5-4 (Vol. 1, Fig. 34.17), see also narrowly conical and broadly conical.

conidium – a non-motile asexual spore.

connate – (stipes) grown together at their bases.

connective hyphae – usually narrow undifferentiated hyphae of the context of a basidiocarp connecting all other elements (used in opposite of fundamental hyphae).

constriction – see median constriction.

continuous – context of pileus and stipe forming one entity; pileus and stipe not easily separating.

convex – (pileus) (Vol. 1, Fig. 29.9).

coralloid – irregularly branching, like in coral.

corneous – (stipe) horny, horn-like in texture.

cortina – a web-like veil connecting pileus margin and stipe.

costate – (pileus and stipe surfaces) with ridges.

crenate – (margin of pileus) with rounded teeth (Vol. 1, Fig. 29.45); – (lamella edge) (Vol. 1, Fig. 30.33).

crenulate – (margin of pileus) minutely crenate (Vol. 1, Fig. 29.46); – (lamella edge) (Vol. 1, Fig. 30.34).

crepidotoid – see pleurotoid.

curved – (stipe) bent from substrate upwards as to adjust to the gravitation.

cutis – a pileipellis consisting of repent non-gelatinizing hyphae (Vol. 1, Fig. 36.1A).

cyanophilous – (spore wall) accumulating Cotton blue.

cylindrical – (stipe) circular in cross-section and of equal diameter from apex to base (Vol, 1, Fig. 31.4); – (spores) Q = 2.0-3.0, in outline with parallel sides; – (cystidia) Q = 2-4 (Vol. 1, Fig. 34.10), see also narrowly cylindrical and broadly cylindrical.

cyphelloid – (basidiocarp) more or less cup-shaped with smooth hymenophore.

cystidioid – cystidium-like.

cystidium – sterile, differentiated, terminal element in the hymenium or on the surfaces of the basidiocarp.

decurrent – (lamellae) descending down the stipe (angle lamellae-stipe 40-60°) (Vol. 1, Fig. 30.28), see also deeply decurrent.

decurrent tooth – (of lamellae) (Vol. 1, Figs. 30.25. 30.26).

deeply decurrent – (lamellae) (angle lamellae-stipe < 40°) (Vol. 1, Fig. 30.29).

deeply infundibuliform – (pileus) (Vol. 1, Fig. 29.23).

deeply umbilicate – (pileus) with deep abrupt depression (Vol. 1, Fig. 29.28).

deflexed – (margin of pileus) bent downwards (Vol. 1, Fig. 29.37).

deliquescent – (lamellae and/or basidiocarp) becoming liquid after maturing.

depressed – (pileus) with central depression/sinking (Vol. 1, Fig. 29.25), see also slightly depressed.

depression – (of pileus), see depressed; – (of spores), see suprahilar depression.

derm – a pileipellis consisting of erect elements or of ascending elements, see trichoderm and hymeniderm.

dextrinoid – (spore wall, hyphal walls) staining red to reddish brown in Melzer's reagent.

dimitic – (tissues) consisting of generative hyphae and skeletal hyphae or binding hyphae.

divergent – (= bilateral) (hymenophoral trama) having downward hyphae turning outward from a median line (Vol. 1, Figs. 35.5, 35.6).

diverticulate – (cystidia) with short finger-like excrescences (Vol. 1, Fig. 34.45).

discontinuous – context of pileus and stipe not forming one entity; pileus easily separating from stipe, see also pluteoid.

duplex – (context) consisting of two structurally differing layers.

eccentric – (stipe) not attached to centre of pileus (Vol. 1, Fig. 31.2); – (germ pore) situated at the abaxial side of the spore (Vol. 1, Fig. 33.26).

echinate – (spores) with spines.

ectosporium – the very thin outer layer of the basidiospore wall.

ellipsoid – (spores) Q = 1.3-1.6 (Vol. 1, Fig. 33.4); – (cystidia) Q = 1.3-1.6 (Vol. 1, Fig. 34.2), see also broadly ellipsoid.

emarginate – (lamellae) notched near the stipe (Vol. 1, Fig. 30.23).

en brosse – (of cystidia) with excrescences, diverticulate (Vol. 1, Fig. 34.45).

encrusted, encrusting – see incrusting.

endosporium – the electron transparent inner layer of the basidiospore wall at the inside of the episporium, but lacking in many white- and pale-spored taxa.

entire – (lamella edge) straight, smooth, and glabrous (Vol. 1, Figs 30.30, 30.38).

episporium – the electron opaque fundamental layer present in all basidiospores of the Hymenomycetes; it is the innermost layer of the spore wall when the endosporium is lacking.

epithelioid hymeniderm – a hymeniderm made up of elements with Q = 1.0-1.15 (Vol. 1, Fig. 36.3C).

epithelium – a pileipellis made up of globose to broadly ellipsoid elements in more than one layer deep; see regular epithelium and irregular epithelium.

equal – (stipe) of equal diameter from apex to base.

erect – (hyphae or projections of hyphae) perpendicular to surface of pileus.

eroded – (margin of pileus) irregularly toothed (Vol. 1, Fig. 29.47); – (lamella edge) (Vol. 1, Fig. 30.37).

euhymeniderm – a hymeniderm made up of elements with Q = 1.15-6 (Vol. 1, Fig. 36.3B).

eusporium – the inner set of firm and resistant layers of the basidiospore wall, consisting of the episporium and the endosporium.

even – (lamella edge) straight, smooth and glabrous, entire (Vol. 1, Figs. 30.30, 30.38).

exceeding – (margin of pileus with regard to lamellae) (Vol. 1, Fig. 29.42).

exosporium – a layer of the basidiospore wall between perisporium and episporium, frequently responsible for the ornamentation of spores.

exscissa-type – see urticiform.

fasciculate – (basidiocarps) growing in a bundle.

felted – (pileus and stipe surfaces or volva) composed of, or covered with, densely compressed, matted hairs or fibrils.

fertile – (lamella edge) composed of basidia only.
fibrillose – (pileus and stipe surfaces) covered with thin, thread-like fibres.
filiform – (cystidia, stipe), very long and narrowly cylindrical.
fimbriate – (lamella edge) with regular hair-like projections (Vol. 1, Fig. 30.39).
fissurate – (pileus and stipe surfaces) with deep and/or distinct clefts.
fistulose – (stipe) hollow (Vol. 1, Fig. 31.11), see also broadly fistulose.
flabelliform – (pileus) fan-shaped (Vol. 1, Fig. 29.2), see also rounded flabelliform.
flattened – (spores) spores adaxially flattened, resulting in a different measure for breadth and width (this volume, Fig. 1.1).
flexuous – (stipe) full of bends; – (cystidia) cylindrical but with bends (Vol. 1, Fig. 34.36).
flocci – small flocks or tufts.
floccose – (pileus and stipe surfaces) covered with tufts of soft hairs.
flocculose – (pileus and stipe surfaces) minutely floccose.
free – (lamellae) not attached to stipe (Vol. 1, Fig. 30.18).
fringed – (lamella edge) with irregular appendages.
frontal view -(of spores) (Vol. 1, Fig. 32.2).
fugacious – (veil) evanescent, early disappearing.
fundamental hyphae – the inflated hyphae giving the fleshy basidiocarp its firmness.
furcate – (lamellae) forked (Vol. 1, Fig. 30.2).
fusiform – (spores) spindle shaped, tapering at both ends, with Q = 2.0-4.0 (Vol. 1, Fig. 33.13); – (cystidia) with Q = 2.0-4.0 (Vol. 1, Fig. 34.20), see also narrowly, broadly, and very broadly fusiform.
horsehair-like – (stipe) very long and thin, stiff, like the hair of a horse.
gelatinous – jelly-like in consistence.
generative hyphae – the basic type of septate, thin- to thick-walled, branching hyphae, present in all (young) basidiocarps, from which all differentiated hyphae arise (used in opposite of binding and skeletal hyphae).
germ pore – (of spores) apical thin-walled spot in spore wall (Vol. 1, Fig. 32.6E), see also central and eccentric germ pore.
glabrous – (pileus and stipe surfaces) bald.
globose – spherical, (spores) Q = 0.95-1.05 (Vol. 1, Fig. 33.1); – (cystidia) Q = 1.0-1.05 (Vol. 1, Fig. 34.5).
glutinous – slimy, very viscid.
granulose – (pileus and stipe surfaces) covered with (or composed of) minute grains.
gregarious – (basidiocarps) growing in a group.
guttate – (pileus and stipe surfaces) with roundish darker spots.
guttulate – (contents of spores and other elements) with (oil) droplets.
guttule – droplet (Vol. 1, Fig. 32.6G).
gymnocarpy – a type of development of the basidiocarp in which the hymenium is exposed from initiation till maturity.
hemispherical – (pileus) with shape of a half sphere (Vol. 1, Fig. 29.10).
heterogeneous – (lamella edge) composed of cystidia and basidia.
heteromerous – (tissue) consisting of hyphae and 'nests' of sphaerocysts.
hexagonal – (spores) six-angled (Vol. 1, Figs. 33.22, 33.23).
hilar appendage – (of spores) short process at basal end of spore by which it was attached to sterigma (Vol. 1, Fig. 32.4C).
hilum – scar left on the hilar appendage of the basidiospore after its discharge from the sterigma.
hirsute – (pileus and stipe surfaces) covered with rather long, rather coarse hairs (coarser than in pubescent, less coarse than in hispid).
hispid – (pileus and stipe surfaces) covered with long or short, erect stiff hairs or bristles.
hispidulous – (pileus and stipe surfaces) minutely hispid.
homoiomerous – (tissue) consisting of hyphae and without nests of sphaerocysts.
hymeniderm – a derm made up of non-septate elements originating a the same level, see also epithelioid hymeniderm, and transition between hymeniderm and epithelium.
hymenocarpy – a type of development of the basidiocarp in which the differentiation of the hymenophore starts as a circular zone in the otherwise still undifferentiated primordium.
hymenopodium – a special (usually large-celled) layer between subhymenium and hymenophoral trama.
hyphal peg – fascicle of unbranched hyphae projecting beyond basidia.
imbricate – (basidiocarps) growing immediately above each other.
incrusted – see incrusting.
incrusting – (pigment) situated on the outer side of the wall, and visible as bands, granules or patches.
inflated – (hyphae) consisting of swollen elements, constricted at septa, not cylindrical.
inflexed – (margin of pileus) bent inwards (Vol. 1, Fig. 29.38).
infundibuliform – (pileus) funnel-shaped (Vol. 1, Fig. 29.22), see also deeply infundibuliform.
insititious – (stipe) grafted on substratum; base of stipe seems inserted in substrate because basal hairs or tomentum are lacking.
intercalary element – between two other elements, not terminal.
intercellular – (pigment) situated between the elements.
intervenose – (lamellae) provided with veins between the lamellae (Vol. 1, Fig. 30.3).
intracellular – (pigment) situated inside the elements.
intricate trichoderm – a trichoderm made up of interwoven elements (Vol. 1, Fig. 36.2B).
inverse – (hymenophoral trama) having downward convergent hyphae, i.e. turning inward to a median line (Vol. 1, Fig. 35.4).
involute – (margin of pileus) rolled in (Vol. 1, Fig. 29.39).
irregular – (hymenophoral trama) having interwoven hyphae (Vol. 1, Fig. 35.3).
irregular epithelium – an epithelium made up of irregularly disposed elements (Vol. 1, Fig. 36.4B).
irregular trichoderm – (Vol. 1, Fig. 36.2C).
isocarpy – a type of development of the basidiocarp in which the differentiation of pileus, stipe, and hymenophore starts at the same time.
ixocutis – a cutis made up of gelatinizing hyphae (Vol. 1, Fig. 36.1B).
ixohymeniderm – a hymeniderm made up of gelatinizing elements.
ixohyphidium – a gelatinizing, more or less differentiated, hypha-like terminal element in the pileipellis.
ixotrichoderm – a trichoderm, made up of gelatinizing elements (Vol. 1, Fig. 36.2D).
laccate – (pileus surface) as though varnished.
lacrymoid – (spores) with confluent hilar appendage; tear-shaped (Vol. 1, Figs. 33.16, 33.17).
lageniform – (cystidia) characterized by neck narrower than half width of cell body (Vol. 1, Fig. 34.25), see also narrowly lageniform and broadly lageniform.
lamellate – (hymenophore) consisting of lamellae (= gills).
lanate – (= woolly) (pileus and stipe surfaces) covered with long, soft, matted hairs.
lateral – (stipe) attached to one side of pileus (Vol. 1, Fig. 31.3).
lecythiform – (cystidia) lageniform and abruptly capitate (Vol. 1, Fig. 34.33).
length – (of spores) distance from apex to bottom as seen in side view (Vol. 1, Fig. 32. 1).
leptocystidium – thin-walled cystidium. Only used in the combination cheiloleptocystidium, when confusion with cheilochrysocystidia may occur.

lichenized – living in symbiotic association with an alga, forming a lichen.
lignicolous – growing on wood.
linear – (lamellae) with straight lamella edge and parallel upper side (Vol. 1, Fig. 30.6).
luminescent – (basidiocarp) fluorescent; giving light in darkness.
marasmioid – (stipe) tough, slender, and yellow-brown, red-brown, or grey-brown at least at base; – (habit) habit with plicate pileus and horsehair-like stipe, revivescent.
marginately bulbous – (base of stipe) provided with a bulb with a raised border (Vol. 1, Fig. 31.19).
marmorate – (= marbled) pileus and stipe surfaces, and context) looking like marble: faintly and irregularly striped or innately veined.
medallion clamp – a clamp connection with an opening between the clamp connection itself and the elements connecting by it.
median constriction – (of spores) transverse contraction in the middle, (Vol. 1, Figs. 33.24, 33.25); – (of cystidia) (Vol. 1, Fig. 34.30).
mediostratum – middle layer.
metachromatic – (spore wall) turning reddish to violet in solution of Cresyl blue in H_2O.
metuloid – deep-rooting cystidium becoming distinctly thick-walled and often incrusted with age.
micaceous – (pileus surface) with glistening particles or spots.
moniliform – (cystidia) cylindrical but contracted at regular intervals, like a string of beads (Vol. 1, Fig. 34.35).
monomitic – (tissue) built up of one type of hyphae.
monovelangiocarpy – a type of angiocarpic development of the basidiocarp in which only a universal veil participates.
mitriform – (spores) shaped like a mitre (this volume, Fig. 2.3).
mucilaginous – consisting of mucilage (= viscous substance).
mucous – (pileus and stipe surfaces) slimy.
mucronate – (cystidia) with small abrupt, acute or blunt protuberance at apex (Vol. 1, Fig. 34.37).
mycenoid – (habit) characterized by pileus conical to paraboloid; lamellae free to adnate; stipe usually long and slender, context usually brittle (Vol. 1, Figs. 28.7, 28.8).
myxosporium – the set of often mucilaginous layers on the outside of the basidiospore wall enveloping the eusporium; its components are ectosporium, perisporium and exosporium.
narrowly adnate – (lamellae) (Vol. 1, Fig. 30.20).
narrowly clavate – (cystidia, basidia) clavate with Q = 4.0-8.0 (Vol. 1, Fig. 34.12), see also very narrowly clavate.
narrowly conical – (pileus) (Vol. 1, Fig. 29.15); – (cystidia) conical with Q>4 (Vol. 1, Fig. 34.15).
narrowly cylindrical – (cystidia) cylindrical with Q>4 (Vol. 1, Fig. 34.9).
narrowly fusiform – (spores) fusiform with Q > 4.0 (Vol. 1, Fig. 33.14); – (cystidia) fusiform with Q > 4 (Vol. 1, Fig. 34.19).
narrowly lageniform – (cystidia) (Vol. 1, Fig. 34.24).
narrowly utriform – (cystidia) (Vol. 1, Fig. 34.27).
necropigment – dark brownish black pigment, usually in form of intracellular pigment-clots.
nettle-hair shaped – (cystidia) lageniform with long, narrow, slender neck (Vol. 1, Fig. 34.23).
nodulose type of hilum – hilum an approximately circular area covered with protuberances (frequent in thin-walled spores).
non-amyloid – (spore wall, spore ornamentation, hyphal walls) not changing colour or only becoming yellowish in Melzer's reagent.
oblong – (spores) Q = 1.6-2.0 (Vol. 1, Fig. 33.5); – (cystidia) Q > 1.6 (Vol. 1, Fig. 34.1).
obovoid – (spores) reversely ovoid, with the broadest and widest part uppermost, (Vol. 1, Fig. 33.9); – (cystidia) (Vol. 1, Fig. 34.8).
obpyriform – (cystidia) reversely pyriform, with the broadest and widest part above (Vol. 1, Fig. 34.32).
obtuse – (apex of cystidia) rounded (Vol. 1, Fig. 34.41).
obtusely conical – (pileus) conical with rounded apex (Vol. 1, Fig. 29.18).
omphalinoid – see omphalioid.
omphalioid (including omphalinoid or clitocyboid) (habit) characterized by pileus plano-convex to deeply infundibuliform; lamellae decurrent (Vol. 1, Figs 28.4, 28.5, 28.6).
opaque – (pileus) not translucent.
open pore type of hilum – hilum with a depression or perforation at one side and sometimes a perforation or tear at the other side of the hilar appendage often connected by a slit (frequent in thick-walled spores).
ovoid – egg-shaped (spores) (Vol. 1, Fig. 33.8); – (cystidia) (Vol. 1, Fig. 34.7).
palisade – (pileipellis) special type of hymeniderm, in which the elements are very long and slenderly cylindrical.
papilla – small nipple-like protuberance (on pileus) (Vol. 1, Fig. 29.29); – (on spores) (Vol. 1, Fig. 33.28), see also abrupt and acute papilla.
papillate – (pileus surface) covered with papillae.
paraboloid – (pileus) (Vol. 1, Fig. 29.11).
paravelangiocarpy – a type of angiocarpic development of the basidiocarp in which only a partial veil participates.
parietal – (pigment) situated in the hyphal wall.
partial veil – see velum partiale.
patent – (hyphae or projections of hyphae) perpendicular to surface of stipe.
pedicillate – (cystidia) provided with a stalk (Vol. 1, Fig. 34.48).
pedunculate – (cystidia) provided with a stalk (Vol. 1, Fig. 34.48).
pellicle – an easily peeling ixocutis.
perisporium – the often mucilaginous layer of the basidiospore wall just inside the ectosporium; sometimes early disappearing, sometimes filling the spaces between exosporial ornamentation.
phaseoliform – (spores) with concave adaxial side, not parallel to abaxial side (Vol. 1, Fig. 33.20).
pilangiocarpy – a type of secondary angiocarpy in which the originally exposed hymenophore in later stages is enclosed by (an outgrowth of) margin of pileus.
pileipellis – cortical layer(s) of pileus.
pileocarpy – a type of development of the basidiocarp in which the pileus is the first part initiated in the primordial bulb.
pileocystidium – cystidium situated on surface of pileus.
pileostipitocarpy – a type of development of the basidiocarp in which the differentiation of pileus and stipe starts at the same time before that of the hymenophore.
plage – (of spores) see suprahilar plage.
plano-concave – (pileus) slightly concave (Vol. 1, Fig. 29.20).
plano-conical (pileus) slightly conical, almost flat.
plano-convex – (pileus) slightly convex (Vol. 1, Fig. 29.8).
pleurocystidium – (lamella or tube) cystidium situated on sides of the hymenophore.
pleurotoid – (including crepidotoid), (habit) characterized by absent or lateral stipe (Vol. 1, Figs. 28.12, 28.13).
plicate – (pileus) folded radially, like a fan.
pluteoid – (habit) characterized by lamellae free; context of pileus discontinuous with context of stipe; stipe usually longer than diameter of pileus (Vol. 1, Fig. 28.1).
polar view – (of spores) (Vol. 1, Fig. 32.3).
primary angiocarpy – a type of angiocarpic development in which the primordial hymenium is initiated in a closed cavity.
primary mycelium – the uninucleate mycelium produced by a germinating basidiospore.

primordium – a very young, not fully differentiated basidiocarp.
protocarpic tuber – a non-persisting fleshy tuber on which one or more basidiocarps may develop.
pruinose – (pileus, lamella and stipe surfaces) covered with a (often white or whitish) powdery 'bloom'.
pseudoangiocarpy – secondary angiocarpy (see there).
pseudocystidium – differentiated prolongation of vascular hypha into the hymenium.
pseudoinsititious – (stipe) at first sight appearing truly insititious, but on closer inspection (lens) with very poorly developed basal mycelium.
pseudoparaphyses – short cells in the hymenium, surrounding the basidia.
pseudorhiza – a root-like extension of the stipe (Vol. 1, Fig. 31.15).
pubescent – (pileus and stipe surfaces) (= downy) covered with soft, fine hairs.
pulverulent – (pileus and stipe surfaces) covered with powder.
pustulate – (stipe and pileus surfaces) with small rounded warts.
pyriform – (cystidia) pear shaped (Vol. 1, Fig. 34.31).
quadrangular – (spores) with shape of rectangle or square; Q equal or less than 1.15 (Vol. 1, Fig. 33.10).
radially rimose – (pileus surface) marked with numerous, superficial, radial clefts or cracks.
radiate growth – (hymenophoral trama) formed by hyphae growing radially at the underside of the pileus from centre towards margin of pileus.
Ramealis structure – (of pileipellis) with irregularly shaped and arranged, nodose or en brosse or diverticulate elements (Vol. 3, Fig. 122).
reduced – (of stipe) very short (Vol. 1, Fig. 31.3).
reflexed – (margin of pileus) bent upwards (Vol. 1, Fig. 29.40).
regular – (hymenophoral trama) having parallel hyphae (Vol. 1, Fig. 35.1).
regular epithelium – an epithelium made up of elements in erect rows (Vol. 1, Fig. 36.4A).
reniform – (pileus) kidney-shaped (Vol. 1, Fig. 29.6).
repent – (hyphae) creeping, not ascending.
resinous – consisting of or covered with resin or resin-like substance.
reticularly venose – (pileus surface) marked with anastomosing veins forming angular patches.
revivescent – (basidiocarp) reviving after desiccation when remoistened, restoring the fresh habit and producing spores again.
revolute – (margin of pileus) rolled back (Vol. 1, Fig. 29.41).
rhizomorph – a visible root-like mycelial strand (Vol. 1, Fig. 31.14).
rhomboid – (spores) more or less quadrangular spore with concave sides (this volume, Fig. 2.2).
rimose – see radially rimose; areolate-rimose.
rimulose – (pileus surface) minutely rimose.
rostrate – (cystidia) provided with a beak-like extension at apex (Vol. 1, Fig. 34.38).
rostrum – beak-like extension at the top of a cystidium.
Rotalis-type – see broom-cells.
rounded flabelliform – (pileus) (Vol. 1, Figs. 29.4, 29.5).
rounded triangular – (spores) rounded three-angled (Vol. 1, Fig. 33.15).
rugose – (pileus surface) irregularly wrinkled.
rugulose – (pileus surface) with minute irregular wrinkles.
sarcodimitic – (tissue) consisting of generative hyphae and chains of very long, thin- to thick-walled elements ('sarcoskeletals').
sarcoskeletals – see sarcodimitic.
sarcotrimitic – (tissue) consisting of (1) generative hyphae, (2) chains of very long thin- to thick-walled elements ('sarcoskeletals') and (3) thick-walled binding hyphae.
scabrous – (stipe surface) scurfy.
Schaeffer-reaction – (pileus surface and surface of base of stipe) cross-reaction of aniline and concentrated nitric acid.
sclerotium – a (long) persisting compact mycelial body.
seceding – (lamellae) at first attached to stipe, but later separating from it (Vol. 1, Fig. 30.22).
secondary angiocarpy – a type of angiocarpic development in which in its later stages the primordial hymenium is enveloped by hyphae originating from the stipe and/or the pileus.
segmentiform – (lamellae) with straight lamella edges and convex upper side (Vol. 1, Figs. 30.7, 30.8, 30.9).
separable pellicle – (pileus) pileipellis a (thick) ixocutis, easily peeling off with help of a needle.
septate – (hyphae) with septa.
sericeous – (= silky) (pileus and stipe surfaces) covered with fine, straight, appressed, glossy hairs or fibrils.
serrate – (lamella edge) toothed like a saw (Vol. 1, Fig. 30.35).
serrulate – (lamella edge) minutely serrate (Vol. 1, Fig. 30.36).
sessile – (cystidia) without a stalk (Vol. 1, Fig. 34.47).
setiform – (cystidia) narrowly conical with thickened wall (Vol. 1, Fig. 34.16).
Siccus-type – see broom-cells.
siderophilous – (particles in basidia) turning blackish purple or blackish violet in acetocarmine in presence of metal ions.
side-view – (of spores) (Vol. 1, Fig. 32.1).
sinuate – (lamellae) having a concave indentation near the stipe (Vol. 1, Fig. 30.24).
skeletal hyphae – aseptate, thick-walled, straight of slightly flexuous hyphae.
slightly depressed – (pileus) with shallow central depression (Vol. 1, Fig. 29.24).
smooth – (pileus and stipe surfaces) without elevations, ridges, grooves, veins, etc.
solid – (stipe) made up of homogeneous tissue. (Vol. 1, Fig. 31.9).
solitary – (basidiocarp) single.
spathuliform – (pileus) elliptic or oblong tapering gradually towards eccentric or lateral stipe (Vol. 1, Fig. 29.3).
spheropedunculate – (cystidia) globose or subglobose with long stalk (Vol. 1, Fig. 34.6).
spinulose – (spores) covered with small spines.
spiny – covered with spines, see also spinulose.
squame – small scale.
squamose – (pileus and stipe surfaces) covered with coarse (appressed) scales.
squamule – scale.
squamulose – (pileus and stipe surfaces) covered with minute scales.
squarrose – (pileus and stipe surfaces) covered with projecting, coarse scales.
squarrulose – (pileus and stipe surfaces) covered with small projecting, coarse scales.
statismosporic basidium – a basidium that does not discharge its spores; they simply break off from the basidium.
sterile – (lamella edge) composed of cystidia only.
stipitipellis – cortical layer of stipe.
stipitocarpy – a type of development of the basidiocarp in which the first differentiating hyphae of the primordium are those of the stipe.
straight – (margin of pileus) not bent upwards or inwards (Vol. 1, Figs. 29.34, 29.35, 29.36).
striate – (pileus and stipe surfaces) marked with regular lines.
strigose – (pileus and stipe surfaces) covered with long, coarse or thick, rather stiff hairs.
stuffed – (stipe) having central part filled with tissue different from tissue in outer part (Vol. 1, Fig. 31.10).

sub- – slightly or almost, under.
subbulbous – (base of stipe) slightly bulbous (Vol. 1, Fig. 31.16).
subcapitate – (apex of cystidia) having a knob (Vol. 1, Fig. 34.43).
subclavate – (stipe) slightly club-shaped (Vol. 1, Fig. 31.7).
subcylindrical – (spores) Q = 2.0-3.0 (Vol. 1, Fig. 33.6).
subdecurrent – (lamellae) slightly decurrent, angle lamella-stipe 60-80°. (Vol. 1, Fig. 30.27).
subglobose – (spores) nearly spherical Q = 1.05-1.15 (Vol. 1, Fig. 33.2); – (cystidia) Q = 1.05-1.15 (Vol. 1, Fig. 34.4).
subgregarious – (basidiocarps) growing in a small group or growing in a group of widespread specimens.
subpellis – lower layer of (pilei-)pellis.
subregular – (hymenophoral trama) having slightly flexuous, nearly parallel hyphae (Vol. 1, Fig. 35.2).
subumbilicate – (pileus) having a small navel-like depression (Vol. 1, Fig. 29.26).
subumbonate – (pileus) with low, broad umbo (Vol. 1, Fig. 29.32).
subventricose – (lamellae) with slightly convex lamella edge (Vol. 1, Fig. 30.10).
sulcate – (pileus and stipe surfaces) with grooves.
suprahilar depression – (of spores) sinking just above the hilar appendage (Vol. 1, Fig. 32.4B).
suprahilar plage – (of spores) rounded, smooth area just above the hilar appendage (Vol. 1, Fig. 32.5D).
tapering downwards – (stipe) becoming narrower from apex to base (Vol. 1, Fig. 31.5).
tapering upwards – (stipe) becoming narrower from base to apex (Vol. 1, Fig. 31.6).
thick-walled – (spores) (Vol. 1, Fig. 32.6F).
tibiiform – (cystidia) lageniform with a long neck and capitate (Vol. 1, Fig. 34.34).
tomentose – (pileus and stipe surfaces) densely covered with matted (more or less appressed), soft hairs.
tooth – (of lamellae) see decurrent tooth.
tortuous – twisted of bent in different directions.
trabecular – (hymenophoral trama) having transversely oriented elements.
tract – (spores) channel in the spore wall leading to the germ pore.
transition between hymeniderm and epithelium – (Vol. 1, Fig. 36.3D).
transvenose – (lamellae) provided with veins on the surface (Vol. 1, Fig. 31.1).
triangular – (lamellae) (Vol. 1, Fig. 30.17); – (spores), see rounded triangular.
trichoderm – a pileipellis made up of erect, straight elements, septate, and/or not originating at the same level (Vol. 1, Fig. 36.2A), see also intricate and irregular trichoderm.
trichohymeniderm – a hymeniderm made up of elements with Q> 6 (Vol. 1, Fig. 36.3A).
tricholomatoid – (habit) characterized by lamellae neither free, nor decurrent; stipe about the same length as pileus diameter or somewhat longer; context fleshy; context of pileus continuous with context of stipe (Vol. 1, Figs. 28.9, 28.10, 28.11).
truncate – (apex of spores) ending abruptly as if cut off, (Vol. 1, Fig. 33.29); – (apex of cystidia) (Vol. 1, Fig. 34.42).
truncately broadly conical – (pileus) broadly conical with as if cut off apex (Vol. 1, Fig. 29.16).
truncately conical – (pileus) conical with as if cut off apex (Vol. 1, Fig. 29.17).
tubular – (hymenophore) consisting of tubes.
tubuliform – (trama elements) tube-shaped.
twisted – (stipe) fibrils ranged spirally round axis because of the base of stipe being rotated with regard to apex.
umbilicate – (pileus) having a navel-like depression (Vol. 1, Fig. 29.27), see also deeply umbilicate.
umbo – (on pileus) broad rounded knob (Vol. 1, Fig. 29.33).
umbonate – (pileus) with broad rounded knob (Vol. 1, Fig. 29.33).
undate – (margin of pileus) wavy (Vol. 1, Fig. 29.43); – (lamellae) undulating lamella edge (Vol. 1, Fig. 30.31).
undulate – minutely undate (margin of pileus) (Vol. 1, Fig. 29.44); – (lamella edge) (Vol. 1, Fig. 30.32).
uniguttulate – (spores) with one droplet (Vol. 1, Fig. 32.6).
uninucleate – with one nucleus.
universal veil – see velum universale.
urticiform — (cystidia) lageniform with a long, tapering neck, bearing needle-shaped crystals, reminiscent of the nettle-cells of *Urtica* species. Two types are distinguished in the genus *Melanoleuca*: *brevipes*-type in which the upper cell is slender, cylindrical, and distinctly separated from the lower cell, and the septum without median spot (this volume, Fig. 2.4, and *exscissa*-type with upper cell gradually attenuated towards apex, and base of upper cell rather wide (this volume, Fig. 2.5).
utriform – (cystidia) characterized by neck broader than half width of cell body (Vol. 1, Fig. 34.28), see also narrowly utriform and broadly utriform.
vascular hyphae – usually aseptate, often irregular, flexuous hyphae with refractive contents.
velar sock – (stipe) covering of veil on lower part of stipe, forming a sock.
velum partiale – (= partial veil) primordial tissue between the hymenophore and the stipe and tissues differentiating from this primordial tissues.
velum universale – (=universal veil) outer differentiated layer enveloping the primordial basidiocarp and tissues differentiating from this layer.
velutinous – (=velvety) (pileus and stipe surfaces) densely covered with fine, short, erect hairs.
venose – (pileus surface) with vein-like wrinkles, see also reticularly venose.
ventricose – (lamellae) with convex lamella edge (Vol. 1, Figs. 30.11, 30.12, 30.13), see also broadly ventricose; – (stipe) considerably broader in the middle than at base and apex.
verrucose (pileus and stipe surfaces, spores) covered with wart-like elevations; – (cystidia) with small hollow or solid protuberances (Vol. 1, Fig. 34.46).
verruculose – (pileus and stipe surfaces, spores) covered with fine, wart-like elevations, see also verrucose.
very broadly fusiform – (spores) fusiform with Q = 1.15-1.5 (Vol. 1, Fig. 33.11); – (cystidia) fusiform with Q < 1.5 (Vol. 1, Fig. 34.22).
very narrowly clavate – (basidia) clavate with Q > 8.0.
villose – (pileus and stipe surfaces) covered with fairly long, soft, more or less straight, not interwoven hairs.
virgate – (pileus and stipe surfaces) streaked.
viscid – (pileus and stipe surfaces) sticky.
water-spots – (surface of pileus and stipe) with roundish, darker spots, as if stained by drops of water.
width – (of spores) largest distance between sides as seen in side-view (Vol. 1, Fig. 32.1).
zonate – (pileus surface) with concentric paler and darker alternating coloured zones or bands.

CHAPTER 3

Abbreviations of authors' names in this volume

E.C. VELLINGA, M.M. NAUTA & M.E. NOORDELOOS

A. & S. – J.B. von Albertini & L.D. von Schweiniz
Albert – L. Albert
Alessio – C.L. Alessio
Àngel – F. Àngel
Anon. – Anonymus
Arnolds – E.J.M. Arnolds
Arnolds & Veerkamp – E.J.M. Arnolds & M.T. Veerkamp
Arora – D. Arora
Atk. – G.F. Atkinson
B. & Br. – M.J. Berkeley & C.E. Broome
B. & C. – M.J. Berkeley & M.A. Curtis
Babos – M. Babos
Bagl. – F. Baglietto
Ballero – M. Ballero
Barbier – M. Barbier
Barla – J.H.J.B. Barla
Bas – C. Bas
Batt. – G.A. Battara
Beeli – M. Beeli
Bellù – F. Bellù
Bender – H. Bender
A. v.d. Berg – A.P. van der Berg
F.A. v.d. Bergh – F.A. van den Bergh
Berk. – M.J. Berkeley
Besl – H. Besl
W. Beyer – W. Beyer
Big. & Guill. – R. Bigeard & H. Guillemin
Bizio – E. Bizio
Bizzi – A. Bizzi
Bodin & Priou – M. Bodin & J.P. Priou
Bohus – G. Bohus
Boisselet & Migl. – P. Boisselet & V. Migliozzi
Bolt. – J. Bolton
M. Bon – M. Bon
Bon & Bellù – M. Bon & F. Bellù
Bon & Boiff. – M. Bon & J. Boiffard
Bon & Candusso – M. Bon & M. Candusso
Bon & Cappelli – M. Bon & A. Cappelli
Bon & Chevassut – M. Bon & G. Chevassut
Bon & Collin – M. Bon & P. Collin
Bon & Courtec. – M. Bon & R. Courtecuisse
Bon & Guinb. – M. Bon & J. Guinberteau
Bon & Haluwijn – M. Bon & Ch. van Haluwijn
Bon & Migl. – M. Bon & V. Migliozzi
Bon & Orton – M. Bon & P.D. Orton
Bon & G. Riousset – M. Bon & G. Riousset
Boud. – J.L.E. Boudier
Bousset & Joss. – M. Bousset & M. Josserand
Brebinaud – P. Brebinaud
Breitenb. & Kränzl. – J. Breitenbach & F. Kränzlin
Bres. – G. Bresadola
Bresinsky – A. Bresinsky
Bresinsky & Haas – A. Bresinsky & H. Haas
Britz. – M. Britzelmayer
R. Brown – R. Brown
Brunelli – F. Brunelli
Bull. – J.B.F. Bulliard
Candusso – M. Candusso
Cappelli – A. Cappelli
Cejp – K. Cejp
Cetto – B. Cetto
Charbonnel – J. Charbonnel
Chatin & Boud. – G.A. Chatin & E. Boudier
Cherubini – A. Cherubini
Chev. – F.F. Chevallier
Chiari – M. Chiari
Chiusa – L. La Chiusa
Chod. & Mart. – R.H. Chodat & C.E. Martin
Chrispijn – R. Chrispijn
Clel. – J.B. Cleland
Clémençon – H. Clémençon
Clericuzio – M. Clericuzio
Coccia – M. Coccia
Cohn – F. Cohn
Collin – P. Collin
Contu – M. Contu
Contu & Currelli – M. Contu & L. Currelli
Contu & Serra – M. Contu & D. Serra
Cooke – M.C. Cooke
Cool – C. Cool
Corda – A.K.J. Corda
Courtecuisse – R. Courtecuisse
Courtec. & Duhem – R. Courtecuisse & B. Duhem
Czern. – V.M. Czernajew
Dähncke – R.M. Dähncke
Dähncke & Dähncke – R.M. Dähncke & S.M. Dähncke
Dal Savio – F. dal Savio
Damblon & Lambinon – J. Damblon & J. Lambinon
Daniel-Arranz – J. Daniel-Arranz
Demoulin – V. Demoulin
Derbsch & Schmitt – H. Derbsch & J.A. Schmitt
Donk – M.A. Donk
Dörfelt – H. Dörfelt
Døssing – L. Døssing
Earle – F.S. Earle
Einh. – A. Einhellinger
Enderle – M. Enderle
Enderle & Laux – M. Enderle & H.E. Laux
Essette – H. Essette
Esteve-Rav. & Altés – F. Esteve-Raventos & A. Altés

Eyre – W.L.W. Eyre
J. Favre – J. Favre
Fay. – V. Fayod
Fillion – R. Fillion
G. Fischer – G. Fischer
Forti – P. Forti
Fourré – G. Fourré
Fr. – E.M. Fries
A.E. Freeman – A.E.H. Freeman
Gallinari & Tomasi – A. Gallinari & R. Tomasi
Gea & Honrubia – F.J. Gea & M. Honrubia
Genev. – L.G. Genevier
Gennari – A. Gennari
Gérault & Girre – A. Gérault & L. Girre
Gerhardt – E. Gerhardt
Gidholm – L. Gidholm
E.J. Gilb. – E.J. Gilbert
Gillet – C.C. Gillet
Gminder – A. Gminder
Godey – Godey
Godfrin – J. Godfrin
S.F. Gray – S.F. Gray
Grilli – E. Grilli
Groves – J.W. Groves
Guéguen – F. Guéguen
Guinb. – J. Guinberteau
Guinb. & Bodin – J. Guinberteau & M. Bodin
Haller – R. Haller
B. Hanff – B. Hanff
Hansen – L. Hansen
Hardtke & Rödel – H.-J. Hardtke & T. Rödel
A. Hauskn. – A. Hausknecht
Heilmann-Clausen – J. Heilmann-Clausen
R. Heim – R. Heim
Heim & Becker – R. Heim & G. Becker
Heim & Romagn. – R. Heim & H.C.L. Romagnesi
Heinem. – P. Heinemann
P. Henn. – P. Hennings
Herink – J. Herink
Hlaváček – J. Hlaváček
Höhn. – F.X.R. von Höhnel
Høiland – K. Høiland
Hoffm. – G.F. Hoffmann
Hongo – T. Hongo
Hora – F.B. Hora
Horak – E. Horak
Hornsch. – Chr.F. Hornschuch
Hotson & Stuntz – J.W. Hotson & D.E. Stuntz
Hotz – O. Hotz
Huds. – W. Hudson
Huijser – H.A. Huijser
Huijsman – H.S.C. Huijsman
Imaz. – R. Imazeki
Imbach – E.J. Imbach
Imler – L. Imler
Johnson & Vilgalys – J. Johnson & R. Vilgalys
Joss. – M. Josserand
Joss. & L. Riousset – M. Josserand & L. Riousset
Jülich – W.F.B. Jülich
Kalchbr. – K. Kalchbrenner
P. Karst. – P.A. Karsten
Kasparek – F. Kasparek
C.H. Kauffm. – C.H. Kauffman
Kelderman – P.H. Kelderman
Keller – J. Keller
Kerrigan – R.W. Kerrigan
Knudsen – H. Knudsen
Kobler – B. Kobler
R. de Kok – R.P.J. de Kok
Kok & Vellinga – R.P.J. de Kok & E.C. Vellinga
Konr. – P. Konrad
Konr. & M. – P. Konrad & A. Maublanc
Korhonen – M. Korhonen
Kreisel – H. Kreisel
Krieglst. – G.J. Krieglsteiner
L. Krieglst. – L. Krieglsteiner
Krombh. – J.V. von Krombholz
Kühner – R. Kühner
Kühner & Romagn. – R. Kühner & H.C.L. Romagnesi
Kumm. – P. Kummer
O. Kuntze – C.E.O. Kuntze
Kuyp. & Schreurs – Th.W. Kuyper & J. Schreurs
L. – C. Linnaeus
Laber – D. Laber
Læssøe – T. Læssøe
Chr. Lange – Chr. Lange
J. Lange – J.E. Lange
Lanzoni – G. Lanzoni
Lasch – W.G. Lasch
Lavorato – C. Lavorato
Lazzari & Bellù – G. Lazzari & F. Bellù
Lincoff – G. Lincoff
Locq. – M.V. Locquin
Lohmeyer – T.R. Lohmeyer
Lonati – G. Lonati
Lund. & Nannf. – S. Lundell & J.A. Nannfeldt
Lütjeharms – W.J. Lütjeharms
Maire – R.C.J.E. Maire
Mal. & Bert. – J.L.G. Malençon & R. Bertault
Malenç. – J.L.G. Malençon
Marchand – A. Marchand
Mass. – G.E. Massee
Massart – F. Massart
Mattirolo – O. Mattirolo
Mattuschka – H.G. von Mattuschka
Melzer – V. Melzer
Ménier – Ch. Ménier
M. Meusers – M. Meusers
G. Meyer – G.F.W. Meyer
Michael – E. Michael
Michael & Hennig – E. Michael & B. Hennig
Migl. – V. Migliozzi
Migl. & Rava – V. Migliozzi & M. Rava
O.K. Miller – O.K. Miller, Jr.
Mitchell & Bresinsky – A.D. Mitchell & A. Bresinsky
Mohr – P. Mohr
F. Møller – F.H. Møller
Møller & J. Lange – F.H. Møller & J.E. Lange
Møller & Schaeff. – F.H. Møller & J. Schaeffer
Mont. – P. Montagne
Moreno – G. Moreno
Morg. – A.P. Morgan
Mornand – J. Mornand
Mos. – M.M. Moser

Mos. & Jül. – M.M. Moser & W.F.B. Jülich
Mos. & Sing. – M.M. Moser & R. Singer
O.F. Müll. – O.F. Müller
Murrill – W.A. Murrill
Narducci & Caroti – R. Narducci & V. Caroti
Nauta – M.M. Nauta
P.D. Orton – P.D. Orton
Over. – C. van Overeem
Pacioni – G. Pacioni
Panizzi – F. Panizzi
Papeti – C. Papeti
Parra – L.A. Parra
Partacini – G. Partacini
Pat. – N.T. Patouillard
Patanè – F. Patanè
Paul. – J.J. Paulet
Pázmány – D. Pázmány
A. Pears. – A.A. Pearson
Peck – C.H. Peck
Pegl. – D.N. Pegler
Pegl. & Brand – D.N. Pegler & A.W. Brand
Pegl. & Calonge – D.N. Pegler & F.D. Calonge
Pegl. & Legon – D.N. Pegler & N.W. Legon
Perrone – L. Perrone
Pers. – C.H. Persoon
J. Petersen – J.H. Petersen
Petch – T. Petch
R. Phillips – R. Phillips
Pilát – A. Pilát
Pilát & Ušák – A. Pilát & O. Ušák
Pilát & Pouz. – A. Pilát & Z. Pouzar
Pötz – H. Pötz
Quél. – L. Quélet
Quél. & Bern. – L. Quélet & G. Bernard
Rab. – G.L. Rabenhorst
Raithelhuber – J. Raithelhuber
Rald – E. Rald
Rauschert – S. Rauschert
Rea – C. Rea
Redhead – S.A. Redhead
D. Reid – D.A. Reid
Reid & Eicker – D.A. Reid & A. Eicker
Reijnders – A.F.M. Reijnders
Relh. – R. Relhan
Richon & Roze – C.E. Richon & E. Roze
J. Rick – J. Rick
G. Riousset – G. Riousset
L. Riousset – L. Riousset
Rocabruna – A. Rocabruna
Rodríguez Armas – L. Rodríguez Armas
Romagn. – H.C.L. Romagnesi
Ryman & Holmåsen – S. Ryman & I. Holmåsen
Sacc. – P.A. Saccardo
Sacc. & Syd. – P.A. Saccardo & P. Sydow
Sacc. & Trott. – P.A. Saccardo & A. Trotter
Saut. – A.E. Sauter
Schaeff. – J.C. Schaeffer
J. Schaeff. – J. Schaeffer
J. Schaeff. & Møller – J. Schaeffer & F.H. Møller
J. Schaeff. & Steer – J. Schaeffer & Steer
Schätzle & Ottmann – E. Schätzle & G. Ottmann
Schnizl. – A.C.F.H.C. Schnizlein
Schrank – F. von Paula von Schrank
Schreurs – J. Schreurs
Schroet. – J. Schroeter
S. Schulz. – S. Schulzer von Muggenburg
Schulz-Weddigen – J. Schulz-Weddigen
Schum. – H.C.F. Schumacher
Schwöbel – H. Schwöbel
Scop. – G.A. Scopoli
Secr. – L. Secretan
Serafin – Serafin
Signorello – P. Signorello
Sing. – R. Singer
Sing. & Clém. – R. Singer & H. Clémençon
Sing. & Digilio – R. Singer & A.P.L. Digilio
A.L. Sm. & Rea – A.L. Smith & C. Rea
A.H. Smith – A.H. Smith
H.V. Smith – H.V Smith
W.G. Sm. – W.G. Smith
Sow. – J. Sowerby
Speg. – C.L. Spegazzini
Stridvall – L. Stridvall
Stridvall & A. Stridv. – L. Stridvall & A. Stridvall
Sturm – J. Sturm
Sundb. – W.J. Sundberg
Svrcek – M. Svrcek
Szujko-Lacza – J. Szujko-Lacza
Tabarés – M. Tabarés
Trimb. – J. Trimbach
Trimb. & Augias – J. Trimbach & Augias
Uljé – C.B. Uljé
Vasas – G. Vasas
Velen. – J. Velenovsky
Vellinga – E.C. Vellinga
Vesterholt – J. Vesterholt
Vila – J. Vila
Vitt. – C. Vittadini
Vogl. – P. Voglino
G.A. de Vries – G.A. de Vries
Wak. & Pears. – E. Wakefield & A.A. Pearson
Wallr. – C.F.W. Wallroth
Wasser – S.P. Wasser
Weholt – Ø. Weholt
Weinm. – J.A. Weinmann
Wichansky – E. Wichansky
Wilhelm – M. Wilhelm
Winterhoff & Bon – W. Winterhoff & M. Bon
Wuilbaut – J.J. Wuilbaut
Zalin & Migl. – G. Zalin & V. Migliozzi
Zecchin – G. Zecchin
Zeller – S.M. Zeller
Zschieschang – G. Zschieschang
Zuccherelli – A. Zuccherelli

CHAPTER 4

Bibliographic abbreviations

E.C. VELLINGA, M.M. NAUTA & M.E. NOORDELOOS

a. *Books*

Arnolds & Veerkamp, Gids Paddest. Meetnet – Gids voor de paddestoelen in het meetnet.

Arnolds et al., Overz. Paddest. Nederland – Overzicht van de paddestoelen in Nederland.

Arora, Mushr. demyst. – Mushrooms demystified.

B. & Br., Notic. Br. Fungi – Notices of British fungi. In various journals.

Barla, Fl. mycol. ill. – Flore mycologique illustrée. Les champignons des Alpes-Maritimes.

Bas et al., Fl. agar. neerl. – Flora agaricina neerlandica.

Big. & Guill., Fl. Champ. sup. France – Flore des champignons supérieurs de France.

Bolt., Hist. Fung. Halifax – A history of fungusses growing in Halifax.

M. Bon, Champ. Eur. occid. – Champignons d'Europe occidentale.

M. Bon, Fl. mycol. Eur. 3, Lépiotes – Flore mycologique d'Europe 3. Les Lépiotes. Doc. mycol. Mémoirs hors série no. 3. Lepiotaceae Roze.

Boud., Ic. mycol. – Icones mycologicae.

Breitenb. & Kränzl., Pilze Schweiz – Pilze der Schweiz.

Bres., Fungi trident. – Fungi tridentini.

Bres., Iconogr. mycol. – Iconographia mycologica.

Bull., Herb. France – Herbier de la France.

Candusso & Lanzoni, Lepiota – Lepiota s.l. Fungi europaei 4.

Cappelli, Agaricus – Agaricus. Fungi europaei 1.

Cetto, Funghi Vero – Funghi dal vero.

Cetto, Gr. Pilzf. – Der große Pilzführer.

Chev., Fl. générale Env. Paris – Flore générale des environs de Paris,...

Chrispijn, Champ. Jordaan – Champignons in de Jordaan. De paddestoelen van Amsterdam.

Clel., Toadst. Mushr. South Australia – Toadstools and mushrooms and other larger fungi of South Australia.

Clémençon, Anat. Hymenomyc. – Anatomie der Hymenomyceten.

Cohn, Krypt.-Fl. Schlesien – Kryptogamenflora von Schlesien.

Cooke, Handb. Brit. Fungi – Handbook of British fungi.

Cooke, Ill. Brit. Fungi – Illustrations of British fungi.

Cooke & Quél., Clav. syn. Hymenomyc. eur. – Clavis synoptica hymenomycetum europaeorum.

Corda, Icon. Fung. – Icones fugnorum hucusque cognitorum...

Courtec. & Duhem, Guide Champ. France Europe – Guide des champignons de France et d'Europe.

Dähncke, 1200 Pilze – 1200 Pilze.

Dähncke & Dähncke, 700 Pilze – 700 Pilze in Farbfotos.

Derbsch & Schmitt, Atl. Pilze Saarlandes – Atlas der Pilze des Saarlandes. Teil 2: Nachweise, Ökologie, Vorkommen und Beschreibungen. Aus Natur und Landschaft im Saarland. Sonderband 3.

Essette, Psalliotes – Les Psalliotes. Atlas mycologiques 1.

J. Favre, Cat. descr. Champ. sup. Zone subalpine – Catalogue descriptif des champignons supérieurs de la zone subalpine du Parc National Suisse. In Ergebn. wiss. Unters. schweiz. NatnParks, n.F. VI, 42.

J. Favre, Champ. sup. Zone alpine – Les champignons supérieurs de la zone alpine du Parc National Suisse. In Ergebn. wiss. Unters. schweiz. NatnParks, n.F. V, 33.

Fr., Epicrisis – Epicrisis systematis mycologi.

Fr., Hymenomyc. eur. – Hymenomycetes europaei sive Epicriseos systematis mycologici.

Fr., Ic. sel. Hymenomyc. – Icones selectae hymenomycetum selectum nondum delineatorum.

Fr., Monogr. Hymenomyc. Sueciae – Monographia Hymenomycetum Sueciae.

Fr., Syst. mycol. – Systema mycologicum.

Fr., Syst. mycol., Ind. gen.– Systema mycologicum, Index generalis.

Fr., Syst. Orb. veg. – Systema orbis vegetabilis.

Gerhardt, Gr. Pilzf. – Große BLV Pilzführer.

E.J. Gilb., Genre Amanita – Le genre Amanita Persoon.

Gillet, Champ. France – Les champignons (fungi, hyménomycètes) qui croissent en France et description et iconographie, propriétés utiles ou vénéneuses.

Gillet, Hyménomycètes – Les Hyménomycètes.

S.F. Gray, Nat. Arr. Br. Pl. – Natural Arrangement of British Plants.

Groves, Edible pois. Mushr. Canada – Edible and poisonous mushrooms of Canada Ed. 2. In Publs Dep. Agric. Can. 1112.

Hansen & Knudsen, Nordic Macromyc. – Nordic Macromycetes.

Hoffm., Abb. Schwämme – Abbildungen der Schwämme.

Horak, Syn. Gen. Agar. – Synopsis Generum Agaricalium. In Beitr. Kryptog.Fl. Schweiz 13.

Hornsch., Syll. Pl. nov. Ratisb. – Sylloge plantarum novarum itemque minus cognitarum a praesantissimis botanicis adhuc viventibus collecta et a societate regia botanica Ratisbonensi edita.

Imaz. & Hongo, Col. Ill. Mushr. Japan – Colored illustrations of mushrooms of Japan.

Imaz. et al., Fungi Japan – Fungi of Japan.

Jülich, Higher Taxa Basidiomyc. – Higher taxa in Basidiomycetes. In Biblthеca mycol. 85.

Kalchbr., Ic. sel. Hymenomyc. Hung. – Icones selectae Hymenomycetum Hungariae.

P. Karst., Ryssl., Finl. Skand. Halføns Hattsvamp. – Rysslands, Finlands och den Skandinaviska halføns hattsvampar. In Bidr. Känn. Finl. Nat. Folk 32.

Kelderman, Parasolzw. Zuid-Limburg – Parasolzwammen van Zuid-Limburg. Lepiota s.l. excl. Macrolepiota.

Keller, Atl. Basidiomyc. – Atlas des Basidiomycètes vus aux microscopies electroniques.

Knudsen & Vesterholt, Truede Storsvampe Danmark – Truede storsvampe i Danmark – en rödliste.

Konr. & M., Ic. sel. Fung. – Icones selectae fungorum.

Krombh., Naturg. Abb. Beschr. essb. schädl. verd. Schwämme –

Naturgetreue Abbildungen und Beschreibungen der essbaren, schädlichen und verdächtigen Schwämme.
Kühner & Romagn., Fl. anal. Champ. sup. – Flore analytique des champignons supérieurs.
Kühner & Romagn., Compl. Fl. anal. – Compléments à la 'Flore analytique'. In various journals. Bibltheca mycol. 56.
Kumm., Führ. Pilzk. – Der Führer in die Pilzkunde.
O. Kuntze, Rev. Gen. Pl. – Revisio generum plantarum.
L., Spec. Pl. – Species plantarum.
J. Lange, Fl. agar. dan. – Flora agaricina danica.
Lazzari & Bellù, Atl. iconogr. – Atlante iconografico. Suppl. Boll. Gr. micol. G. Bres. 24.
Lincoff, Field Guide N. Amer. Mushr. – The Audubon Society Field Guide to North American Mushrooms.
Mal. & Bert., Fl. Champ. sup. Maroc – Flore des champignons supérieurs du Maroc.
Manz, Unters. Kultur Lebensz. Leucoagaricus naucinus, Macrolepiota procera – Untersuchungen über die Kultur und den Lebenszyklus von Leucoagaricus naucinus (Fr.) Sing. und Macrolepiota procera (Scop. ex Fr.) Sing.
Marchand, Champ. Nord Midi – Champignons du nord et du midi.
Mass., Brit. Fungus Fl. – British fungus flora.
Massart, Champignons – Les champignons. Où et quand les trouver.
G. Meyer, Pr. Fl. essequ. – Primitiae florae essequeboensis.
Michael, Führ. Pilzfr. – Führer für Pilzfreunde.
Michael & Hennig, Handb. Pilzfr. – Handbuch für Pilzfreunde.
Michael et al., Handb. Pilzfr. – Handbuch für Pilzfreunde.
Mos., Blätter-, Bauchpilze – Die Blätter- und Bauchpilze.
Mos., Röhrlinge, Blätter-, Bauchpilze – Die Röhrlinge, Blätter- und Bauchpilze.
Mos., Röhrlinge Blätterpilze – Röhrlinge und Blätterpilze.
Mos. & Jül., Farbatl. Basidiomyc. – Farbatlas der Basidiomyceten.
Nauta & Vellinga, Atl. Nederl. Paddest. – Atlas van Nederlandse paddestoelen.
Pat., Essai tax. Hym. – Essai taxonomique sur les familles et les genres des Hyménomycètes.
Paul., Tr. Champ. – Traité des champignons.
Pegl., Agaric Fl. Lesser Antilles – Agaric Flora of the Lesser Antilles. Kew Bull. add. Series 9.
Pegl., Agaric Fl. Sri Lanka – Agaric Flora of Sri Lanka. Kew Bull. add. Series 12.
Pegl., Prel. Agaric Fl. East Africa – A preliminary Agaric flora of East Africa. Kew Bull. add. Series 6.
Pers., Observ. mycol. – Observationes mycologicae.
Pers., Syn. meth. Fung. – Synopsis methodica fungorum.
Pers., Tent. Disp. meth. Fung. – Tentamen dispositionis mehtodicae fungorum...
R. Phillips, Paddest. Schimm. – Paddestoelen en schimmels van West-Europa.
Pilát, Klíč urč. Hub hřib. bedl. – Klíč k určování našich hub hřibovitých a bedlovitých.
Pilát & Ušák, Naše Houby – Naše Houby.
Quél., Champ. Jura Vosges – Les Champignons du Jura et des Vosges. In various journals.
Quél., Enchir. Fung. – Enchiridion fungorum qui in Europa media et praesertim in Gallia vigentium.
Quél., Fl. mycol. France – Flore mycologique de la France et des pays limitrophes.
Rab., Deutschl. Krypt.Fl. – Deutschlands Kryptogamen-Flora.
Rea, Brit. Basidiomyc. – British Basidiomycetae.
Richon & Roze, Atl. Champ. comest. vénéneux – Atlas des champignons comestibles et vénéneux de la France et des pays circonvoisins.
Ryman & Holmåsen, Svampar – Svampar.
Sacc., Syll. Fung. – Sylloge fungorum.
Schaeff., Fung. Bavariae – Fungorum qui in Bavaria et Palatinatu circa Ratisbonam nascuntur icones.
Scop., Fl. carn. – Flora carniolica.
Sing., Agar. mod. Taxon. – The Agaricales in modern taxonomy.
A.H. Smith, Mushr. nat. Hab. – Mushrooms in their natural habitats.
W.G. Sm., Synopsis Brit. Basidiomyc. – Synopsis of the British basidiomycetes.
Sow., Col. Figs Engl. Fungi – Coloured figures of English fungi or mushrooms.
Sturm, Deutschl. Fl. – Deutschlands Flora.
Szujko-Lacza, Fl. Hortobágy natn. Park – Flora of the Hortobágy National Park (Budapest).
Urbonas et al., Konsp. agar. Grib. LSSR, LSSR, ESSR – Konspekt izucheniva agarikovykh gribov Litovskei SSR, Latvisoii SSR, Estonskoi SSR (Materialy 1778-1973).
Velen., České Houby – České houby.
Velen., Novit. mycol. – Novitates mycologicae.
Velen., Novit. mycol. nov. – Novitates mycologicae novissimae.
Vitt., Descr. Funghi mang. Italia – Descrizione dei Funghi mangerecci più comuni dell' Italia.
Wasser, Tr. Agariceae Soviet Union – Tribe Agariceae Pat. of the Soviet Union.
Wasser, Agarikovye Griby S.S.S.R. – Agarikovye Griby S.S.S.R.
Wasser, Fl. Fung. R.S.S. Ucrainicae, Agaricaceae – Flora fungorum RSS Ucrainicae. Basidiomycetes, Agaricaceae Cohn.
Zuccherelli, Funghi Pinete Zone medit. – I funghi delle pinete delle zone mediterranee.

b. *Journals and series*

Acta Mus. nat. Prag. – Acta musei nationalis Pragae (Sborník národního musea v Praze – Sb. nár. Mus. Praze).
Acta phytotax. barc. – Acta phytotaxonomica barcinonesia.
Agarica – Agarica.
An. Mus. argent. Cienc. nat. – Anales del Museo argentino de Ciencias naturales 'Bernardino Ravadavia' Buenos Aires.
An. Mus. nac. Hist. nat. B. Aires – Anales del Museo nacional de historia natural de Buenos Aires.
An. Soc. cient. arg. – Anales de la Sociedad científica argentina.
Ann. Mag. nat. Hist. – Annals and Magazin of Natural History.
Annls hist.-nat. Mus. natn. hung. – Annales historico-naturales Musei nationalis hungarici.
Annls mycol. – Annales mycologici.
Ann. Rep. N. Y. State Bot. – Annual Report of the New York State Botanist.
Annls Sci. nat., Bot. – Annales des sciences naturelles, sér. II, Botanique.
Atti Accad. naz. Lincei Memorie – Atti dell' Accademia nazionale dei Lincei. Memorie.
Atti XIX Com. scient. naz. Serina (Bergamo) – Atti di XIX Comitato Scientifico Nazionale, Serina (Bergamo).
Beih. Nova Hedwigia – Beihefte zur Nova Hedwigia.
Beih. Sydowia – Beihefte zur Sydowia.
Beih. Z. Pilzk. – Beihefte zur Zeitschrift für Mykologie.
Beitr. Kenntn. Pilze Mitteleur. – Beiträge zur Kenntnis der Pilze Mitteleuropas.
Belg. J. Bot. – Belgian Journal of Botany.
Ber. bayer. bot. Ges. – Bericht der Bayerischen botanischen Gesellschaft zur Erforschung der heimischen Flora.
Ber. naturh. Ver. Augsburg – Bericht des naturhistorischen Vereins in Augsburg.

Ber. naturf. Ges. Augsburg – Bericht der naturforschenden Gesellschaft Augsburg.
Bidr. Känn. Finl. Nat. Folk – Bidrag til kännedom om Finlands natur och folk.
Blyttia – Blyttia.
Bol. Soc. Brot. – Boletim da Sociedade Broteriana.
Bol. Soc. micol. Madrid – Boletín de la Sociedad Micologica de Madrid.
Bolets Catalunya – Bolets de Catalunya.
Boletus – Boletus.
Boll. Ass. micol. ecol. Romana – Bollettino dell'Associazione micologica ed ecologica romana.
Boll. Circ. micol. G. Carini – Bollettino del Circolo micologico «Giovanni Carini».
Boll. Gruppo micol. G. Bres. – Bollettino del Gruppo micologico 'G. Bresadola'.
Boln Acad. nac. Cienc. Córdoba – Boletin de la Academia nacional de ciencias en Córdoba.
Borbásia – Borbásia, Dissertationes botanicae.
Bot. Bull. Acad. sinica – Botanical Bulletin of Academia Sinica.
Bot. Gaz. – Botanical Gazette.
Bot. Tidsskr. – Botanisk Tidsskrift.
Bull. Féd. mycol. Dauph. Savoie – Bulletin trimestriel de la Fédération Mycologique Dauphiné-Savoie.
Bull. Inst. agron. Stns Rech. Gembloux – Bulletin de l'Institut agronomique de l'état et des stations de recherches de Gembloux.
Bull. Jard. bot. Buitenzorg – Bulletin du Jardin botanique de Buitenzorg.
Bull. Jard. bot. État – Bulletin du Jardin Botanique de l'État à Bruxelles.
Bull. Jard. bot. natn. Belg. – Bulletin de Jardin botanique national de Belgique.
Bull. mens. Soc. linn. Lyon – Bulletin mensuel de la Société Linnéenne de Lyon.
Bull. N.Y. bot. Gdn – Bulletin of the New York Botanical Garden.
Bull. semest. Soc. mycol. Nord – Bulletin semestriel de la Société Mycologique du Nord.
Bull. Soc. bot. Fr. – Bulletin Société botanique. France.
Bull. Soc. bot. Genève – Bulletin de la Société botanique de Genève.
Bull. Soc. Hist. nat. Afr. N. – Bulletin de la Société d'histoire naturelle de l'Afrique du Nord.
Bull. Soc. mycol. Fr. – Bulletin de la Société mycologique de France.
Bull. Soc. nat. Oyonnax – Bulletin de la Société des naturalistes d'Oyonnax pour l'étude et la diffusion des sciences naturelles dans la région.
Bull. Soc. roy. bot. Belg. – Bulletin de la Société Royale de Botanique de Belgique.
Bull. Torrey bot. Cl. – Bulletin of the Torrey Botanical Club.
Bull. trimest. Soc. mycol. Fr. – Bulletin trimestriel de la Société mycologique de France.
C. r. hebd. Séanc. Acad. Sci., Paris – Compte rendu hebdomadaire des séances de l'Académie des sciences. Paris.
C. r. Ass. franç. Av. Sci. – Compte rendu de l'Association française pour l'avancement des sciences.
Carinthia – Carinthia.
Carolinea – Carolinea.
Česká Mykol. – Česká Mykologie.
Comm. Soc. critt. ital. – Società crittogamologica italiana. Commentario.
Contr. Univ. Mich. Herb. – Contributions from the University of Michigan Herbarium.
Coolia – Coolia.
Cryptog. Mycol. – Cryptogamie, Mycologie.
Dansk bot. Ark. – Dansk botanisk Arkiv.
Denkschr. bayer. bot. Ges. Regensburg – Denkschriften der Königlichen Bayerischen botanischen Gesellschaft zu Regensburg.
Doc. mycol. – Documents mycologiques.
Ergebn. wiss. Unters. schweiz. NatnParks – Ergebnisse der wissenschaftlichen Untersuchungen des schweizerischen Nationalparks.
Fl. batava – Flora batava.
Fl. mycol. Eur. – Flore mycologique d'Europe. Documents mycologiques Mémoire hors Série.
Fl. icon. Champ. Congo – Flore iconographique des champignons du Congo.
Food Chem. – Food Chemistry.
Friesia – Friesia.
Fung. rar. Ic. col. – Fungorum rariorum icones coloratae.
Funghi Amb. – Funghi e ambiente.
Fungi exs. suec. – Fungi exsiccati sueci.
Fungus – Fungus.
Göteborgs Svampekl. Årsskr. – Göteborgs Svampeklubbs Årsskrift.
Grevillea – Grevillea.
Hedwigia – Hedwigia.
Iheringia, Bot. – Iheringia, Botânica.
J. Bot., Paris – Journal de Botanique, Paris.
J. Jap. Bot. – Journal of Japanese botany.
J. Mycol. – Journal of Mycology.
J. Toxicol. Clin. Toxicol. – Journal of Toxicology. Clinical Toxicology.
Jordstjärnan – Jordstjärnan.
Kew Bull. – Kew Bulletin.
Kew Bull. add. Series – Kew Bulletin Additional Series.
Lejeunia – Lejeunia.
Libri bot. – Libri botanici.
Lilloa – Lilloa.
Linnaea – Linnaea.
Lloydia – Lloydia.
Madroño – Madroño.
Magy tudom. Akad. Értek. természettud. Köreb. – Magyar Tudományos Akadémia. Értekezések a természettudományok köréből.
Meded. Ned. mycol. Vereen. – Mededeelingen van de Nederlandsche Mycologische Vereeniging.
Mem. N.Y. bot. Gdn – Memoirs of the New York Botanical Garden.
Mem. Fac. Educ. Shiga Univ. Nat. Sci. – Memoirs of the Faculty of Education, Shiga University. Natural Science.
Mém. Soc. Émul. Montbéliard – Mémoires de la Société d'émulation de Montbéliard.
Memorie Soc. tosc. Sci. nat. – Memorie della Società Toscana di Scienze Naturali.
Metrodiana – Metrodiana.
Micol. ital. – Micologia italiana.
Micol. Veget. medit. – Micologia e vegetazione mediterranea.
Micol. veneta – Micologia veneta.
Mikol. Közlem. – Mikologiai Közlemények
Mitt. aargau. naturf. Ges. – Mitteilungen der Aargauischen naturforschenden Gesellschaft.
Mitt. naturf. Ges. Luzern – Mitteilungen der naturforschenden Gesellschaft in Luzern.
Mittbl. Arbeitsgem. Pilzk. Niederrhein – Mitteilungsblatt der 'Arbeitsgemeinschaft Pilzkunde Niederrhein'.
Mol. Phylogen. Evol. – Molecular Phylogenetics and Evolution.
Mycol. Res. – Mycological Research.
Mycologia – Mycologia.

Mycologist – The Mycologist; Mycologist.
Mycopath. Mycol. appl. – Mycopathologia et mycologia applicata.
Mycotaxon – Mycotaxon.
Mykol. Mittbl. – Mykologisches Mitteilungssblatt.
Mykol. Sb., Praha – Mykologicky sbornik, Praha.
Mykologia – Mykologia.
N. Amer. Fl. – North American Flora.
N. Z. J. Bot. – New Zealand Journal of Botany.
Nordic J. Bot. – Nordic Journal of Botany.
Not. bot. Horti agrobot. Cluj-Napoca – Notulae botanicae Horti agrobotanici Cluj-Napoca.
Notes R. bot. Gdn Edinb. – Notes from the Royal Botanic Garden, Edinburgh.
Nova Hedwigia – Nova Hedwigia.
Nov. Sist. vyssh. nizsh. Rast. – Novosti Sistematiki vysshikh i nizshikh Rastenii.
Papers Mich. Acad. Sci., Arts Letters – Papers from the Michigan Academy of Science, Arts and Letters.
Persoonia – Persoonia.
Pilzfl. Nordwestoberfrankens – Pilzflora Nordwestoberfrankens.
Publs Dep. Agric. Can. – Publications. Department of Agriculture. Canada.
Rep. N.Y. St. Mus. nat. Hist. – Report on the New York State Museum of natural History.
Reprium nov. Spec. Regni veg. – Repertorium specierum novarum regni vegetabilis.
Rev. catal. Micol. – Revista Catalana di Micologia.
Revue gén. Bot. – Revue générale de Botanique.
Riv. Micol. – Rivista di Micologia.
S. Afr. J. Bot. – South African Journal of Botany.
Schweiz. Z. Pilzk. – Schweizerische Zeitschrift für Pilzkunde.
Science – Science.
Sc. tot. Env. – Science of the Total Environment.
Seem. J. Bot. – Seemann's Journal of Botany.
Sieni Lehti – Sieni Lehti.
Svampe – Svampe.
Südwestd. Pilzrundschau – Südwestdeutsche Pilzrundschau.
Sydowia – Sydowia.
Trans. Br. mycol. Soc. – Transactions of the British Mycological Society.
Ukr. bot. Zh. – Ukrayins'kyi botanichnyi zhurnal.
Ulmer Pilzfl. – Ulmer Pilzflora.
Verh. bot. Ver. Prov. Brandenb. – Verhandlungen des Botanischen Vereins für die Provinz Brandenburg.
Verh. zool. bot. Ges. Wien – Verhandlungen der Zoologisch-botanischen Gesellschaft in Wien.
Wiss. Z. Ernst Moritz Arndt-Univ. Greifswald – Wissenschaftliche Zeitschrift der Ernst Moritz Arndt-Universität Greifswald.
Z. Mykol. – Zeitschrift für Mykologie.
Z. Pilzk. – Zeitschrift für Pilzkunde.

B
Taxonomic part

Agaricaceae (Fr.) Cohn

ELSE C. VELLINGA

Agaricus 'subordo' Agaricini Fr., Syst. Orb. veg.: 65. 1825; Agaricus 'ordo' Agariceae Chev., Fl. générale Env. Paris 1: 121. 1826; Agaricaceae (Fr.) Cohn in Hedwigia 11: 17. 1872. – Lepiotaceae Over. in Bull. Jard. bot. Buitenzorg 9: 19. 1927. – Leucocoprinaceae Sing. in Annls mycol. 34: 323. 1936 (not valid); Leucocoprinaceae Sing. ex Jülich, Higher Taxa Basidiomyc.: 376. 1981.

Basidiocarp pluteoid or, more rarely, collybioid or mycenoid; lamellae free, irregular in secotioid species; universal and partial veil in most species present; annulus or annular zone often present; spore print white, cream, pale lilac, pale pink, brown, (pale) grey-brown, dark reddish brown or reddish brown, green, in one species discolouring on drying to blackish, even blue in one tropical genus.

Spores smooth, rarely ornamented (in most cases small warts, in one tropical genus an intricate reticulate pattern), uninucleate or binucleate, with or without germ pore, without or with apical endosporal thickening, thick-walled, dextrinoid, rarely not, and often metachromatic in Cresyl Blue, but those reactions may be obscured by pigmentation; cheilocystidia almost always present; pleurocystidia almost always absent; hymenophoral trama regular or trabecular; clamp-connections absent or present. Development bivelangiocarpic in most species, rarely monovelangiocarpic, and pileocarpic, pileostipitocarpic, hymenocarpic, stipitocarpic, or isocarpic. – Type genus *Agaricus* L.: Fr.

HABITAT & DISTRIBUTION. – Solitary to gregarious or in fairy rings, saprotrophic and terrestrial, rarely on decaying wood, in woods and in grasslands, often on soil relatively rich in nutrients (esp. nitrogen), widespread, and cosmopolitan; with many diverse representatives in the tropics.

Singer (Agar. mod. Taxon., Ed. 4: 465-467. 1986) had a wider concept of the family than is practiced here; he included tribus Cystodermateae Sing. and the genus *Pseudobaeospora* Sing. within the Agaricaceae. As argued by Bas (in Bas et al., Fl. agar. neerl. 1: 44. 1989) and confirmed by molecular evidence (Johnson & Vilgalys in Mycologia 90: 976. 1998; Vellinga, unpublished results) neither of these taxa belong to the Agaricaceae.

Singer (Agar. mod. Taxon., Ed. 4: 465-467. 1986) recognized three tribus (excluding the Cystodermateae), viz. Leucocoprineae, Agariceae, and Lepioteae. This subdivision of the family is not supported by molecular evidence (Johnson & Vilgalys in Mycologia 90: 971-979. 1998; Johnson in Mycologia 91: 443-458. 1999). Further molecular research by the present author on this group shows that a division into two groups is more plausible, combining the former tribus Agariceae and Leucocoprineae, while transferring *Melanophyllum* Velen. to tribus Lepioteae.

Coprinus comatus (O.F. Müll.: Fr.) Pers. and *C. sterquilinus* Fr. are treated under *Coprinus* (Pers.: Fr.) S.F. Gray, though they are considered more closely related to members of the Agaricaceae than to the rest of the genus *Coprinus* (Hopple & Vilgalys in Mol. Phylogen. Evol. 13: 1-19. 1999).

Some secotioid genera are closely related to members of the Agaricaceae. An example is *Endoptychum* Czern., which is represented with one species in Europe, viz. *E. agaricoides* Czern. Singer (Agar. mod. Taxon., Ed. 4. 1986) did not mention this genus in his treatment of the Agaricales.

Several species are considered excellent edibles and are widely cultivated or gathered, but the family also harbours deadly toxic members.

KEY TO THE GENERA

1. Spore print brown, (dark) reddish brown, or reddish turning blackish on drying; lamellae turning brown with age, or pinkish red
   2. Pileus covering granular, made up of globose elements only . . . . . **10 (1) Melanophyllum haematospermum**
   2. Pileus covering smooth to radially fibrillose or squamose, made up of radial hyphae, rarely with clavate terminal elements

3. Basidiocarps discolouring yellow or red when scratched or cut, or not at all; spores without apical endosporal thickening; cheilocystidia clavate to globose, sometimes utriform or cylindrical, but without apical capitulum, or cheilocystidia absent ..... **1. Agaricus**
3. Basidiocarps when cut or scratched first discolouring yellow, then after c. 15 minutes vinaceous red to red; spores with apical endosporal thickening; cheilocystidia narrowly lageniform to almost cylindrical with apical capitulum ..... **2. Allopsalliota**

1. Spore print white or very pale (cream, light lilacinous, pink etc.), or green
4. Annulus complicated, with a double, fringed edge (see Fig. 44), movable with age
5. Spores and spore print white, cream or pale pink ..... **3. Macrolepiota** p.p.
5. Spores and spore print green ..... **4. Chlorophyllum**
4. Annulus simple, without fringes etc., only present as a thickened band on the stipe, or absent
6. Lamellae turning green or red in ammonia vapour ..... **6. Leucoagaricus** p.p.
6. Lamellae not turning green or red in ammonia vapour
7. Pileus radially sulcate; context in pileus thin and pliable; basidia surrounded by pseudoparaphyses; clamp-connections absent ..... **5. Leucocoprinus** p.p.
7. Pileus not radially sulcate, though radially fibrillose or squamose, smooth, or floccose; context thin to thick; pseudoparaphyses absent; clamp-connections present or absent
8. Pileus covering granular, floccose, warty, made up of globose to inflated, often loosely arranged elements
9. Pileus covering made up of globose elements; clamp-connections absent or present
10. Clamp-connections absent ..... **5. Leucocoprinus** p.p.
10. Clamp-connections present
11. Spore print pale green; lamellae pale blue-green ..... **10 (2) Melanophyllum eyrei**
11. Spore print white, cream; lamellae white, cream
12. Pileus covering made up of agglutinated chains of elements; terminal elements ellipsoid to globose ..... **7. Lepiota** p.p.
12. Pileus covering made up loosely arranged globose elements ..... **9. Cystolepiota** p.p.
9. Pileus covering made up of inflated elements; clamp-connections absent
13. Spores (3.5-)4.0-5.5(-6.0) 3 (2.0-)2.5-3.5 µm, thin-walled, without germ pore; pileus not radially sulcate ..... **9 (8) Cystolepiota pulverulenta**
13. Spores 8.0-12 3 5.5-7.5 µm, thick-walled, with germ pore; pileus radially sulcate in marginal zone ..... **5 (2) Leucocoprinus cretaceus**
8. Pileus covering smooth, squamose, with pointed warts or squamules, fibrillose, made up of narrowly clavate, or elongated, sometimes cystidioid elements, or both rounded elements in agglutinated chains and elongated connecting elements
14. Spores with germ pore
15. Spores 11.0-18.5(-20) 3 (6.5-)7.5-12 µm with hyaline cap over the pore **3. Macrolepiota** p.p.
15. Spores 7.0-11.5 3 5.0-8.0 µm, without or with hyaline cap over pore
16. Spores 9.5-11.5 3 6.5-8.0 µm with truncate apex with germ pore; pileus covering with tightly packed narrowly clavate terminal elements ..... **3. Macrolepiota** p.p.
16. Spores 7.0-10.0(-11) 3 5.0-7.0 µm with rounded apex; pileus covering with erect short to long cylindrical elements ..... **6. Leucoagaricus** p.p.
14. Spores without germ pore
17. Clamp-connections present, at least in pileus covering
18. Pileus covering smooth, but not gelatinized, with squamules made up of erect long elements, with pointed warts, or radially fibrillose etc.; pleurocystidia absent **7. Lepiota** p.p.
18. Pileus covering smooth, a hymeniderm, gelatinized; pleurocystidia present, large, with refractive contents ..... **8. Chamaemyces**
17. Clamp-connections absent
19. Pileus covering innately fibrillose, fibrillose-squamulose, sometimes slightly gelatinized at centre, not lanate, nor with pointed acute squamules, ranging in colour from white to black, pink, red, brown, or purplish lilac; basidiocarps pliable with soft tissues, and often fragile **6. Leucoagaricus** p.p.
19. Pileus covering either totally fibrillose-lanate, dull purplish, or with pointed acute squamules and brown; basidiocarps not pliable and fragile ..... **7. Lepiota** p.p.

1. Agaricus L.

MARIJKE M. NAUTA

Agaricus L., Spec. Pl. 2: 1171. 1753; *Agaricus* L.: Fr., Syst. mycol. 1: lvi, 8. 1821. – *Agaricus* tribus *Psalliota* Fr., Syst. mycol. 1: 280. 1821; *Psalliota* (Fr.) Kumm., Führ. Pilzk.: 23. 1871. – *Agaricus* # *Pratella* Pers., Syn. meth. Fung.: XVI. 1801; *Pratella* (Pers.) S.F. Gray, Nat. Arr. Br. Pl. 1: 626. 1821.

SELECTED LITERATURE – Bohus in Mikol. Közlem. 34: 5-36. 1995; M. Bon in Doc. mycol. 15(60): 1-37. 1985; Cappelli, Agaricus. 1984; Heinem. in Sydowia 30: 6-37. ('1977') 1978; M. Meusers in Beitr. Kenntn. Pilze Mitteleur. 2: 27-56. 1985; F. Møller in Friesia 4: 1-60. 1950; 135-220. 1952; Nauta in Persoonia 17: 221-233. 1999; Pilát in Acta Mus. nat. Prag. 7B (1): 1-142. 1951; Wasser, Tr. Agariceae Soviet Union: 15-120. 1989.

Basidiocarps pluteoid or collybioid, sometimes mycenoid; pileus smooth or fibrillose, or squam(ul)ose, dry, white to yellow or reddish to purplish brown, not discolouring to yellowing or reddening when touched or damaged; lamellae free, at first (pale) pinkish grey to (pale) pinkish brown, finally dark brown, sometimes brown; stipe central, often annulate; veil usually well-developed, white, present in form of usually appendiculate flocks at margin, sometimes on surface of pileus near margin, and as annulus attached at upper half of stipe; context not discolouring or (sometimes faintly) yellowish or reddish on exposure or when damaged; spore print dark reddish brown (Mu. 5 YR 3/2-3).

Spores smooth, also when observed with Scanning Electron Microscope, often relatively thick-walled, greyish brown or brown in water, KOH or ammonia when observed with light microscope, occasionally with germ pore or apically with thin spot; lamella edge usually with a sterile layer consisting of often catenate cheilocystidia; cheilocystidia cylindrical, clavate to subglobose; pleurocystidia absent; hymenophoral trama regular to irregular; pileipellis a cutis; pigment usually pale, parietal or intracellular; veil usually consisting of narrow hyphae; clamp-connections lacking in all tissues. Development bivelangiocarpic, isocarpic or hymenocarpic. – Typus conservandus: *Agaricus campestris* L.: Fr.

HABITAT & DISTRIBUTION – Saprotrophic, terrestrial on roadsides, in woods, city parks etc., also in grasslands, lawns, open dunes, often on nutrient-rich places. Widespread, often cosmopolitan, relatively more common in temperate zones.

The taxonomy of *Agaricus* remains far from clear, despite the contributions of many authors in recent times. It has not been possible in this study to unravel all the species-complexes to full satisfaction. A practical approach had to be chosen, but more research is needed, preferably of morphological as well as molecular characters. It is to be hoped that molecular studies will give a better insight in the infrageneric taxonomy of this genus.

In general the morphological features of the basidiocarps in this genus are rather variable, and the microscopical characters do not show much differentiation. In the work of Møller (in Friesia 4: 1-60. 1950; 135-220. 1952) the given spore measures are usually too small, in the work of Pilát (in Acta Mus. nat. Prag. 7B (1): 1-142. 1951) the given spore sizes are mostly larger than in reality. This combined with the scarcely preserved type material of Møller makes it sometimes difficult to ascertain the identity of species described by Møller or Pilát.

Average spore size and spore form (Qav) proved to be a useful character in *Agaricus*, but accuracy and the use of an oil-immersion lens is required.

The position of the annulus is given with regard to the base of the stipe.

KEYS TO THE SPECIES

1. Surface of basidiocarps and/or context yellow or yellowing (sometimes pale, but without brownish tinges) on exposure or when handled, damaged or cut, sometimes only in base of stipe or only rhizomorphs yellowing
   2. Context at first entirely and quickly bright yellow, then slowly vinaceous red, in the end surface of pileus and context entirely red; lamellae at first yellowish brown; spores with apically thickened endospore **Allopsalliota geesterani**
2. Context not discolouring as described above; lamellae at first greyish, greyish brown or pinkish brown; spores not with apically thickened endospore
   3. Spores with germ pore or with thin-walled spot at apex; lamella edge fertile, cheilocystidia absent; annulus fragile, evanescent (species of sect. *Agaricus* with yellowing pileus) ..... KEY ONE
   3. Spores without germ pore or thin-walled spot at apex; lamella edge sterile or partly fertile, usually with conspicuous cheilocystidia; annulus fragile to relatively persistent, fibrillose or squamose at underside

4. Annulus ascending or velar sock present (species of sect. *Bitorques* with sometimes yellowing pileus) KEY TWO
4. Annulus descending; no velar sock present
5. Rhizomorphs or pseudorhiza conspicuous and yellowing; Schaeffer-reaction orange on base of stipe, negative on surface of pileus
6. Pileus entirely reddish brown squamulose; stipe below annulus pruinose; veil composed of hyphae with inflated elements, intermixed with subglobose elements ..... **41. A. rufotegulis**
6. Pileus whitish to dark brown, stipe below annulus fibrillose or with brown girdles, not pruinose; veil composed of hyphae (sect. *Spissicaules*) ..... KEY THREE
5. Rhizomorphs or pseudorhiza if present white to brownish and not discolouring; Schaeffer-reaction either negative on base of stipe, or if positive (orange) also orange on pileus surface
7. Pileus not discolouring or sometimes yellow when damaged, yellow discoloration usually quickly disappearing, not visible on drying; stipe usually strongly yellow at base (surface and sometimes also context) when damaged or on oxidation, elsewhere sometimes faintly yellowing; smell unpleasant; Schaeffer-reaction on pileus negative (sect. *Xanthodermi*) ..... KEY FOUR
7. Pileus usually yellowing on handling, yellow discoloration not quickly disappearing, also visible or intensifying on drying; surface of stipe not discolouring to entirely yellowing on handling, not only at base; smell fresh pleasant, sometimes later unpleasant; Schaeffer-reaction on pileus positive (orange), rarely negative
8. Annulus broad, 9-35 mm wide, thick, underside floccose to squamose; stipe yellowish or not on handling; average spore length . 6.0 μm, often > 6.5 μm; lamella edge usually with broad layer of catenate sterile elements (sect. *Arvenses*) ..... KEY FIVE
8. Annulus narrow, up to 10 mm wide, thin, underside fibrillose; stipe usually strongly yellowing on handling; average spore length < 6.5 μm; sterile elements on lamella edge catenate or not, not forming broad sterile layer (sect. *Minores*) ..... KEY SIX

1. Neither surface nor context yellowing, sometimes yellowish brown tinges occur; rhizomorphs, if present, not yellowing
9. Spores with germ pore or with thin-walled spot at apex; lamella edge fertile: cheilocystidia absent; annulus thin, usually soon disappearing (sect. *Agaricus*) ..... KEY ONE
9. Spores without germ pore or thin-walled spot at apex; lamella edge sterile, with cheilocystidia; annulus thin or thick or with thickened margin, rarely only velar sock present
10. Context not discolouring on oxidation
11. Spores broad, average spore width > 4.6 μm; Qav 1.10-1.35(-1.45); terminal elements of cheilocystidia up to 13(-15) mm wide (species of sect. *Bitorques* with not discolouring context) ..... KEY TWO
11. Spores narrow, average spore width < 4.0 μm, Qav 1.40-1.70; terminal elements of cheilocystidia up to 20(-24) mm wide
12. Surface of stipe below annulus fibrillose-squamulose to flocculose; KOH on context or stipe yellowish brown; average spore size (5.1-)5.7-6.2 3 3.5-3.9 mm ..... **16. A. impudicus**
12. Surface of stipe below annulus fibrillose to satiny striate; KOH on context or stipe yellow to orange; average spore size 5.3-5.7 × 3.7-4.0 μm ..... **37. A. phaeolepidotus**
10. Context reddening or brownish on exposure or when damaged
13. Spores narrow, Qav > 1.40; cheilocystidia clavate to globose, up to 20(-25) μm wide
14. Surface of stipe below annulus fibrillose to satiny striate; KOH on context or stipe yellow to orange **37. A. phaeolepidotus**
14. Surface of stipe below annulus fibrillose-squamulose to lanate; KOH on context or stipe negative or yellowish brown (sect. *Sanguinolenti*) ..... KEY SEVEN
13. Spores relatively broad, Qav < 1.40; cheilocystidia clavate to cylindrical, up to 15(-17) μm wide
15. Annulus at underside at margin with radially arranged squames; average spore length 6.9-8.4 μm **20. A. depauperatus**
15. Annulus not with radially arranged squames at underside; average spore length 5.8-7.3 μm, if up to 7.7 μm only velar sock present (sect. *Bitorques*) ..... KEY TWO

KEY ONE

Pileus not discolouring, sometimes yellowing; veil usually present as thin, evanescent annulus; context not discolouring or discolouring faintly reddish; spores with germ pore or with thin-walled spot at apex; lamella edge fertile, cheilocystidia absent (sect. *Agaricus*)

1. Pileus covered with dark (grey-)brown to purple-brown fibrils or squamules
   2. Pileus with appressed greyish brown to greyish squamules, average spore size 7.5-7.9(-8.1) × 5.0-5.6 µm **1c. A. campestris** var. **squamulosus**
   2. Pileus entirely fibrillose, sometimes fibrillose-squamulose, usually dark purplish brown, average spore size varying from 6.4-8.3 µm
      3. Average spore length 7.6-8.3 µm; stipe typically attenuated towards base ..... **5. A. cupreobrunneus**
      3. Average spore length 6.4-6.9 mm; stipe typically ventricose ..... **6. A. porphyrocephalus**
1. Pileus white to sometimes yellowish, smooth, fibrillose or fibrillose-squamulose, fibrils only in the end brownish or greyish
   4. Stipe up to 100 mm long, longer than diameter of pileus; context in stipe usually reddish in upper part, yellowish in base ..... **4. A. altipes**
   4. Stipe usually up to 65 mm long, shorter than diameter of pileus; context not discolouring except for yellow-brown discoloration in base of stipe
      5. Pileus yellowing, surface nearly smooth
         6. Pileus white to yellowish, discolouring yellowish on handling or damaging, finally pale yellow; surface of stipe above annulus flocculose; average spore length 6.2-7.1 µm ..... **2. A. moellerianus**
         6. Pileus white, strongly yellowing; surface of stipe above annulus smooth; average length of spores 7.9-8.2 µm ..... **1b. A. campestris** var. **equestris**
      5. Pileus not to only very slightly yellowing; surface usually fibrillose or fibrillose-squamulose, rarely smooth
         7. Average length of spores 8.7-9.4 µm ..... **3. A. pampeanus**
         7. Average length of spores 7.5-8.1 µm ..... **1a. A. campestris** var. **campestris**

KEY TWO

Pileus not discolouring or slightly yellowing, rarely slightly reddening; annulus ascending and thin to thick or descending and thick, sometimes only velar sock present; context usually discolouring reddish or brownish on oxidation, sometimes not discolouring; spores without germ pore, relatively broad, Qav < 1.35(-1.45); lamella edge sterile, cheilocystidia conspicuous, clavate to cylindrical, up to 15 µm wide (sect. *Bitorques*)

1. Pileus whitish from the beginning, sometimes later with brownish tinges
   2. Basidiocarps small, fragile; diameter pileus up to 50(-55) mm; annulus relatively thin, narrow, velar sock absent **11. A. devoniensis**
   2. Basidiocarps larger, robust; diameter of pileus ≥ 50 mm; annulus thick and triangular or double, if narrow or absent velar sock present
      3. Annulus thick and triangular in transverse section; basidia 2-spored .... **10. A. bisporus** (cultivated variant)
      3. Annulus double, or narrow and ascending, or velar sock present; basidia 4-spored
         4. Annulus double, sometimes a high and low annulus present; velar sock absent; average spore size 5.9-6.5 × 4.6-4.9 µm ..... **7. A. bitorquis**
         4. Annulus, if present, narrow and ascending; velar sock present; average spore size (6.0-)6.6-7.7 × 4.9-6.2 µm
            5. Annulus usually present; average spore size (6.0-)6.6-7.3 × 4.9-6.1 µm; cheilocystidia long, cylindrical to clavate, 35-58 × 6.5-10(-12.5) µm ..... **8. A. bernardii**
            5. Annulus absent; average spore size 7.7 × 5.7-6.2 µm; cheilocystidia clavate, 20-36 × 8.5-10 µm **9. A. gennadii**
1. Pileus brown(ish) from the beginning
   6. Pileus fibrillose, usually with whitish velar flocks near margin ..... **12. A. subfloccosus**
   6. Pileus usually squamose, if only fibrillose then with broad white rim
      7. Pileus brown fibrillose to squamose, with broad white rim; smell fungoid, pleasant; basidia 2-spored; average spore size 7.1-7.3 × 5.4-5.9 µm ..... **10. A. bisporus**
      7. Pileus squamose; smell unpleasant; basidia 4-spored; average spore size 5.8-7.0 × 5.2-5.6 µm
         8. Basidiocarps solitary or in small groups, stipe clavate; cheilocystidia in clusters, width (5.5-)7.5-13 mm; average spore size 6.6-7.0 × 5.2-5.6 µm ..... **13. A. subperonatus**
         8. Basidiocarps fasciculate, with fusiform stipe; cheilocystidia not in clusters, width 6.0-9.0 mm; average spore size 5.8-6.5 × (4.8)5.3-5.5 µm ..... **14. A. bohusii**

KEY THREE

Pileus often slightly yellowing; base of stipe with yellowing rhizomorphs; context in base of stipe usually yellow on oxidation, usually faintly reddish elsewhere; Schaeffer-reaction positive (orange) on base of stipe, negative on surface of pileus; spores without germ pore; cheilocystidia either globose to clavate or inconspicuous (basidioliform), sometimes scarce (sect. *Spissicaules*)

1 Pileus mainly brown squamose; stipe below annulus with brown girdles ..... **39. A. lanipes**
1. Pileus mainly whitish to pale brownish, usually with appressed brownish squames at centre only; stipe below annulus smooth to fibrillose
  2. Pileus with appendiculate veil; average spore size (7.1-)7.4-8.0 × 5.2-5.8 μm; lamella edge usually partly fertile **38. A. litoralis**
  2. Pileus without appendiculate veil; average spore size 6.0-6.7 × 4.2-4.7 μm; lamella edge fertile to almost sterile **40. A. bresadolanus**

KEY FOUR

Pileus not discolouring or sometimes yellow on scratching, disappearing on drying, rarely slightly pink; context and/or surface in base of stipe discolouring yellow, usually brightly; KOH-reaction yellow to orange at base of stipe; Schaeffer-reaction on surface of pileus and base of stipe negative; smell unpleasant; spores without germ pore, length < 6.5 mm on average (sect. *Xanthodermi*)

1. Pileus grey or white, or greyish brown, starting smooth, sometimes later at centre breaking up into large indistinct squames and then brownish or reddish brown at centre
  2. Lamella edge sterile; cheilocystidia 10-20 mm wide, not in chains; pileus usually white, sometimes greyish, not discolouring pinkish on handling; annulus thickened at margin ..... **33. A. xanthodermus**
  2. Lamella edge in part fertile; cheilocystidia 6.5-12 mm wide, in short chains; pileus whitish or greyish brown, sometimes on handling becoming slightly pinkish brown
    3. Context strongly yellowing at base of stipe; pileus smooth to fibrillose, not breaking up into squames; annulus thickened at margin and split, forming triangle in transverse section. ..... **34. A. pilatianus**
    3. Context slightly yellowing at base of stipe, soon turning reddish; pileus soon breaking up into large indistinct squames at centre, sometimes remaining smooth; annulus relatively thin but persistent, not triangular **35. A. pseudopratensis**
1. Pileus entirely covered with brown or dark greyish brown fibrillose squamules even in young specimens 4
  4. Pileus with brownish to dark greyish brown small fibrillose squamules; context in base of stipe usually strongly yellowing on exposure or when damaged; cheilocystidia (terminal elements) globose to clavate, up to 15 mm wide. ..... **36. A. moelleri**
  4. Pileus with light brown, rather large fibrillose squames; context in base of stipe first pale yellow, later faintly brownish; cheilocystidia clavate, obovoid to globose, up to 23 mm wide ..... **37. A. phaeolepidotus**

KEY FIVE

Pileus yellowish on handling, especially on drying; annulus broad, up to 35 mm wide, with remnants of universal veil as thick flocks or warts at underside; context not discolouring or discolouring slightly yellow or orange to pinkish; KOH-reaction on context usually positive and yellow; Schaeffer-reaction on pileus orange, rarely negative; average spore length > 6.0 mm; without germ pore; cheilocystidia catenate (sect. *Arvenses*)

1. Pileus covered with yellow to brown squames on paler background; stipe often rooting; cheilocystidia in protuberant clusters and frequently of irregular form ..... **22. A. augustus**
1. Pileus white to yellowish or yellowish brown, if squames present these are mostly concolorous; stipe not rooting; cheilocystidia not in protuberant clusters
  2. Average spore size 10.1-10.7 3 6.5-7.2 mm; basidiocarps robust; smell soon unpleasant .... **27. A. urinascens**
  2. Average spore size , 9.5 3 6.0 mm; basidiocarps gracile to robust; smell usually pleasant, like almonds or anise
    3. Spores 9.0-9.5 × 5.0-5.5 mm; pileus with appressed coarse squames ..... **A. arvensis** var. **macrolepis** Pilát & Pouz. in Acta Mus. nat. Prag. 7B (1): 134. 1951 from eastern Europe, not yet found in the Netherlands and adjacent countries
    3. Spores < 9.0 μm; pileus without coarse squames, at most squamulose
      4. Average spore size 7.7-8.6 × 5.3-5.9 mm

5. Basidiocarps relatively gracile; pileus usually < 105 mm in diameter; stipe smooth to fibrillose below annulus, cylindrical to subbulbous, 55-120 × 10-20 mm (occasionally up to 34 mm at base); mostly in grassland ..... **21. A. arvensis**
5. Robust basidiocarps; pileus > 120 mm in diameter; stipe usually floccose-squamulose below annulus, bulbous, 100-200 × 20-30 mm (- 45 mm at base); mostly in woods ..... **26. A. macrocarpus**

4. Average spore size 6.0-7.5 × 4.1-5.3 µm
6. Basidiocarps gracile, quickly yellowing; annulus usually fragile; average spore size 6.0-6.7 × 4.1-4.7 µm; cheilocystidia globose to clavate ..... **25. A. sylvicola**
6. Basidiocarps gracile or robust, slowly and often faintly yellowing; annulus thick, persistent; average spore size 6.5-7.5 × 4.5-5.3 mm; cheilocystidia globose to clavate, in part utriform
7. Stipe cylindrical to rarely subbulbous, (65-)80-120 × 15-28 mm; pileus usually plano-convex, sometimes irregular, 80-175 mm in diameter; average spore size 6.8-7.5 3 4.8-5.3 µm; in grasslands, rarely in woods ..... **23. A. osecanus**
7. Stipe clavate to bulbous, 50-80 × 8-18 mm, at base 20-26 mm wide; pileus regularly convex, 65-95 mm in diameter; average spore size 6.5-7.2 × 4.5-5.0 µm; in woods ..... **24. A. pseudoumbrella**

KEY SIX

Surface of pileus and stipe strongly yellowing when touched or on drying; annulus narrow, thin, up to 10 mm wide, sometimes absent, fibrillose, without flocks or warts at underside; context discolouring slightly yellow, orange-yellow or yellowish brown on exposure or when damaged; Schaeffer-reaction on surface of pileus strongly orange; average spore length < 6.5 mm; cheilocystidia shortly catenate or not (sect. *Minores*)

1. Pileus at first white, quickly yellowing, rarely young with some purplish fibrils
2. Pileus 17-35(-40) mm in diameter, white, soon discolouring yellow, appressed fibrillose; lamella edge with minority of cystidia, sometimes cheilocystidia hardly present ..... **30. A. comtulus**
2. Pileus 40-70(-85) mm in diameter, white at first, soon yellowing, with yellowish brown fibrillose squames, later entirely yellow-brown; lamella edge almost sterile ..... **31. A. xantholepis**

1. Pileus vinaceous brown, or greyish brown to yellowish brown with purple brown fibrillose centre
3. Pileus reddish to purplish brown with numerous purplish brown fibrils and squames, later (reddish) brown, up to 90 mm in diameter ..... **32. A. porphyrizon**
3. Pileus at centre with vinaceous fibrils, sometimes with some squames, later yellowish brown, up to 65(-80) mm in diam.
4. Average spore length < 5.7 mm ..... **28. A. dulcidulus**
4. Average spore length > 6.0 mm ..... **29. A. luteomaculatus**

KEY SEVEN

Pileus not discolouring or reddening or browning; annulus relatively persistent, with thickened margin; context not discolouring or reddening or browning on exposure or when damaged; KOH and Schaeffer-reaction negative; spores narrow, Qav > (1.30-)1.40, without germ pore; lamella edge sterile; cheilocystidia clavate to (sub)globose, up to 20 µm wide (sect. *Sanguinolenti*)

1. Pileus whitish to pale (greyish) brown, if squamulose squamules concolorous with pileus
2. Basidiocarps (and context) intensely reddening when handled or damaged; spores 5.0-7.0 × 3.0-5.0 µm; on average 5.5-6.5 × 3.5-4.5 µm ..... **19. A. benesii**
2. Pileus not discolouring on handling; context slowly but not intensely bright red on exposure or when damaged; spores 6.0-9.5 × 4.5-6.0 µm; on average 6.9-8.4 × 4.8-5.6 mm ..... **20. A. depauperatus**

1. Pileus with brown to reddish brown squam(ul)es, or dark red-brown fibrillose
3. Spores < 7.0 mm long; average spore length 5.1-6.5 µm
4. Context not or hardly discolouring when cut; cystidia width up to 20(-24) µm ..... **16. A. impudicus**
4. Context clearly reddening when cut; cystidia up to 12 µm wide
5. Pileus thin-fleshed; context up to 7 mm thick in pileus; squames dark brown or reddish brown **15. A. sylvaticus**
5. Pileus thick-fleshed; context up to 17 mm thick in pileus; squames pale brown, concolorous to pileus **19. A. benesii**

3. Spores > 6.5 mm long; average spore length 6.9-8.3 μm
   6. Pileus densely covered with brown to reddish brown relatively broad squames; average spore size (7.6)7.8-8.3 × 4.4-5.4 μm ..... **17. A. langei**
   6. Pileus dark red-brown fibrillose; average spore size 6.9-7.7 × 4.3-4.5 μm ..... **18. A. fuscofibrillosus**

Subgen. **Agaricus**

Veil composed of hyphae with usually cylindrical, 3.0-8.0 μm wide elements, with some inflated elements up to 12(-17) μm.

Sect. **Agaricus**

Pileus not discolouring, sometimes yellowing; veil usually present as thin, evanescent annulus; context not discolouring or discolouring faintly reddish, sometimes also yellowish brown in base of stipe.

KOH-reaction negative; Schaeffer-reaction negative on all parts of basidiocarps.

Spores ellipsoid, Qav > 1.40, with germ pore or with thin-walled spot at apex; lamella edge fertile; cheilocystidia absent.

1. Agaricus campestris L., Spec. Pl. 2: 1173. 1753:Fr. – Fig. 2.

Agaricus campestris L.: Fr., Syst. mycol. 1: 281. 1821; *Psalliota campestris* (L.) Quél. in Mém. Soc. Émul. Montbéliard sér. II, 5: 140. 1872 (Champ. Jura Vosges 1).

EXCL. – *Agaricus campestris* sensu Cooke, Ill. Brit. Fungi 4: pl. 527. 1885; *Psalliota campestris* sensu Bres., Iconogr. mycol. 17: pl. 823. 1931. (= *A. bisporus*).

VERN. NAME – Weidechampignon.

The taxonomy of the *Agaricus campestris*-group is rather confusing. Very few characters are available, which implies a risk of overestimating the importance of variable characters like the colour and structure of the pileus. In this study a practical approach is used. Among the many infraspecific taxa and related species of *Agaricus campestris* which have been described, only a few could be recognised in the collections from the Netherlands and adjacent regions. For an extensive discussion see Nauta (in Persoonia 17. 2001; in prep.).

KEY TO THE VARIETIES

1. Pileus nearly smooth, only at margin slightly squamulose, strongly discolouring yellow
   1b. var. **equestris**
1. Pileus fibrillose or fibrillose-squamulose, not to only very slightly yellowing
   2. Pileus white, in the end with some pale greyish brown fibrils
      1a. var. **campestris**
   2. Pileus with appressed greyish to greyish brown squamules
      1c. var. **squamulosus**

1a. var. **campestris**

SEL. ICON. – Cappelli, Agaricus: pl. 9. 1984; Dähncke, 1200 Pilze: 493. 1993; J. Lange, Fl. agar. dan. 4: pl. 138C. 1939.

SEL. DESCR. & FIGS. – J. Lange, Fl. agar. dan. 4: 59-60. 1939; F. Møller in Friesia 4: 56, pl. 17. 1950.

Pileus 45-90(-110) mm, at first hemispherical, later convex with flattened centre to plano-convex, at first with inflexed margin, later with margin largely exceeding lamellae, white to whitish or greyish white,

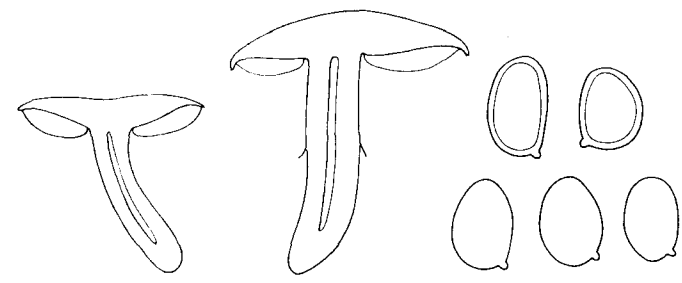

Fig. 2. *Agaricus campestris*. (habit × ½).

not to very slightly yellowing on handling, finally sometimes pale yellow (Mu. 5 Y 8/3), often with some finally greyish or pale greyish brown small fibrils, usually fibrillose-squamulose, sometimes only fibrillose. Lamellae, L = 95-130, l = 1-3(-5), crowded, free, undate to ventricose, up to 8 mm broad, at first pinkish grey to pinkish brown (7.5 YR 7/2; 5 YR 5/3), later brown to reddish brown (5 YR 6/2, 7.5 YR 3/2), finally dark brown, with concolorous to slightly paler, entire edge. Stipe (40-)45-60(-100) × 9-15 mm, usually annulate, cylindrical, often tapering towards base, sometimes slightly enlarged up to 22 mm at base, straight, stuffed to narrowly fistulose, white, later greyish in upper half or with purple tinge below lamellae, yellowish or brownish to faintly orange-yellow at base of stipe on handling, above annulus smooth, below annulus smooth to fibrillose, sometimes with fibrillose girdles, or flocculose. Annulus at 0.50-0.70 of height of stipe, 1-5 mm wide, descending, pending, thin, fibrillose, later disappearing, white, not discolouring, with smooth upperside; underside fibrillose. Context up to 12(-18) mm thick in pileus, white, firm, not discolouring when cut, except for a sometimes orange yellowish brown discoloration at the base of the stipe. Smell indistinct, or pleasant, fungoid or nut-like. Taste fungoid.

Macrochemical reactions: KOH negative (surface of pileus), orange (base of stipe); Schaeffer-reaction negative to faintly orange (surface of pileus), negative (base of stipe).

Spores 6.5-8.5 × 4.5-6.0 mm, on average 7.5-7.9(-8.1) × 5.0-5.6 mm, Q = 1.30-1.65, Qav = 1.40-1.45(-1.50), ellipsoid, with thin-walled spot at apex. Basidia 21-24 × 7.0-8.5 mm, 4-spored. Lamella edge fertile, cheilocystidia lacking, sometimes some sterile basidia present. Pileipellis a slightly gelatinized cutis of 4.5-7.0 mm wide hyphae with cylindrical elements, gradually passing into pileitrama, with pale yellowish intracellular pigment. Stipitipellis a cutis of unbranched, 6.5-7.0(-8.5) mm wide hyphae, sometimes constricted at septa, with cylindrical elements, with pale yellowish, intracellular pigment.

HABITAT & DISTR. – Solitary or in small groups, saprotrophic, terrestrial in grasslands, meadows, grassy roadside verges, sometimes in woods on various soil types. Common and widespread in the Netherlands, Aug.-Nov. Common and widespread in Europe, cosmopolitan.

Agaricus campestris var. *campestris* is here considered in the strict sense of Lange (in Dansk bot. Ark. 4(12): 9. 1926). Since the original descriptions of Linnaeus and Fries are not unambiguous, this species has sometimes been understood as what modern authors

would call *A. bisporus*. The interpretation of Lange is generally followed in modern literature.

1b. var. **equestris** (F. Møller) Pilát in Acta Mus. nat. Prag. 7B (1): 14. 1951.

Psalliota campestris var. *equestris* F. Møller in Friesia 4: 57. 1950.

SEL. DESCR. & FIGS. – F. Møller in Friesia 4: 57. 1950.

CHARACTERISTICS – Differing from var. *campestris* in the nearly smooth, strongly yellowing pileus.

Spores 7.0-9.0(-10.0) × 5.0-6.0(-6.5) µm, on average 7.9-8.2 × 5.4-5.5(-5.9) µm, Q = 1.35-1.60, Qav = (1.40-)1.45-1.50, germ pore conspicuous, up to 1 µm wide. Other microscopical characters as in the typical variety.

HABITAT & DISTR. – Occurs in the same habitats as the type variety. Less common than, but as widespread as the typical variety.

The taxonomical rank of this taxon needs further study. The intensity of yellowing of the pileus seems to be variable. Møller's statement that the spores are smaller than in the typical variety could not be verified. The germ pore, however, of this variety seems to be more conspicuous than in the typical variety. According to other authors (Bon in Doc. mycol. 15(60): 6. 1985) this variety also differs in a stronger red discoloration of the context. This could not be found in the examined material, nor is it clear from Møller's original description.

1c. var. **squamulosus** (Rea) Pilát in Acta Mus. nat. Prag. 7B (1): 14. 1951.

Psalliota campestris var. *squamulosa* Rea in Trans. Br. mycol. Soc. 17: 50. 1932.

SEL. ICON.- Cappelli, Agaricus: pl. 10. 1984.

SEL. DESCR. & FIGS. – F. Møller in Friesia 4: 59, fig. 14. 1950.

CHARACTERISTICS – Differing from var. *campestris* in the appressed greyish brown to greyish squamules on the pileus.

Microscopical characters as in the typical variety.

HABITAT & DISTR. – Same as typical variety; this variety seems to be less common than the typical one.

2. Agaricus moellerianus M. Bon in Doc. mycol. 15(60): 6. 1985. – Fig. 3.

Psalliota campestris var. *floccipes* F. Møller in Friesia 4: 57. 1950; *Agaricus campestris* var. *floccipes* (F. Møller) Pilát in Acta Mus. nat. Prag. 7(B)1: 14. 1951; *Agaricus floccipes* (F. Møller) Bohus in Annls hist.-nat. Mus. natn. hung. 70: 107. 1978, non *A. floccipes* Fr. 1838.

SEL. ICON.- Cappelli, Agaricus: pl. 11. 1984 (as *A. floccipes*).

SEL. DESCR. & FIGS. – Bohus in Annls hist.-nat. Mus. natn. hung. 70: 107-109, fig. 3. 1978; F. Møller in Friesia 4: 57-58, fig. 12. 1950.

VERN. NAME – Kleinsporige weidechampignon.

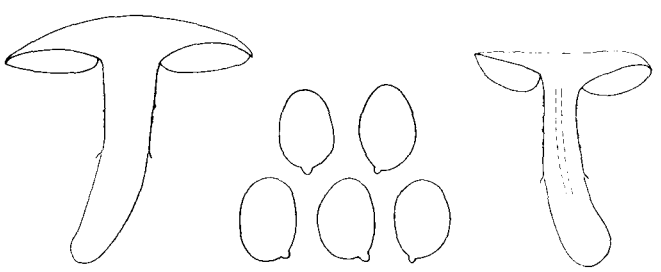

Fig. 3. *Agaricus moellerianus*. (habit × ½).

Pileus 45-85(-95) mm, at first convex, expanding to plano-convex to (irregularly) applanate, with inflexed margin, exceeding lamellae; white to yellowish, discolouring yellowish on handling or damaging, finally pale yellow (Mu. 5 Y 8/5, 9/6), at centre smooth, often near margin fibrillose-squamulose, sometimes with pale brownish fibrillose squamules. Lamellae, L = 105-115, l = 1-3(-7), crowded, free, subventricose, up to 9 mm broad, at first bright pink to pinkish, remaining pinkish for a long time, later pinkish brown, with concolorous, entire edge. Stipe 40-80 × 8-15.5(-22) mm, usually with annular zone, sometimes with well-developed annulus, cylindrical to tapering at base, sometimes with slightly enlarged base, straight to slightly curved, stuffed to narrowly fistulose, white, not discolouring on handling, above annulus smooth to fibrillose or floccose, below annulus fibrillose-pruinose to fibrillose. Annulus at 0.50 of height of stipe, narrow, up to 2 mm wide, usually present as annular zone, descending, pending to slightly spreading, thin, soon disappearing, white, fibrillose, with striate upperside. Context 7-11.5 mm thick in pileus, firm, white, not discolouring when cut, except in base of stipe where it sometimes turns brownish yellow. Smell indistinct. Taste like nuts.

Macrochemical reactions: KOH 10% negative (surface of pileus); Schaeffer-reaction negative, sometimes weakly orange (surface of pileus).

Spores 5.5-7.5 × 4.0-5.5 mm, on average 6.2-7.1 × 4.1-5.1 mm, Q = (1.15-)1.30-1.65(-1.75), Qav = (1.30-)1.40-1.55, ellipsoid, sometimes broadly ellipsoid or oblong, without germ pore, with thin-walled spot at apex; often aberrant spores present. Basidia 22-27 × 7.0-8.0 mm, 4-spored. Lamella edge fertile, cheilocystidia lacking, sometimes some sterile basidia present. Pileipellis a slightly irregular cutis of 3.5-7.0 mm wide hyphae with cylindrical, to sometimes inflated up to 11 µm elements, gradually passing into pileitrama, with yellowish intracellular and parietal pigment. Stipitipellis a cutis of sometimes branched, 4.5-8.5 µm wide hyphae with cylindrical elements, with pale yellowish intracellular pigment and cylindrical, up to 8.5 wide terminal elements.

HABITAT & DISTR. – In small groups or solitary, saprotrophic, terrestrial in grasslands on dunes or on slopes of dikes, along roads, or on nutrient-poor meadows on various soils. Rare but widespread in the Netherlands, July-Nov. Rare but widespread in Europe.

Macroscopically this taxon differs in a more smooth pileus surface and the flocculose surface of the stipe above the annulus. The smell of almonds or anise which is mentioned by various authors (Møller in Friesia 4: 57. 1950; Bohus in Annls hist.-nat. Mus. natn. hung. 70: 107. 1978) could not be observed.

3. Agaricus pampeanus Speg. in An. Soc. cient. arg. 9: 280. 1880. – Fig. 4.

SEL. ICON.- Albert in Mikol. Közlem. 36(2-3): 62. 1997; Breitenb. & Kränzl., Pilze Schweiz 4: pl. 186. 1995; Lavorato in Riv. Micol. 33: 252. 1991.

SEL. DESCR. & FIGS. – Heinem. in Bull. trimest. Soc. mycol. Fr. 81: 374-375. 1965.

VERN. NAME – Steppechampignon.

Pileus 45-85(-115) mm, at first convex to hemispherical, expanding to convex with applanate centre or plano-convex, with slightly inflexed margin, whitish to cream at first, faintly yellowing sometimes, smooth to appressed fibrillose or fibrillose-squamulose, later sometimes fissured; fibrils later usually brownish (Mu. 5 YR 4/3, 7.5 YR 5/4); veil present when young as broad appendiculate whitish cottony zone. Lamellae, L = c. 100, l = 3-7, crowded, free, ventricose, up to 10 mm broad, at first pinkish grey (K. & W. 7-8D5), later dark brown, with concolorous, entire edge. Stipe 35-65 × 11-17 mm, usually annulate

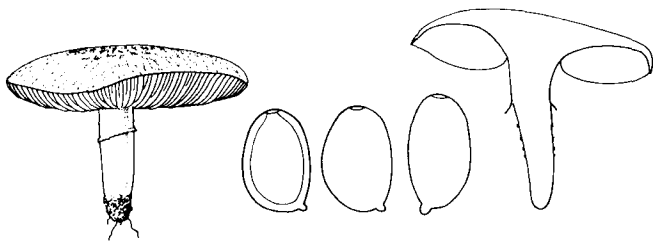

Fig. 4. *Agaricus pampeanus*. (habit × ½).

when young, tapering towards base, sometimes cylindrical, straight, sometimes with few white, thin rhizomorphs, stuffed, whitish, somewhat brownish near base, above annulus with pinkish tinge, smooth, below annulus with white, sometimes at base pale brown, floccose girdles. Annulus at 0.50-0.75 of height of stipe, narrow, 1-2 mm wide, descending, sometimes patent, thin, soon disappearing, fibrillose, white, not discolouring, with smooth upperside. Context up to 14 mm thick in pileus, white, not discolouring. Smell indistinct, sometimes aromatic when cut. Taste mild, not unpleasant.

Macrochemical reactions: KOH 40% brownish (surface of pileus, base of stipe); Schaeffer-reaction negative to weakly orange (surface of pileus, surface of stipe).

Spores 7.5-10.5(-11.0) × 5.0-7.0 mm, on average 8.7-9.4 × 5.6-6.3(-6.8) mm, Q = 1.25-1.75(-1.80), Qav = (1.40-)1.45-1.55(-1.65), ellipsoid, sometimes oblong or broadly ellipsoid, with conspicuous germ pore up to 1.5 µm wide. Basidia 26-30 × 8.0-9.0 mm, predominantly 4-spored, usually also (1-)2-spored basidia present. Lamella edge fertile, without cheilocystidia. Pileipellis a cutis of irregularly arranged, 4.5-6.5(-8.5) mm wide hyphae with cylindrical elements, with some ascending clavate terminal elements, gradually passing into pileitrama, with pale yellowish intracellular pigment. Stipitipellis a cutis of unbranched, 4.5-8.0 mm wide hyphae with cylindrical, sometimes up to 10.5 µm inflated elements, with pale yellowish, parietal and intracellular pigment.

HABITAT & DISTR. – Solitary or in small groups, saprotrophic, terrestrial in grasslands in the coastal region, sometimes with a direct maritime influence. Rare, only known from the coastal region. Aug.-Oct.(-Dec.). Rare but widespread in Europe. Also recorded from northern Africa and South America.

This taxon is distinguished from *A. campestris* by its larger spores with a more conspicuous germ pore. The original description of *A. pampeanus* may differ in the silvery, purely white, smooth pileus and a white stipe, and microscopically in smaller spores, 6-7 × 4-5 mm. However, according to Heinemann (in Bull. Inst. agron. Stns Rech. Gembloux 30: 273-282. 1962), who studied the type, the spore measures are in fact 8.5-10 × 5.5-7 mm. Within the scope of this study this could not be verified.

A related taxon is *Psalliota flocculosa* Rea (in Trans. Br. mycol. Soc. 17: 50. 1932), with a densely flocculose snow-white pileus.

4. Agaricus altipes (F. Møller) Pilát in Acta Mus. nat. Prag. 7B (1): 24. 1951. – Fig. 5.

Psalliota altipes F. Møller in Friesia 4: 46. 1950. – *Psalliota aestivalis* F. Møller in Friesia 4: 50. 1950; *Agaricus aestivalis* (F. Møller) Pilát in Acta Mus. nat. Prag. 7B (1): 25. 1951, non *A. aestivalis* Schum. 1803; *A. albosericeus* Rauschert in Nova Hedwigia 54: 213. 1992. – *Psalliota aestivalis* var. *flavotactus* F. Møller in Friesia 4: 51. 1950; *Agaricus aestivalis* var. *flavotactus* (F. Møller) Pilát in Acta Mus. nat.

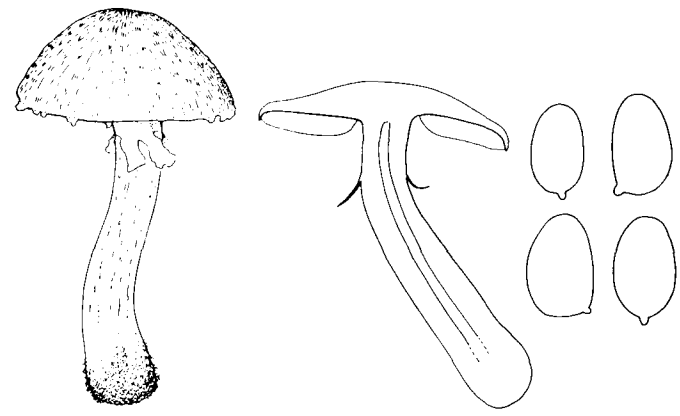

Fig. 5. *Agaricus altipes*. (habit × ½).

Prag. 7B (1): 13. 1951. – *Psalliota aestivalis* var. *veneris* Heim & Becker in Bull. trimest. Soc. mycol. Fr. 76: 240. 1960 (invalid); *Agaricus aestivalis* var. *veneris* Heim & Becker in Bull. trimest. Soc. mycol. Fr. 76: 240. 1960 (invalid); *Agaricus veneris* (Heim & Becker) M. Bon in Doc. mycol. 15(60): 7. 1985 (invalid).

SEL. ICON.- Cappelli, Agaricus: pl. 31, 46. 1984 (as *A. aestivalis*); Breitenb. & Kränzl., Pilze Schweiz 4: pl. 167. 1995 (as *A. aestivalis* var. *veneris*); Gidholm in Jordstjärnan 16: opposite 80. 1995.

SEL. DESCR. & FIGS. – F. Møller in Friesia 4: 46-48, 50-51 (as *A. aestivalis*), fig. 9, pl. 4a. 1950.

VERN. NAME – Valse anijschampignon.

Pileus 50-100 mm, at first hemispherical to convex, later convex to conico-convex, often with flattened centre, sometimes umbonate, with inflexed margin, whitish with usually pale yellowish centre (Mu. 2.5 Y 8/2, 8/4, 10 YR 8/3), later greyish to pale brownish, especially near margin, usually yellowing on handling especially when young, young with appressed, often yellowish silky fibrils to occasionally strongly fibrillose, later with larger fibrils, often with adhering soil remnants, at margin sometimes flocculose-squamulose; veil present as appendiculate whitish remnants. Lamellae, L = 110-145, l = 1-3, crowded, free, subventricose, up to 8 mm broad, at first bright pinkish brown to pale reddish brown (2.5 YR 5/6, 5 YR 7/3), later dark greyish brown, with entire, concolorous edge. Stipe (65-)70-100 × (9-)11-20 mm, usually longer than pileus diameter, annulate, cylindrical to subclavate, at base up to 23 mm broad, sometimes tapering towards base, straight to somewhat curved, narrowly fistulose, white, in lower half faintly yellowing on handling, at base discolouring yellow to brownish yellow when handled, above annulus sometimes reddish; above annulus glabrous, smooth, below annulus with white to faintly yellow silky fibrils or fibrillose girdles, sometimes with few fibrillose squamules. Annulus at 0.75-0.90 of height of stipe, up to 10 mm wide, descending, pending, thin and evanescent, white, not discolouring, with greyish, striate upperside; underside sometimes with thin fibrillose squamules near margin; margin sometimes split. Context 9-11 mm thick in pileus, soft, white, usually only faintly discolouring, in upper half of stipe with reddish tinge, in base yellowish to brownish yellow (2.5 Y 8/4, 8/6) when cut. Smell indistinct to slightly fruity, sometimes like *Pelargonium* or weakly like *Lepiota cristata*. Taste indistinct to faintly nut-like.

Macrochemical reactions: KOH 10% negative (surface of pileus and stipe); Schaeffer-reaction negative to slightly orange (surface of pileus; base of stipe).

Spores 6.5-9.0(-9.5) × 4.5-6.0 mm, on average 7.6-8.0 × 4.9-5.5 mm, Q = 1.30-1.70(-1.75), Qav = 1.45-1.55, ellipsoid, sometimes

oblong, with narrow, indistinct germ pore, or thin-walled spot at apex. Basidia 15-20 × 8.0-9.0 mm, 4-spored. Lamella edge fertile, usually with some sterile basidia. Pileipellis a sometimes very slightly gelatinized cutis of sometimes branched, 3.5-6.5 μm wide hyphae with usually cylindrical, rarely inflated elements up to 9.0(-10.0) μm wide, with some ascending cylindrical terminal elements, gradually passing into pileitrama, with parietal, pale yellow pigment. Stipitipellis a cutis of 4.0-6.5 mm wide hyphae with cylindrical, sometimes up to 8.5 μm inflated, elements, and some ascending clavate terminal elements, with yellowish, parietal or intracellular pigment.

HABITAT & DISTR. – Solitary to gregarious, saprotrophic, terrestrial in parks, avenues, deciduous or coniferous woods, sometimes in dune scrub, often on nutrient-rich or humus-rich soil. Rather rare and scattered in the Netherlands. June-Oct. Rather rare but widespread in Europe. Also known from North America and southern South America.

The above description is also based on collections from Denmark.

Because of the yellow discoloration of the pileus and the occasionally split margin of the annulus this taxon is sometimes considered to belong to sect. *Arvenses*. The presence of a thin-walled apex of the spores and the absence of cheilocystidia, and also the reddish discoloration in the upper part of the stipe place it clearly close to *A. campestris* in sect. *Agaricus*.

Agaricus aestivalis (F. Møller) Pilát is considered conspecific on account of the same discoloration of the context in the stipe, and the microscopy. The intensity of yellowing of the pileus seems to be variable. *Agaricus wasseri* Bon & Courtec. (in Doc. mycol. 15(60): 7. 1985; nom. nov. for *Agaricus longicaudus* Wasser) may be a synonym.

5. Agaricus cupreobrunneus (F. Møller) Pilát in Acta Mus. nat. Prag. 7B (1): 14. 1951. – Fig. 6.

Psalliota campestris var. *cupreobrunnea* J. Schaeff. & Steer in Michael, Führ. Pilzfr. I: 147. 1939 (invalid); *Psalliota cupreobrunnea* J. Schaeff. & Steer ex F. Møller in Friesia 4: 54. 1950.

SEL. ICON.- Bohus & Babos in Fung. rar. Ic. col. 8: pl. 57. 1977; Cappelli, Agaricus: pl. 12. 1984; F. Møller in Friesia 4: pl. 4b. 1950.

SEL. DESCR. & FIGS. – Bohus & Babos in Fung. rar. Ic. col. 8: 1-3. 1977; F. Møller in Friesia 4: 54-55. 1950.

VERN. NAME – Bruine weidechampignon.

Pileus (25-)40-60(-110) mm, at first convex with flattened centre, expanding to plano-convex, often with depressed centre, sometimes irregularly undulated plano-convex, with inflexed, fringed margin, later exceeding lamellae, young pinkish brown to pinkish grey, soon darker to reddish brown, often in part dark brown to (dark) purple-brown (Mu. 7.5 YR 6-4/2, 5 YR 4-5/3, 6/4), floccose-fibrillose to entirely fibrillose, at centre later often smooth, towards margin dark radially fibrillose on paler, whitish to ochraceous or brownish background; at first with appendiculate floccose margin, sometimes with few whitish velar flocks near margin. Lamellae, L = 80-90, l = (0-)1-3, crowded, free, ventricose, up to 7(-10.5) mm broad, at first pinkish white to bright pink or greyish pink (7.5 YR 8/2, 5 YR 7/4, 8/2), later reddish brown (5 YR 5-6/3), finally dark brown (5 YR 3/3), with paler, entire edge. Stipe 30-55(-80) × (7-)9-18(-22) mm, annulate or with annular zone, cylindrical to attenuated towards base, straight to slightly curved, without rhizomorphs, narrowly fistulose, white to whitish, later with brownish tinge, not discolouring or becoming brownish yellow at base on handling, above annulus brownish to greyish, minutely flocculose, below annulus flocculose-squamulose, occasionally when young with squamules in girdles turning brownish on handling. Annulus at 0.60-0.70 of height of stipe, narrow, up to 2 mm wide, descending, pending, thin, fibrillose, soon disappearing, white, not discolouring, often with thickened margin, with striate upperside; underside squamulose. Context 10 mm thick in pileus, white, discolouring weakly pinkish brownish in apex of stipe, sometimes pale brown in cortex of stipe, in pileus faintly reddish when cut, yellowish to orange-brown in base. Smell indistinct to slightly fungoid-aromatic. Taste fungoid.

Macrochemical reactions: KOH 10% negative (pileus surface, context); Schaeffer-reaction negative (surface of pileus).

Spores 7.0-9.5 × 5.0-6.0 mm, on average 7.6-8.3 × 5.1-5.5 mm, Q = 1.35-1.65(-1.70), Qav = 1.49-1.52, ellipsoid, sometimes oblong, with narrow germ pore, or with thin-walled spot at apex. Basidia 20-30 × 7.0-10 mm, 4-spored. Lamella edge fertile or partly sterile, usually only composed of basidia, sometimes with few clavate cheilocystidia, 22 × 8.5-10.0 μm. Pileipellis a slightly irregular cutis of 3.0-7.0 mm wide hyphae with cylindrical, sometimes up to 8.5 μm inflated elements, with cylindrical terminal elements, gradually passing into pileitrama, with yellowish to brownish parietal pigment. Stipitipellis a cutis of 5.5-7.0 mm wide hyphae with cylindrical elements, with pale yellow, intracellular pigment.

HABITAT & DISTR. – Solitary, saprotrophic, terrestrial in relatively nutrient-poor grasslands and roadside verges, often on calcareous dune sand. Rather rare, more common in dune region of the Netherlands; Sept.-Nov. Widespread but not common in Europe. Also recorded from Asia and North America.

6. Agaricus porphyrocephalus F. Mller in Friesia 4: 204. 1952. – Fig. 7.

Psalliota porphyrea F. Møller in Friesia 4: 53. 1950; *Agaricus porphyreus* (F. Møller) Pilát in Acta Mus. nat. Prag. 7B (1): 13. 1951, non *A. porphyreus* (A. & S.:Fr.) Fr. 1821.

SEL. ICON.- Cappelli, Agaricus: pl. 13. 1984; F. Møller in Friesia 4: pl. 4c. 1950.

SEL. DESCR. & FIGS. - F. Møller in Friesia 4: 53-54. 1950.

VERN. NAME – Porfierchampignon.

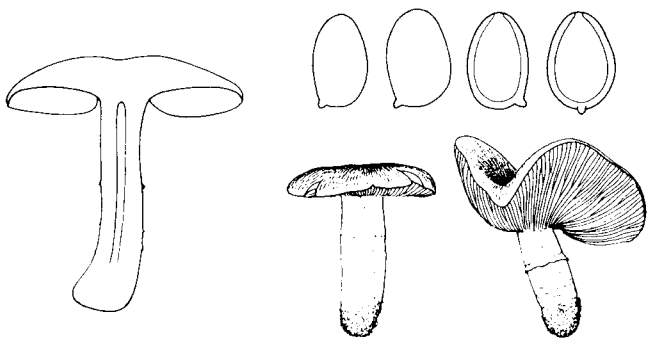

Fig. 6. *Agaricus cupreobrunneus*. (habit × ½).

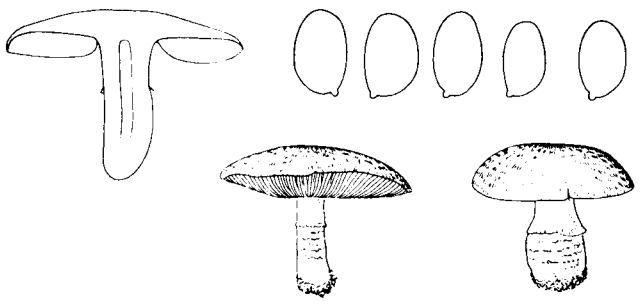

Fig. 7. *Agaricus porphyrocephalus*. (habit × ½).

Pileus 45-65(-85) mm, at first truncately conical, or hemispherical to convex with flattened centre, expanding to convex to irregularly planoconvex with usually (slightly) depressed or flattened centre, with at first inflexed, later deflexed margin, which exceeds lamellae for 2 mm, pale to dark (purple-)brown to reddish brown, sometimes grey-brown fibrillose-squamulose (Mu. 2.5 YR 2/4, 5 YR 3-4/2, 3-6/3, 10YR 2/2-3/4) on greyish brown to pale brown background (2.5 YR 5/4, 5 YR 7/3, 7.5 YR 6/4, 10 YR 7/3, 6/4). Lamellae, L = 85-100, l = 1-3, crowded, free, subventricose, 6-11 mm broad, at first pale greyish pink to bright pinkish, later pinkish brown (7.5 YR 8/4-7/4), finally dark brown to purplish brown (5 YR 3/2 - 7.5 YR 5/4), with slightly paler, entire edge. Stipe 30-45(-70) × 9-12(-14) mm, annulate or with annular zone, cylindrical to ventricose, rarely tapering downwards or clavate, sometimes at base up to 19 mm broad, straight to slightly curved, narrowly fistulose to stuffed, whitish, often with brownish tinge, somewhat ochraceous to browning towards base on handling, above annulus smooth to silky striate, below annulus flocculose-subsquamulose, sometimes with several fibrillose girdles. Annulus at 0.45-0.60 of height of stipe, narrow, up to 2.5 mm wide, descending, thin, fugacious, fibrillose, white, not discolouring, with striate upperside; underside subfloccose-fibrillose; often only fibrillose remnants present. Context 7-9 mm thick in pileus, white to whitish, hardly discolouring when cut, after a long time somewhat sordid pinkish or faintly pinkish brown in pileus, in base of stipe somewhat pinkish yellowish. Smell faint when cut, when young distinctly aromatic, later faintly fungoid. Taste fungoid.

Macrochemical reactions: Schaeffer-reaction negative or doubtful (surface of pileus).

Spores (5.5-)6.0-7.5(-8.0) × 4.0-5.0 mm, on average 6.4-6.9 × 4.1-4.3 mm, Q = (1.40-)1.45-1.75(-1.80), Qav = 1.55-1.60, ellipsoid to oblong, with thin-walled spot at apex. Basidia 21-25 × 6.0-8.0 mm, 4-spored. Lamella edge fertile, composed of fertile basidia, sometimes intermixed with some sterile basidia of the same size and shape. Pileipellis a regular cutis of 3.5-5.0(-7.0) mm wide hyphae with cylindrical, sometimes up to 10 µm inflated elements, with some ascending, clavate terminal elements up to 8.5 µm wide, gradually passing into pileitrama, with pale yellow to brownish, parietal to intracellular pigment. Squames consisting of slightly curved, interwoven, 4.0-6.0 mm wide hyphae with 30-40 mm long, cylindrical elements and ascending, clavate, up to 10 µm wide terminal elements, with warm brown, intracellular pigment. Stipitipellis a sometimes irregular cutis of 4.0-7.0 mm wide hyphae with cylindrical, sometimes up to 9.5 µm inflated, elements, with pale yellow parietal or intracellular pigment.

HABITAT & DISTR. – Solitary or in small groups, sometimes in fairy rings, saprotrophic and terrestrial in unmanured meadows or roadside verges on nutrient-poor soil. Very rare in the Netherlands, Oct.-Nov. Widespread but rare in Europe.

Agaricus lividonitidus (F. Møller) Pilát is very close, and perhaps a synonym. It seems to differ in a more yellowing base of the stipe. *Agaricus calongei* Daniel-Arranz (in Bol. Soc. micol. Madrid 24: 72. 1999) is very probably a synonym of *A. lividonitidus*. Since no type-material has been studied of any of the two species this synonymy could not be made certain. Also, *Agaricus biberi* Hlaváček (in Mykol. Sb., Praha 61: 74. 1984; invalid: no type designated), with a greyish instead of purplish brown pileus, is closely related to *A. porphyrocephalus*.

Sect. **Bitorques** (Heinem.) Bon & Cappelli

Pileus not discolouring or slightly yellowing, rarely slightly reddening; annulus ascending and thin to thick or descending and thick, sometimes only velar sock present; context usually discolouring reddish or brownish on exposure or damaging, sometimes not discolouring.

KOH-reaction negative; Schaeffer-reaction negative.

Spores (broadly) ellipsoid, relatively broad, Qav < 1.35(-1.45), without germ pore; lamella edge sterile; cheilocystidia conspicuous, clavate to cylindrical, up to 15 µm wide.

7. Agaricus bitorquis (Quél.) Sacc., Syll. Fung. 5: 998. 1887. – Fig. 8.

Psalliota bitorquis Quél. in C. r. Ass. franç. Av. Sci. 12: 500. 1884 (Champ. Jura Vosges Suppl. 12). – *Agaricus campestris* var. *edulis* Vitt., Descr. Funghi mang. Italia: 41. 1832; *Agaricus edulis* (Vitt.) Møller & Schaeff. in Annls mycol. 36: 75. 1938. – *Psalliota edulis* var. *validus* F. Møller in Friesia 4: 14. 1950; *Agaricus bitorquis* var. *validus* (F. Møller) Bon & Cappelli in Doc. mycol. 13(52): 16. 1983.

SEL. ICON. – Cappelli, Agaricus: pl. 1. 1984; Dähncke, 1200 Pilze: 486. 1993; R. Phillips, Paddest. Schimm.: 163. 1981.

SEL. DESCR. & FIGS. – F. Møller in Friesia 4: 13-14. 1950; Wasser, Tr. Agariceae Soviet Union: 52-54. 1989.

VERN. NAME – Straatchampignon.

Pileus (45-)50-110(-120) mm, at first convex, later convex, usually with depressed centre, to applanate, with inflexed or involute, later straight margin, dirty white to greyish white, with yellow spots or yellowing on handling (Mu. 2.5 Y 8/2, 9/4), rarely reddening on handling (7.5 YR 7/6); surface smooth, rarely with some appressed squames, sometimes fibrillose to fibrillose-squamulose near margin, shiny, usually with attached sand; margin with some adhering veil remnants when young. Lamellae, L = 95-200, l = 0-3, crowded, free, straight, up to 6.5 mm broad, at first pink, later brown, finally dark brown, with paler, denticulate edge. Stipe 35-55(-100) × 14-20(-24) mm, annulate, cylindrical to clavate, at base up to 29 mm broad, straight, stuffed or narrowly fistulose, whitish, not discolouring on handling, above annu-

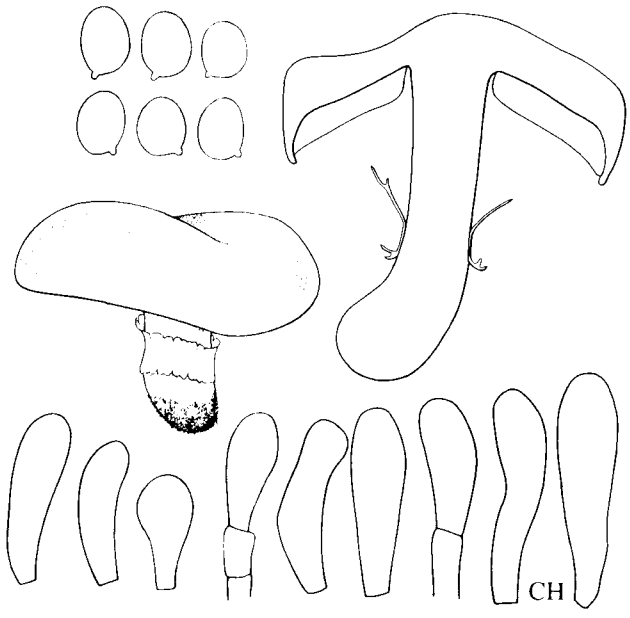

Fig. 8. *Agaricus bitorquis*. (habit × ½).

lus smooth, below annulus fibrillose, sometimes with velar sock forming narrow ascending annulus at upper side at 0.25 of height of stipe, without rhizomorphs. Annulus at 0.65 of height of stipe, up to 11 mm wide, ascending, double, usually upper margin patent or upwards and lower margin to a lesser extent recurved, occasionally with a second, narrower annulus some distance below, thick, persistent, whitish to brownish (10 YR 8/4), with striate to sulcate upperside; underside smooth. Context 12-23 mm thick in pileus, firm, white, discolouring reddish brown or orange-red when cut in pileus above lamellae and upper half of stipe, sometimes faintly. Smell unpleasant, like canned applesauce, or like gas. Taste not known.

Macrochemical reactions: KOH 10% negative (surface of pileus; context); Schaeffer-reaction negative (surface of pileus).

Spores 5.0-7.0 × 4.0-5.5 mm, on average 5.9-6.5 × 4.6-4.9 mm, Q = 1.10-1.45, Qav = 1.20-1.35, broadly ellipsoid to ellipsoid, without germ pore; sometimes with aberrant spores up to 9 × 5 µm. Basidia 20-25 × 6.5-8.5 mm, usually 4-spored, often also 2-spored basidia present. Lamella edge with a narrow, 30-50 mm broad, almost sterile layer consisting of cheilocystidia intermixed with some basidia; cheilocystidia usually not in chains, 16-28 × 5.5-9.0(-13) µm, clavate to cylindrical, hyaline, rarely with some basal septa, forming rectangular elements of 3.0-7.0 × 4.0-5.0 µm. Pileipellis an often slightly gelatinized cutis of irregularly radially arranged, 2.5-5.5 mm wide hyphae with cylindrical elements, with cylindrical terminal elements, with very pale yellow intracellular pigment, gradually passing into pileitrama. Stipitipellis a cutis of unbranched, irregularly arranged, 2.5-5.5 mm wide hyphae with cylindrical elements.

HABITAT & DISTR. – Solitary or in small groups, saprotrophic, terrestrial in roadside verges, gardens, city parks, on various, usually nutrient-rich soils. Rather common and widespread in the Netherlands. May, July-Nov. Widespread and relatively common in Europe. Cosmopolitan.

8. Agaricus bernardii Quél. in Cooke & Quél., Clav. syn. Hymenomyc. eur.: 89. 1878. – Fig. 9.

Psalliota ingrata F. Møller in Friesia 4: 17. 1950; *Agaricus ingratus* (F. Møller) Pilát in Acta Mus. nat. Prag. 7B (1): 5. 1951, non *A. ingratus* Schum. 1803:Fr.; *Agaricus maleolens* F. Møller in Friesia 4: 203. 1952.

SEL. ICON.- Cappelli, Agaricus: pl. 2. 1984; R. Phillips, Paddest. Schimm.: 161. 1981; Wasser in Fung. rar. Ic. col. 10: pl. 76. 1979.

SEL. DESCR. & FIGS. – F. Møller in Friesia 4: 14-17, fig. 4, pl. 7; 17-19, fig. 5, pl. 8 (as *P. ingrata*). 1950; Wasser in Fung. rar. Ic. col. 10: 9. 1979.

VERN. NAME – Kwelderchampignon.

Pileus 65-125 mm, at first hemispherical, later convex to plano-convex, often with flattened centre, with broad, white, involute, later inflexed margin exceeding lamellae, white or greyish white to pale brown (Mu. 10 YR 8/1-2, 7/2), later rarely with slightly yellow or pinkish patches or with yellowish fibrils (10 YR 8/4-6); surface smooth or innately fibrillose to appressed squamose or squamulose, sometimes with few large, unclearly delimited innate squames, occasionally areolate-rimose, near margin sometimes fissurate. Lamellae, L = 65-180, l = 1-5(-7), crowded, free, straight to undate, usually not very broad, sometimes up to 11 mm broad, at first pinkish to pale grey-brown (10 YR 7/3), later reddish grey, finally dark brown (7.5 YR 3/2, 4/2), with whitish or concolorous, granulate to denticulate edge. Stipe (30-)55-80(-120) × (15-)20-30 mm, usually annulate, cylindrical or subclavate to fusiform, sometimes slightly enlarged at base, straight, stuffed, whitish to pale brown, sometimes later discolouring to orange-brown

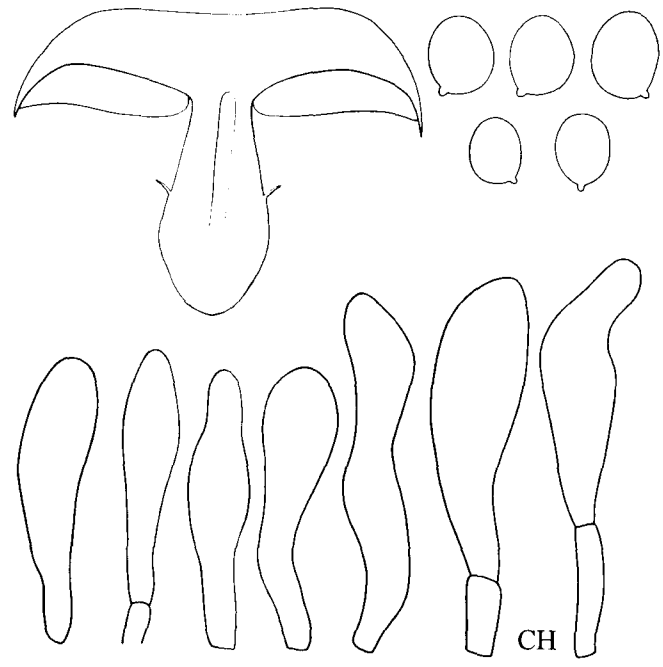

Fig. 9. *Agaricus bernardii*. (habit × ½).

or reddish on handling, especially in lower half, fibrillose to slightly squamulose, above annulus smooth to slightly fibrillose and sometimes later greyish, below annulus fibrillose; sometimes only with thick, fibrillose, whitish velar sock up to 0.45-0.60 of height of stipe; sometimes yellowing on handling. Annulus at 0.35-0.60 of height of stipe, (2-)6-10 mm wide, ascending, patent or upward, young thick, rarely double, later thin, rarely persistent, fibrillose, whitish to pale brown, rarely yellowish, with smooth to striate upperside; underside fibrillose. Context (11-)15-25 mm thick in pileus, firm to soft, white to whitish or pale brown, discolouring slowly to quickly flesh-coloured to pink or reddish when cut, especially in pileus, orange to orange-brown in base of stipe. Smell usually unpleasant, varying from strong to faint, carbolic, metallic or with dung component. Taste fungoid.

Macrochemical reactions: ammonia negative (surface of pileus and stipe, context of pileus and stipe); KOH 10% negative (surface of pileus); Schaeffer-reaction negative (surface of pileus and base of stipe).

Spores 5.5-7.5(-8.0) × 4.5-6.5 mm, on average (6.0-)6.6-7.3 × 4.9-6.1 mm, Q = 1.10-1.40(-1.50), Qav = 1.15-1.25(-1.35), broadly ellipsoid to ellipsoid, without germ pore. Basidia 27-32 × 7.0-7.5 mm, 4-spored. Lamella edge with a 50-80 mm broad sterile layer; cheilocystidia not in chains, (27-)35-58 × (4.5-)6.5-10(-12.5) µm, cylindrical to narrowly clavate, often flexuous, sometimes irregular, occasionally with a few basal septa, forming rectangular elements of 8.0-15 × 3.3-5.0 mm, usually with brownish contents, often borne by long oleiferous hyphae. Pileipellis a slightly gelatinized cutis of irregularly radially arranged, (2.0-)3.5-5.5 mm wide hyphae with cylindrical elements, with very pale yellow, intracellular pigment gradually passing into pileitrama,. Stipitipellis a cutis of unbranched, 3.0-5.5 mm wide hyphae with cylindrical elements, with very pale yellow intracellular pigment.

HABITAT & DISTR. – Solitary or in groups, saprotrophic, terrestrial, on soil in roadside verges, in (dune) grasslands or grazed pastures or saltings, often on eutrophicated places, on clayey or sandy soil. Rather rare, but widespread in the Netherlands. June, Sept.-Nov. Widespread in Europe. Cosmopolitan.

Agaricus maleolens F. Møller, as described and depicted by Møller (in Friesia 4: 17-19, pl. 8, fig. 5; as *P. ingrata*), is considered conspecific with *A. bernardii*. Except for the areolate-rimose surface of the pileus in specimens collected near the sea, no other possible distinguishing characters could be found. Some authors (e.g. Bon in Doc. mycol. 15(60): 13. 1985) interpret *A. maleolens* as a species with smaller spores than *A. bernardii*, which is not in accordance with its original sense.

Another variant without an annulus but with a conspicuous velar sock differed in no other aspect from the typical form, and is included in the above description.

Closely related species are *Agaricus bernardiiformis* Bohus (in Annls hist.-nat. Mus. natn. hung. 67: 37. 1975), differing in the not discolouring context and faint and not unpleasant smell, and *Agaricus robynsianus* Heinem. (in Bull. Jard. bot. État 27: 449. 1957), differing in a less reddening context and a smell like *Lepiota cristata*.

9. Agaricus gennadii (Chatin & Boud.) P.D. Orton in Trans. Br. mycol. Soc. 43: 174. 1960. – Fig. 10.

Chitonia gennadii Chatin & Boud. in J. Bot., Paris 12: 66. 1898.

SEL. ICON.- Cappelli, Agaricus: pl. 5. 1984.

SEL. DESCR. & FIGS. – P.D. Orton in Trans. Br. mycol. Soc. 43: 181-182. 1960; Romagn. in Bull. Féd. mycol. Dauph. Savoie 100: 9-10. 1986.

VERN. NAME – Beurschampignon.

Pileus 65-100 mm, at first hemispherical, expanding to convex, sometimes with depressed centre, with first involute, later straight margin, whitish to yellowish (Mu. 2.5 Y 8/2), later also with brownish spots (10 YR 8/6), not discolouring on handling; surface smooth to slightly fibrillose, with much adhering soil when young. Lamellae, L = 145-175, l = 1-5, crowded, free, subventricose, up to 5 mm broad, at first pinkish, later dark brown, with paler, entire to pruinose edge. Stipe 40-65 × 15-27 mm, fusiform, at base up to 25 mm broad, straight, stuffed, whitish, with whitish velar sock up to 0.50 of height of stipe, with ascending, patent, 3 mm broad margin, above velar sock with greyish brown (10 YR 7/3) fibrillose-flocculose girdles, at base faintly yellowish brown (9 YR 7.5/6) on handling, with pseudorhiza. Annulus absent. Context 15 mm thick in pileus, firm, white, not or very faintly brown when cut, in base of stipe orange-yellow (7.5 YR 8/5). Smell weak to strong, fungoid or unpleasant. Taste not known.

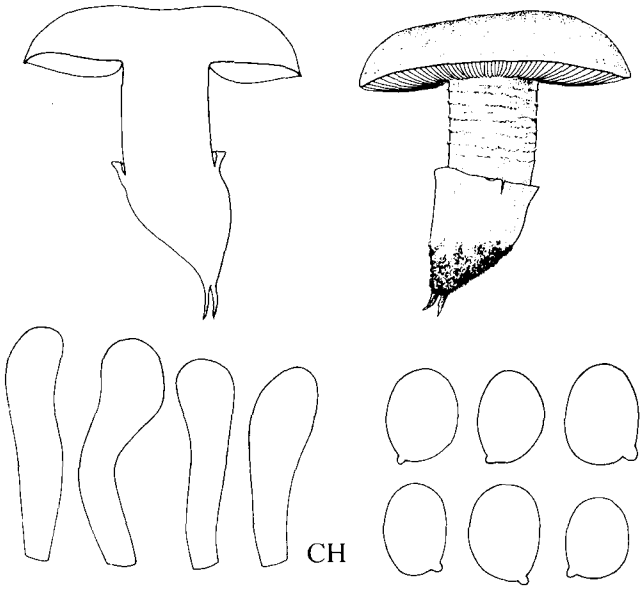

Fig. 10. *Agaricus gennadii*. (habit × ½).

Macrochemical reactions: KOH 10% negative (surface of pileus); Schaeffer-reaction negative (surface of pileus, base of stipe).

Spores 6.5-8.5 × 5.5-6.5(-7.0) mm, on average 7.7 × 5.7-6.2 mm, Q = 1.15-1.45(-1.60), Qav = 1.25-1.35, broadly ellipsoid to ellipsoid, without germ pore. Basidia 26-34 × 8.5-9.5 mm, 4-spored. Lamella edge with a narrow sterile layer; cheilocystidia 20-36 × 8.5-10 µm, cylindrical to narrowly clavate, with hyaline to pale brown contents. Pileipellis a slightly gelatinized cutis of 4.0-5.5 mm wide hyphae with cylindrical elements, with pale yellow intracellular pigment, gradually passing into pileitrama. Stipitipellis a cutis of unbranched, 3.0-7.0 mm wide hyphae with cylindrical elements with pale yellow intracellular pigment. Velar sock consisting of interwoven, slightly agglutinated, branched, 3.0-5.5 mm wide hyphae with cylindrical elements, with pale yellow intracellular pigment.

HABITAT & DISTR. – Solitary or in small groups, saprotrophic, terrestrial in roadside verge on slush of ditch, in *Picea*-wood on calcareous soil. Very rare in the Netherlands (Oegstgeest; Wijlre), Sept. Scattered and very rare in Europe, more common in the mediterranean region. Also recorded from northern Africa and Israel.

Agaricus gennadii can superficially resemble variants of *A. bernardii* without an annulus. It differs from *A. bernardii* in the larger spores, fusiform stipe with pseudorhiza and the hardly discolouring context.

Agaricus volvatus (A. Pears.) Heinem. is closely related or perhaps conspecific. *Agaricus slovenicus* Hlaváček (in Mykol. Sb., Praha 69: 129. 1992) is an invalid name since no type was designated. It may be very close to or perhaps conspecific with this taxon. *Agaricus pequinii* (Boud.) Konr. & M. (= *A. gennadii* ssp. *microsporus* Bohus) is a closely related species, differing in the smaller spores and larger basidiocarps, which occurs more to the south in Europe. *Agaricus rollanii* Parra (in Bol. Soc. micol. Madrid 20: 132. 1995) is probably also a closely related taxon.

10. Agaricus bisporus (J. Lange) Imbach in Mitt. naturf. Ges. Luzern 15: 15. 1946. – Fig. 11. Dansk bot. Ark. 4(12): 8. 1926; *Psalliota bispora* (J. Lange) Møller & Schaeff. in Annls mycol. 36: 69. 1938. – *Agaricus campestris* var. *hortensis* Cooke, Handb. Brit. Fungi: 138. 1870; *Psalliota hortensis* (Cooke) J. Lange, in Dansk bot. Ark. 4(12): 8. 1926; *Agaricus hortensis* (Cooke) Pilát in Acta Mus. nat. Prag. 7B (1): 6. 1951, non *A. hortensis* Pers. 1801:Fr. – *Psalliota hortensis* f. *albida* J. Lange in Dansk bot. Ark. 4(12): 9. 1926.

SEL. ICON.- Cappelli, Agaricus: pl. 7. 1984; Dähncke, 1200 Pilze: 485. 1993; R. Phillips, Paddest. Schimm.: 163. 1981.

SEL. DESCR. & FIGS. – F. Møller in Friesia 4: 10-11. 1950.

VERN. NAME – Gekweekte champignon.

Pileus (35-)60-120(-130) mm, at first hemispherical or conico-convex, later convex to plano-convex with flattened or slightly depressed centre, with inflexed, later deflexed margin, light brown to brown at centre (Mu. 5 YR 5/6-4/3, 7.5 YR 3/2, 5/4, 7/6, 10 YR 6-7/4), towards margin paler, brown fibrillose or covered with brown appressed, fibrillose pointed radially arranged squames (5 YR 4/3, 7.5 YR 4/4, 10 YR 6/3-4, 5/4, 8/3) on whitish to pale brown background, sometimes entirely white (cultivated variant), not discolouring on handling; margin exceeding lamellae for up to 4 mm with whitish rim. Lamellae, L = 90-175, l = 1-3, crowded, free, straight, up to 8 mm broad, at first pinkish grey-brown to pinkish brown (K. & W. 8C-D5; Mu. 2.5 YR 6/6-10 R 6/6), finally dark brown (7.5 YR 5/4, 5 YR 4/4), with whitish to paler brownish flocculose to denticulate edge. Stipe (30-)40-60(-80)

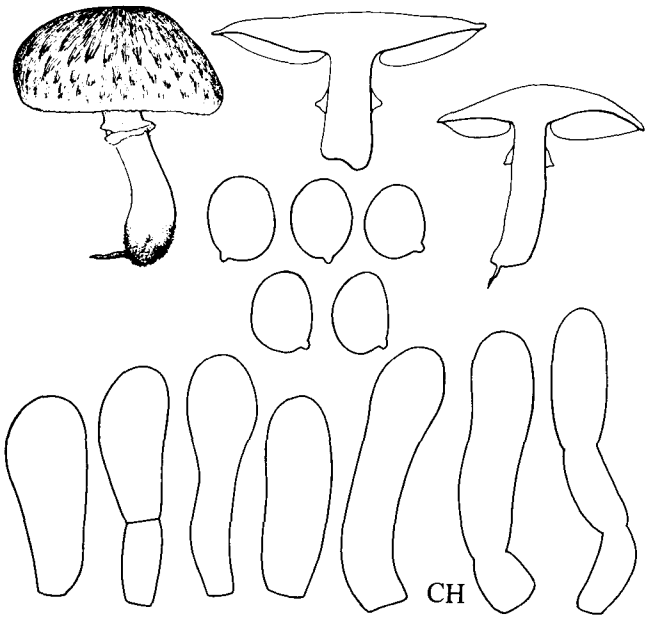

Fig. 11. *Agaricus bisporus*. (habit × ½).

× (9-)12-20 mm, annulate, cylindrical to subclavate, slightly attenuated or enlarged at base up to 23 mm broad, straight to curved, narrowly fistulose, whitish, occasionally brown or reddish brown on handling, especially towards base, above annulus smooth, satiny, sometimes pale pinkish brown, below annulus usually flocculose or with some floccose veil remnants, without rhizomorphs or occasionally with a few short, thick, white rhizomorphs. Annulus at 0.50 - 0.80 of height of stipe, 5-8 mm wide, ascending or descending, patent to pending, thick, c. triangular in transverse section, persistent, whitish, not discolouring, with striate or sometimes sulcate upperside; underside floccose, or with brownish squames, sometimes with incised margin. Context 10-15 mm thick in pileus, firm, whitish, (faintly) discolouring pinkish or brownish when cut, especially in pileus and upper part of stipe, in base of stipe sometimes yellowish pink. Smell herb-like, spicy, fungoid, like nuts. Taste fungoid, not very distinct.

Macrochemical reactions: KOH 10% negative (context of stipe; surface of pileus); Schaeffer-reaction negative (surface of pileus, surface of base of stipe).

Spores 6.5-8.0 × (5.0-)5.5-6.5 mm, on average 7.1-7.3 × 5.4-5.9 mm, Q = 1.10-1.45, Qav = 1.20-1.30, broadly ellipsoid, sometimes ellipsoid, without germ pore. Basidia 20-23 × 7.0-8.0 mm, 2-spored, usually with some 1-spored present. Lamella edge with a 40-75 mm broad sterile layer; cheilocystidia 16.5-33(-36) × (6.5-)8.5-12 mm, narrowly clavate to sometimes utriform, occasionally with some basal septa, forming short chains of 2-3 rectangular elements, 8.0-13 × 5.0-5.5 mm, with colourless or often brownish contents. Pileipellis a slightly gelatinized cutis of unbranched, 3.0-6.0 mm wide hyphae with cylindrical elements, with clavate to cylindrical terminal elements, gradually passing into pileitrama, with brownish intracellular pigment. Fibrils consisting of curved, up to 5.0 mm wide hyphae, with brownish intracellular and parietal pigment. Stipitipellis a regular cutis of unbranched, 3.0-5.5 mm wide hyphae with cylindrical elements, with pale yellow intracellular pigment.

HABITAT & DISTR. – Solitary or in small groups, saprotrophic, terrestrial on soil along roads, in roadside verges, in parks, more rarely in (fertilized) meadows or in dry dunes, on various soil types. Rather common, widespread. May-Nov. Common and widespread in Europe. Cosmopolitan.

The cultivated variant with the almost white pileus is sometimes distinguished at species level as *A. hortensis*, but has no taxonomical importance. This variant is rarely found in nature.

Agaricus brunnescens Peck is considered a different taxon, differing in the not discolouring context and 4-spored basidia. This taxon is by some authors regarded as conspecific with *A. bisporus* and used as the correct name for the cultivated mushroom. For a discussion see Kerrigan (in Wuest et al., Cultivating edible fungi: 141-154. 1987), Malloch (in Mycologia 79: 839-846. 1987) and Singer (in Mycotaxon 20: 479-482. 1984).

11. Agaricus devoniensis P.D. Orton in Trans. Br. mycol. Soc. 43: 173. 1960. – Fig. 12

Psalliota arenicola Wak. & Pears. in Trans. Br. mycol. Soc. 29: 205. 1946; *Agaricus arenicola* (Wak. & Pears.) Pilát, Klíč urč. Hub hřib. bedl.: 401. 1951, non *A. arenicola* Berk. 1843; *Agaricus arenophilus* Huijsman in Persoonia 1: 324. 1960 (superfluous).

SEL. ICON.- Cappelli, Agaricus: pl. 4. 1984; Dal Savio in Boll. Gruppo micol. G. Bres. 27: 155. 1984; Gennari in Riv. Micol. 37: 11. 1994.

SEL. DESCR. & FIGS. – M. Bon in Doc. mycol. 19(76): 75. 1989; F. Møller in Friesia 4: 199-201, fig. 33. 1952 (as *Psalliota arenicola*).

VERN. NAME – Zeeduinchampignon.

Pileus (25-)30-50(-55) mm, at first convex, later plano-convex to applanate or convex with flattened or depressed centre, with inflexed, later straight margin exceeding lamellae, white to whitish (Mu. 10 YR 8/1), sometimes with pale brown centre, sometimes later with faintly yellowish spots or yellowish at centre (2.5 Y 8/4); surface innately to

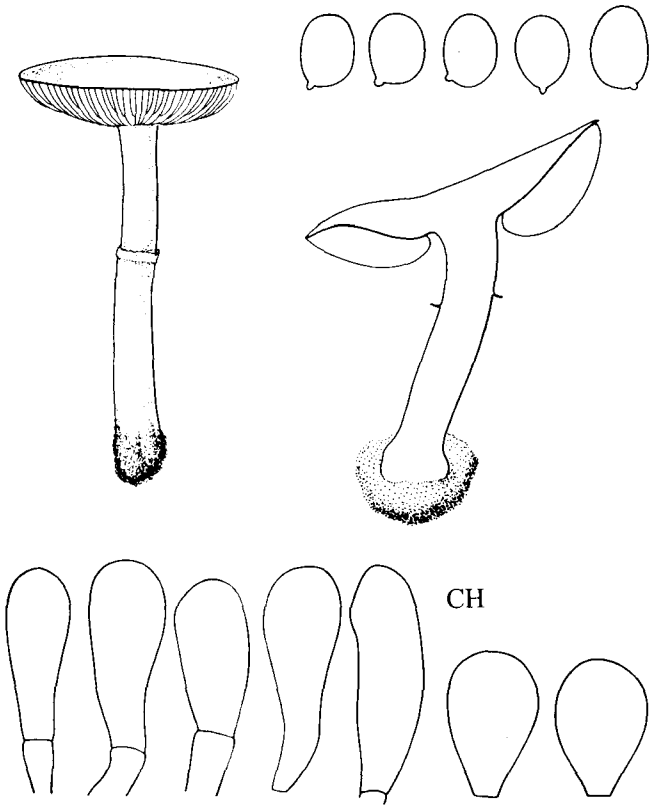

Fig. 12. *Agaricus devoniensis*.

appressed radially fibrillose, with much adhering sand. Lamellae, L = 80-95, l = 1-3(-9), crowded, free, subventricose, up to 6 mm broad, at first greyish brown to pinkish grey (7.5 YR 6/2, 5/4), finally dark brown, with whitish to concolorous, entire edge. Stipe 25-50 × 5-10(-15) mm, usually annulate, occasionally with additional velar zones below, sometimes only with floccose velar zones, cylindrical, sometimes slightly enlarged at base, straight, narrowly fistulose, white, fibrillose, above annulus smooth to subfloccose or with few flocks, sometimes with reddish hue, below annulus floccose, especially at base, often with mycelial clod, sometimes with few thin white rhizomorphs. Annulus at c. 0.50 of height of stipe, narrow, c. 3 mm wide, ascending, slightly patent, thin, fibrillose, white, with smooth upperside; underside fibrillose. Context 7 mm thick in pileus, white, not discolouring or discolouring faintly pinkish or brownish when cut, especially in upper part of stipe. Smell indistinct or faintly like radish. Taste not known.

Macrochemical reactions: KOH 10% negative (surface of pileus); Schaeffer-reaction negative (surface of pileus and base of stipe).

Spores (6.0-)6.5-7.5 × (4.0-)4.5-5.5 mm, on average (6.1-)6.6-6.9 × 4.6-5.3 mm, Q = 1.20-1.40(-1.55), Qav = 1.25-1.30(-1.45), ellipsoid to broadly ellipsoid, without germ pore. Basidia 20-25 × 7.0-9.0 mm, usually 4-spored, occasionally also 2-spored basidia present. Lamella edge with an up to 40 mm broad sterile layer; cheilocystidia not in chains, (15-)20-33 × 9.0-13(-15.5) mm, clavate, hyaline or with brown contents. Pileipellis a slightly gelatinized cutis of slightly irregularly and loosely arranged, 2.5-7.5 mm wide hyphae with cylindrical elements, sometimes inflated up to 9.5 µm, gradually passing into pileitrama, with very pale yellow intracellular pigment. Stipitipellis a cutis of unbranched, 4.0-8.0 mm wide hyphae with cylindrical elements, with intracellular very pale yellow pigment, partly covered with veil composed of curved hyphae with short, inflated elements up to 9.5 µm.

HABITAT & DISTR. – Usually solitary, saprotrophic, terrestrial on bare, sandy soil in coastal sand dunes, also rarely inland on sandy soil. Common along the coast, very rare elsewhere in the Netherlands, Sept.-Nov. Rare but widespread in Europe.

12. Agaricus subfloccosus (J. Lange) Pilát in Acta Mus. nat. Prag. 7B (1): 6. 1951. – Fig. 13.

Psalliota hortensis f. *subfloccosa* J. Lange in Dansk bot. Ark. 4(12): 8. 1926; *Psalliota subfloccosa* (J. Lange) J. Lange, Fl. agar. dan. 4: 58. 1939.

SEL. ICON.- Breitenb. & Kränzl., Pilze Schweiz 4: pl. 195. 1995; Cappelli, Agaricus: pl. 26, 26bis. 1984; J. Lange, Fl. agar. dan. 4: 139D. 1939.

SEL. DESCR. & FIGS. – Cappelli in Boll. Gruppo micol. G. Bres. 26: 28. 1983; Cappelli, Agaricus: 202. 1984; J. Lange, Fl. agar. dan. 4: 58-59. 1939; F. Møller in Friesia 4: 11-12. 1950.

VERN. NAME – Rafelige champignon.

Pileus 65-110(-120) mm, at first convex, later convex with flattened centre to plano-convex, sometimes with depressed centre, with inflexed, later deflexed margin, at first greyish to brownish white or pale greyish brown, later usually at centre brownish (Mu. 10 YR 5/3, 6/4), towards margin paler brown (2.5 Y 7/4, 10 YR 6/3, 7/4, 8/2-3) with darker brown fibrils concolorous to centre, rarely remaining pale brownish white, not discolouring or rarely reddish on handling; surface radially fibrillose to fibrillose-flocculose, occasionally with large fibrillose appressed innate squames, in centre occasionally areolate-rimose, sometimes towards margin fissurate, near margin also with some whitish velar flocks; margin exceeding lamellae, with broad adhering veil remnants. Lamellae, L = (80-)100-165, l = 2-3(-7), moderately crowded, free, arcuate, up to 7 mm broad, at first reddish brown, later dark brown (5 YR 3/2; 7.5 YR 3/2), with pale brown to white, pruinose edge. Stipe (30-)50-60(-70) × (12-)15-25(-30) mm, usually annulate, cylindrical to clavate, sometimes fusiform, at base up to 28 mm broad, straight, stuffed to narrowly fistulose, white to pale brown, sometimes brownish or reddening at base on handling, above annulus smooth to scarcely flocculose, below annulus fibrillose, floccose to flocculose or fibrillose-squamulose, sometimes with short white rhizomorphs. Annulus at 0.60-0.80 of height of stipe, 8-13 mm wide, sometimes remaining attached at margin of pileus, ascending, patent to slightly pending, very thick, persistent, white to pale brown, not discolouring, with striate to sulcate upperside; underside fibrillose to squamulose, with thickened margin. Context 12-18 mm thick in pileus, firm, white, discolouring quickly, rarely slowly, greyish pink, or reddish brown to reddish in pileus and upper part of stipe when cut (10 R 8/3), in stipe soon fading to brownish or brownish orange. Smell indistinct to agreeable, aromatic with chemical compound, fungoid, rarely unpleasant. Taste fungoid with unpleasant compound.

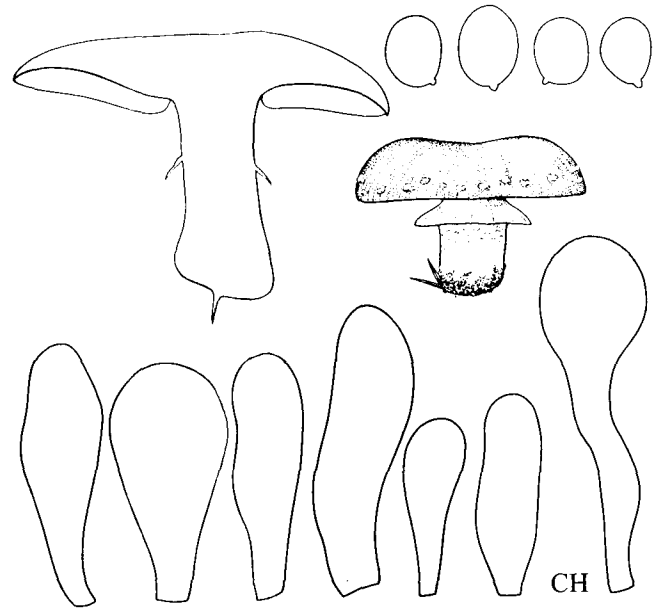

Fig. 13. *Agaricus subfloccosus*. (habit × ½).

Macrochemical reactions: KOH 10% negative (surface of pileus and stipe); Schaeffer-reaction negative (surface of pileus).

Spores 5.5-7.5 × 4.5-6.0 mm, on average 6.0-6.8 × 5.0-5.2 mm, Q = 1.15-1.45, Qav = 1.25-1.30, ellipsoid to broadly ellipsoid, without germ pore. Basidia 23-39 × (6.0-)7.5-10.5 mm, 4-spored. Lamella edge with a 55-80 mm broad sterile layer; cheilocystidia not in chains, (26.5-)30-49 × 8.5-15.0(-16.5) mm, cylindrical to narrowly clavate, rarely some large elements present up to 70 × 30 µm, hyaline or with brownish content. Pileipellis a cutis of unbranched, irregularly radially arranged, (2.0-)3.0-5.5(-7.5) mm wide hyphae with cylindrical, rarely slightly inflated elements, gradually passing into pileitrama, with pale yellow intracellular pigment. Fibrils consisting of branched, curved, 4.0-5.5 mm wide hyphae with cylindrical elements with pale yellow intracellular pigment. Stipitipellis a cutis of sometimes branched, (2.5-)3.5-5.5 mm wide hyphae with cylindrical elements, with some slightly ascending, cylindrical to clavate, up to 6.5 µm wide terminal elements, with very pale yellow, parietal and intracellular pigment.

HABITAT & DISTR. - Solitary or in small groups, saprotrophic, terrestrial in *Picea*-woods or on roadside verges in deciduous woods, also in garden, on humus-rich and calcareous soil. Widespread but rare in

the Netherlands, May-June and Sept.-Oct. Widespread but very rare in Europe. Also known from North America.

Recent research of Noble et al. (in Mycol. Res. 99: 1453-1461. 1995) and Kerrigan et al. (in Mycol. Res. 103: 1515-1523. 1999) revealed two genetically different groups within this taxon, one from higher elevation and one from lower elevation. The morphological differences between the two groups proved rather small, and the morphological variability of the specimens studied from the Netherlands seems to cover the whole range of the two groups, even within one collection. This taxon requires further study.

13. Agaricus subperonatus (J. Lange) Sing. in Lilloa 22: 431. ('1949') 1951. – Fig. 14.

Psalliota hortensis f. *subperonata* J. Lange in Dansk bot. Ark. 4(12): 8. 1926; *Psalliota subperonata* (J. Lange) J. Lange, Fl. agar. dan. 4: 59. 1939. – *Agaricus campestris* β *vaporarius* Pers., Syn. meth. Fung.: 418. 1801; *Psalliota vaporaria* (Pers.) Møller & Schaeff. in Annls mycol. 36: 71. 1938; *Agaricus vaporarius* (Pers.) Cappelli, Agaricus: 149. 1984, non *A. vaporarius* Schrank 1789; *Agaricus pseudovillaticus* Rauschert in Nova Hedwigia 54: 214. 1992.

SEL. ICON. – Cappelli, Agaricus: pl. 15. 1984; Dähncke, 1200 Pilze: 487. 1993; J. Lange, Fl. agar. dan. 4: 140D. 1939.

SEL. DESCR. & FIGS. – J. Lange, Fl. agar. dan. 4: 59. 1939; F. Møller in Friesia 4: 42. 1950.

VERN. NAME – Gordelchampignon.

Pileus (40-)60-125(-135) mm, at first hemispherical to convex, expanding to convex with slightly flattened centre or plano-convex,

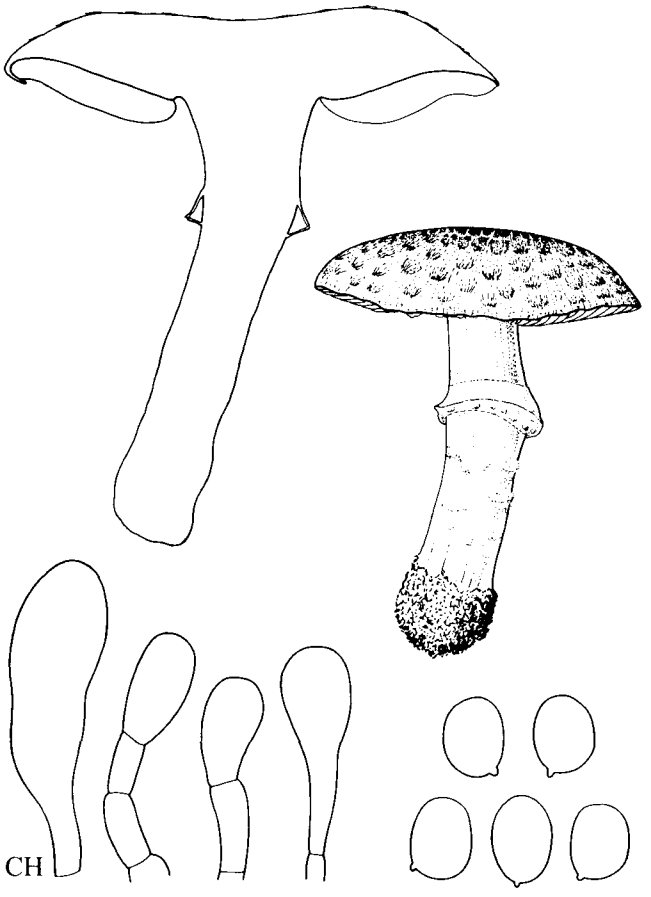

Fig. 14. *Agaricus subperonatus*. (habit × ½).

with at first inflexed margin, brownish, brown or dark greyish brown to dark brown (Mu. 10 YR 7/4-6, 7.5-10 YR 4/4, 7.5 YR 4/2-5/5, 4/4, 5-6/6), not discolouring on handling, radially squamose with unclearly delimited, appressed, fibrillose (dark) brown squames on pale brown to whitish background (10 YR 8/4); surface slightly viscid when moist; margin slightly exceeding lamellae, white appendiculate-dentate. Lamellae, L = 100-210, l = 1-3(-9), crowded, free, straight to subventricose or undate, up to 9.5 mm broad, pinkish brown (5 YR 3/4, 7.5 YR 5/4-10 YR 4/4, 7.5 YR 6/4, 10 YR 5/3), later brown to dark brown (7.5 YR 3/2), with whitish denticulate edge. Stipe (35-)65-120 × (14-)19-25(-29) mm, annulate, cylindrical, slightly enlarged at base up to 30 mm, or slightly ventricose, straight, stuffed, whitish to pinkish grey, above annulus smooth to fibrillose, below annulus with several, distant, often incomplete, (pale) brownish girdles of veil or brown-squamose, sometimes with pale brown velar sock, rarely with few thin white rhizomorphs. Annulus at 0.70-0.85 of height of stipe, 9-15 mm wide, descending, pending to appressed, triangular in transverse section, thick, persistent, white to brownish, not discolouring, with striate to smooth upperside; underside fibrillose to squamulose. Context 11-24 mm thick in pileus, firm, white to pale brown, discolouring (pale) pinkish in pileus and upper part of stipe when cut, fading to brownish, rarely not discolouring. Smell indistinct to faint, disagreeable to fungoid or pleasant. Taste not known.

Macrochemical reactions: ammonia pale yellow (context of stipe); KOH 10% negative (context of stipe and pileus); Schaeffer-reaction negative (surface of pileus).

Spores (5.5-)6.0-8.0 × 4.5-6.5 mm, on average 6.6-7.0 × 5.2-5.6 mm, Q = 1.10-1.40(-1.50), Qav = 1.20-1.30, broadly ellipsoid, sometimes ellipsoid, without germ pore. Basidia 18-27 × 6.5-9.0 mm, in majority 4-spored, usually also a variable amount of 2-spored present. Lamella edge with a 40-70 mm broad, sometimes agglutinated, often sterile layer; cheilocystidia usually in protruding clusters, 18-36(-45) × (5.5-)7.5-13 mm, clavate, sometimes with few basal septa, forming short chains of rectangular elements of 7.0-12 × 3.0-5.0 mm, hyaline or rarely with pale brown contents. Pileipellis a slightly gelatinized cutis of radially, sometimes irregularly arranged, (3.5-)4.5-8.0 mm wide hyphae with cylindrical elements, with brownish intracellular pigment, gradually passing into pileitrama. Squames and fibrils indistinguishable. Stipitipellis a cutis of sometimes branched, 4.5-6.5 mm wide hyphae with cylindrical elements, with cylindrical to narrowly clavate terminal elements up to 7.0 μm wide, with pale yellow intracellular pigment.

HABITAT & DISTR. – Usually gregarious, saprotrophic, terrestrial on, usually clayey, soil or debris in roadside verges, city parks, woods, riverdikes, often on nutrient-rich soil. Moderately common, but increasing in the Netherlands, July-Nov. Widespread but uncommon in Europe. Cosmopolitan.

The differences between *Agaricus pseudovillaticus* (= *Psalliota vaporaria*) and *A. subperonatus* according to Møller (in Friesia 4: 40-43. 1950) are very subtle, and to be found in the size, colour and stature of the basidiocarps, and in the size of the cystidia. No such differences were found in the collections studied, which covered the whole range of character-states mentioned by Møller.

14. Agaricus bohusii M. Bon in Doc. mycol. 13(49): 56. 1981. – Fig. 15.

Agaricus caespitipes Hlaváček in Mykol. Sb., Praha 59: 66. 1982 (invalid); *Agaricus caespitipes* Hlaváček in Mykol. Sb., Praha 74: 51. 1999.

MISAPPL. – *Agaricus elvensis* sensu Cooke, Ill. Brit. Fungi 4: pl. 522. 1885.

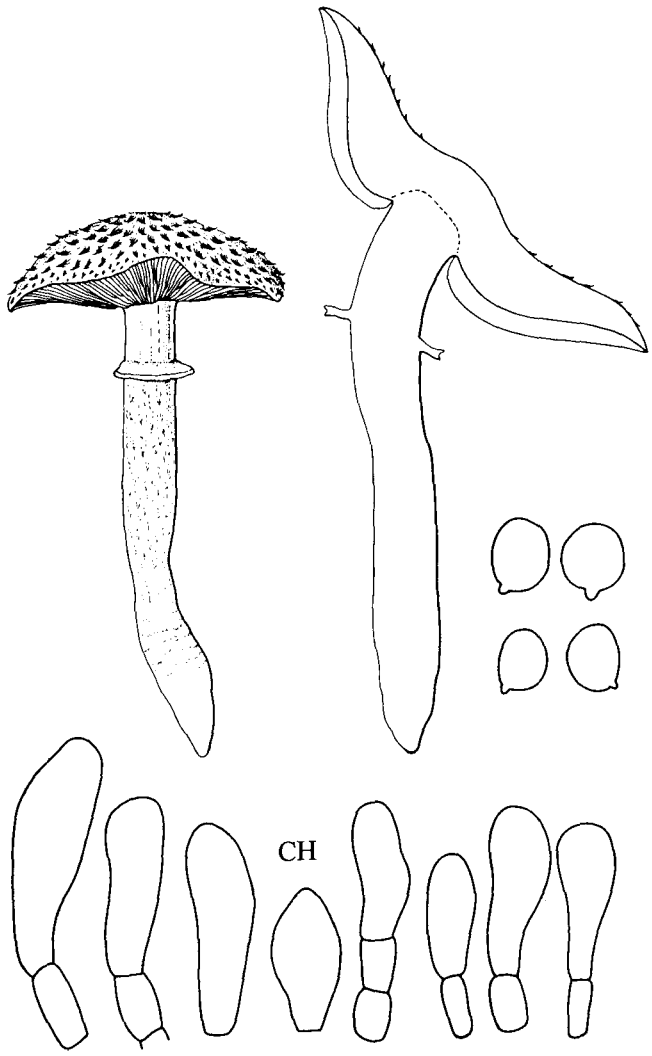

Fig. 15. *Agaricus bohusii*. (habit × ½).

SEL. ICON.- Bohus & Babos in Fung. rar. Ic. col. 8: pl. 59. 1977 (as *A. elvensis* sensu Cooke); Cappelli, Agaricus: pl. 22. 1984.

SEL. DESCR. & FIGS. – Bohus in Annls hist.-nat. Mus. natn. hung. 63: 77. 1971; Bohus & Babos in Fung. rar. Ic. col. 8: 5-6, fig. 3. 1977 (as *A. elvensis* sensu Cooke).

VERN. NAME – Spoelvoetchampignon.

Basidiocarps fasciculate. Pileus (55-)75-160(-220) mm, at first conical, later convex, with at first involute margin, later reflexed and exceeding lamellae and slightly appendiculate, at centre brown to dark brown (Mu. 6 YR 4/3, 7.5 YR 5/4, 8 YR 4-5/4, 10 YR 4-5/4, 5/3), lanate-fibrillose with small squames, towards margin covered with large, fibrillose, pointed, usually recurved brown to reddish brown concentrically arranged squames, concolorous with centre, on pale brown background (6 YR 5/4). Lamellae, L = 80-175, l = 1-3, moderately crowded, free, segmentiform, slightly undate, up to 9(-11) mm broad, at first pale brown to greyish pink (10 YR 6/4; 7.5 YR 4/2), later reddish brown (5 YR 5/4), finally dark brown, with concolorous to paler denticulate to serrulate edge. Stipe (75-)135-185 × 13-28(-36) mm, annulate, fusiform or cylindrical and tapering towards base, straight to slightly curved, deeply rooting with pseudorhiza, stuffed to narrowly fistulose, white to pale brown, reddish yellow to reddish brown on handling, fibrillose, above annulus shiny, smooth to striate, below annulus fibrillose to flocculose-squamulose, with brownish girdles of veil remnants. Annulus at 0.60-0.85 of height of stipe, up to 12 mm wide, descending, pending, thick, often triangular in transverse section, persistent, double, pale brown (7.5 YR 5/4), with smooth to fibrillose upperside; underside lanate-fibrillose to fibrillose-squamulose. Context (11-)15-22 mm thick in pileus, firm, white to very pale brown, discolouring pale reddish brown to reddish in upper part of stipe and pileus when cut, sometimes not discolouring. Smell indistinct. Taste not known.

Macrochemical reactions: KOH 10% pale yellow to reddish (context of pileus); Schaeffer-reaction yellow to orange yellow (surface of pileus).

Spores 5.5-7.0 × 4.5-6.0 mm, on average 5.8-6.5 × (4.8-)5.3-5.5 mm, Q = 1.05-1.30, Qav = 1.10-1.20, broadly ellipsoid to subglobose, without germ pore. Basidia 22-26 × 7.0-9.0 mm, 4-spored. Lamella edge with a c. 50 mm broad sterile layer; cheilocystidia 15-25(-33) × 6.0-9.0 mm, clavate, colourless or with brownish contents, often with few basal septa, forming short chains of rectangular, sometimes inflated elements of 10-13 × 4.0-5.5 mm. Pileipellis a slightly gelatinized cutis of unbranched, 4.5-8.0 mm wide hyphae with cylindrical elements, with intracellular yellowish brown pigment, gradually passing into pileitrama. Squames consisting of curved, up to 6.0 mm wide hyphae with cylindrical elements and recurved, narrowly clavate, up to 8.0 µm wide terminal elements, with yellowish brown intracellular pigment. Stipitipellis a cutis of slightly irregularly arranged, unbranched, 2.5-6.0 mm wide hyphae with cylindrical elements, with pale yellow intracellular pigment. Veil consisting of interwoven, 4.0-5.0 mm wide hyphae with relatively short, 14-30(-45) mm long, cylindrical elements, with yellowish brown, parietal pigment.

HABITAT & DISTR. – Fasciculate, in clusters of up to 25 basidiocarps, saprotrophic, terrestrial in estates or dikes on clayey soil. Rare, in river region. Sept. Rare but widespread in Europe. Also known from North America.

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Pileus not discolouring or reddening or browning; annulus relatively persistent, with thickened margin; context not discolouring or reddening or browning on exposure or when damaged.

KOH-reaction negative; Schaeffer-reaction negative.

Spores ellipsoid to oblong, Qav > (1.30-)1.40; without germ pore; lamella edge sterile; cheilocystidia clavate to (sub)globose, up to 20 µm wide.

15. Agaricus sylvaticus Schaeff., Fung. Bavariae 4: 62. 1774:Fr. – Fig. 16.

Agaricus sylvaticus Schaeff.:Fr., Syst. mycol. 1: 282. 1821 (as *A. silvaticus*); *Psalliota sylvatica* (Schaeff.) Kumm., Führ. Pilzk.: 73. 1871 (as *P. silvaticus*) – *Agaricus haemorrhoidarius* S. Schulz. in Kalchbr., Ic. sel. Hymenomyc. Hung.: 29. 1874. – *Agaricus sanguinarius* P. Karst., Rvssl., Finl. Skand. Halføns Hattsvamp.: 232. 1882. – *Agaricus vinosobrunneus* P.D. Orton in Trans. Br. mycol. Soc. 43: 183. 1960; *Agaricus sylvaticus* var. *vinosobrunneus* (P.D. Orton) Heinem. in Sydowia 30: 7. ('1977') 1978. – *Psalliota sylvatica* var. *saturata* F. Møller in Friesia 4: 38. 1950; *Agaricus sylvaticus* var. *saturatus* (F. Møller) F. Møller in Friesia 4: 203. 1952.

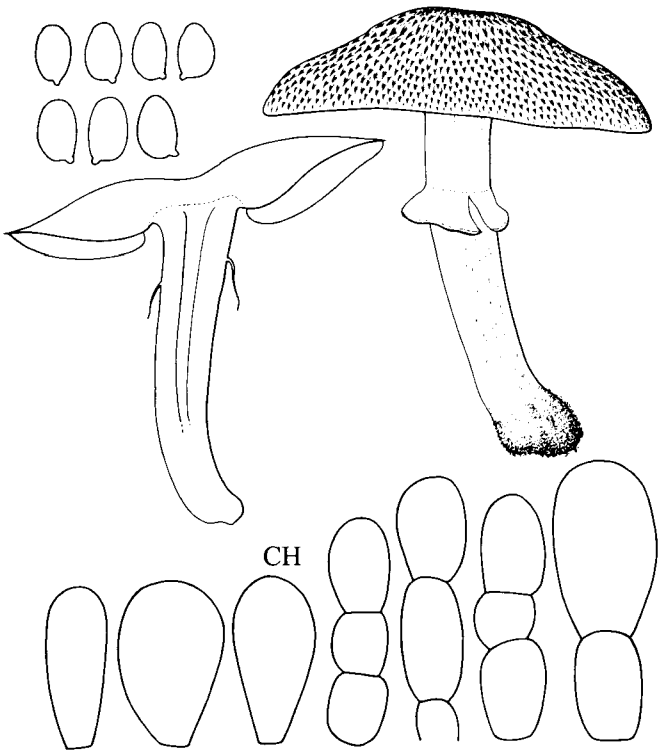

Fig. 16. *Agaricus sylvaticus*. (habit × ½).

SEL. ICON.- Cappelli in Boll. Gruppo micol. G. Bres. 26: 12. 1983; Cappelli, Agaricus: pl. 17, 17bis. 1984; R. Phillips, Paddest. Schimm.: 160. 1981.

SEL. DESCR. & FIGS. – Cappelli, Agaricus: 163-164. 1984. F. Møller in Friesia 4: 33-38, pl. 14-15. 1950 (resp. as *P. haemorrhoidaria* and *P. silvatica*).

VERN. NAME – Schubbige boschampignon.

Pileus 30-100(-145) mm, at first hemispherical, expanding to convex to plano-convex, sometimes irregularly, sometimes with slightly depressed centre, with involute margin, later with margin slightly exceeding lamellae, in centre reddish brown to dark yellowish brown, rarely brown (Mu. 5-7.5 YR 4.5-6/4-5, 10 YR 4/4, 5-6/3), for the rest breaking up or covered with likewise coloured, appressed, fibrillose squamules on paler background, rarely squarrulose or covered with thick, wart-like squamules; quickly discolouring red when damaged; veil present as appendiculate white fringe. Lamellae, L = (95-)105-160, l = 1-3, moderately crowded, free, ventricose to undate, up to 8(-11) mm broad, dark greyish to pinkish brown (7.5 YR 3/2, 4/2), with whitish, dentate to serrulate edge. Stipe (30-)40-140 × 6-12(-21) mm, annulate, clavate to cylindrical with bulbous, up to 28 mm broad at base, straight, fistulose, whitish, above annulus greyish brown, usually reddening when damaged, sometimes immediately red, sometimes slightly browning on handling, above annulus lengthwise silky striate, below annulus whitish to brownish flocc(ul)ose, without rhizomorphs. Annulus at 0.60-0.90 of height of stipe, 6-10(-13) mm wide, descending, pending to slightly spreading, floppy, relatively thin, white to brown, with thickened, double margin; upperside smooth to finely striate; underside fibrillose, or with small brown squamules or large teeth at edge. Context 7 mm thick in pileus, whitish to pale brown, discolouring red(dish) to orange-red in upper part of stipe when cut, occasionally also in pileus, especially above lamellae, sometimes pinkish in apex of stipe; colour occasionally disappearing quickly, in base of stipe rarely yellowish brown. Smell like nuts or indistinct. Taste not known.

Macrochemical reactions: KOH 10% negative (surface of pileus, context pileus); Schaeffer-reaction negative (all parts).

Spores 4.5-6.0 × (3.0-)3.5-4.0 mm, on average 5.0-5.5(-5.7) × 3.4-3.7 mm, Q = 1.30-1.65(-1.70), Qav = 1.40-1.55, ellipsoid, without germ pore. Basidia 18-23 × 6.0-7.5 mm, 4-spored. Lamella edge with a 40-65 mm broad sterile layer; cheilocystidia in short chains of globose to rounded rectangular elements of 6.0-9.0(-17.5) × (4.0-)6.5-8.5 mm, with clavate terminal elements of (12-)14-25.5 × (5.5-)6.0-13 mm, sometimes with brownish contents. Pileipellis a cutis of 4.0-8.0 mm wide hyphae with cylindrical elements, with slightly ascending, cylindrical terminal elements, gradually passing into pileitrama, with yellowish, parietal pigment. Stipitipellis a, sometimes slightly gelatinized, cutis of 4.5-6.0(-8.5) mm wide hyphae with cylindrical elements. Squames consisting of curved, up to 8.5 mm wide hyphae with some inflated, up to 10.5 mm wide elements, and cylindrical terminal elements, with yellowish, parietal pigment.

HABITAT & DISTR. – Usually in groups, saprotrophic, terrestrial in deciduous and coniferous woods, parks, roadside verges on humus-rich soil, sometimes in open dunes. Rather common in the Netherlands, Sept.-Nov. Widespread and rather common in Europe. Cosmopolitan.

The identity of the taxa *Agaricus sylvaticus* var. *pallidus* (F. Møller) F. Møller and *A. sylvaticus* var. *fuscosquamatus* (F. Møller) F. Møller (in Friesia 4: 203. 1952) is unclear. Unfortunately no type or original material has been preserved.

16. Agaricus impudicus (Rea) Pilát, Klíč urč. Hub hřib. bedl.: 403. 1951. – Fig. 17.

Psalliota impudica Rea in Trans. Br. mycol. Soc. 17: 37. 1932; *Agaricus reai* M. Bon in Doc. mycol. 11(44): 28. 1981 (superfluous). – *Psalliota variegata* F. Møller in Friesia 4: 30. 1950; *Agaricus variegatus* (F. Møller) Pilát in Acta Mus. nat. Prag. 7B (1): 8. 1951, non *A. variegatus* Pers. 1801:Fr.; *Agaricus variegans* F. Møller in Friesia 4: 203. 1952. – *Psalliota variegata* var. *koelerionensis* M. Bon in Doc. mycol. 3: 12. 1972; *Agaricus koelerionensis* (M. Bon) M. Bon in Doc. mycol. 10(37-38): 91. 1979.

SEL. ICON. – Cappelli in Boll. Gruppo micol. G. Bres. 26: 13. 1983; Cappelli, Agaricus: pl. 18, 18bis. 1984; Dähncke, 1200 Pilze: 488. 1993.

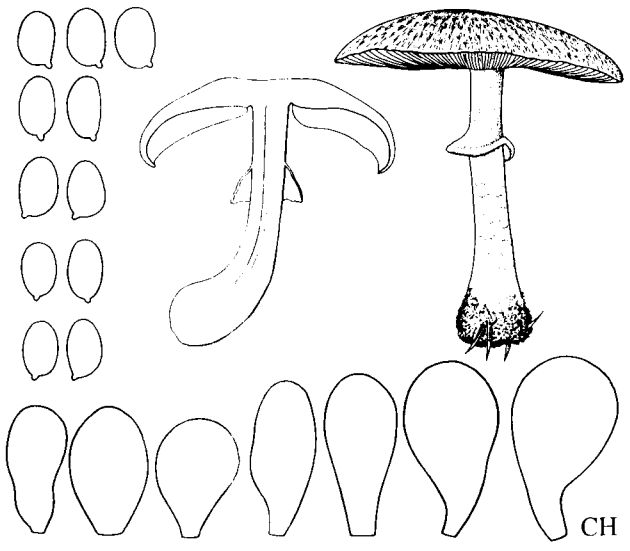

Fig. 17. *Agaricus impudicus*. (habit × ½).

SEL. DESCR. & FIGS. – F. Møller in Friesia 4: 31-33, pl. 1a & 13. 1950.

VERN. NAME – Panterchampignon.

Pileus (30-)40-110(-125) mm, at first hemispherical to conico-convex, expanding to convex to plano-convex with slightly depressed centre, sometimes with faint umbo, with margin exceeding lamellae, at centre usually dark greyish brown to reddish brown (Mu. 5 YR 3/2-3, 6 YR 4/4-6, 7.5 YR 3/2, 4/2-4; 10 YR 5/4), sometimes yellowish brown (10 YR 6/4), fibrillose to fibrillose-squamulose; otherwise covered with concentrically arranged dark red-brown (5 YR 4/3), appressed fibrillose squames on paler, whitish to pinkish background (7.5 YR 8/4); squames getting smaller towards margin; at margin, mainly in old specimens, sometimes only fibrillose; surface not discolouring on handling; veil often present as thin dark brownish fibrillose squames some millimetres from margin, sometimes also present as white fringe or appendiculate flocks, later disappearing. Lamellae, L = 90-130, l = 1-5, crowded, free, segmentiform to subventricose, up to 9 mm broad, at first pinkish (5 YR 5-6/4, 8/3; 7.5 YR 5/4, 7/2-6/4), sometimes slightly reddening when damaged, later light reddish brown to brownish pink (2.5 YR 6/4; 5 YR 4/3, 6/4) to brown (10 YR 5/3), with paler, entire to denticulate edge. Stipe (35-)50-110(-125) × (5-)6-12 mm, annulate, subclavate to clavate, at base up to 23 mm broad, sometimes with bulbous base up to 29 mm broad, straight, narrowly fistulose, white, later brownish on handling, above annulus glabrous to striate, below annulus usually fibrillose-squamulose to flocculose, sometimes lanate, sometimes with brownish squames (4 YR 4/4) forming girdles at base, later occasionally smooth, occasionally with some short or long, narrow, white, not discolouring rhizomorphs. Annulus at 0.65-0.85 of height of stipe, (7-)9-15 mm wide, descending, patent, thin to moderately thick, persistent, whitish, not discolouring, with usually smooth or velvety, sometimes striate upperside; underside fibrillose-squamulose, velvety to floccose or cottony, usually at margin with brownish rim or with radially arranged, slightly thicker, whitish, yellowish brown to brownish squames. Context 7-10 mm thick in pileus, white to whitish, not or hardly discolouring when cut, sometimes in pileus faintly and slowly reddish to reddish brown, sometimes in older specimens faintly brown in upper half of stipe (10 YR 6/3), sometimes pale brown to pale yellowish brown in base of stipe; in base of stipe faintly yellowish brown on scratching (10 YR 8/3-4). Smell indistinct or unpleasant when cut: faintly like *Lepiota cristata* (metallic with sweetish (fruity) component), sometimes slightly fruity with unpleasant compound. Taste like nuts but with unpleasant aftertaste.

Macrochemical reactions: ammonia negative (surface of pileus, context in base of stipe); KOH 10% and 40% pale yellowish brown (context in base of stipe and pileus; rarely negative) or faintly yellow (surface of pileus); Schaeffer-reaction negative (surface of pileus and stipe).

Spores (4.5-)5.0-7.0 × 3.5-4.0(-4.5) mm, on average (5.1-)5.7-6.2 × 3.5-3.9 mm, Q = (1.30-)1.40-1.80(-2.00), Qav = (1.40-)1.50-1.70, ellipsoid to oblong, sometimes amygdaliform, without germ pore. Basidia 17-23 × 6.5-9.5 mm, 4-spored. Lamella edge with a 65-70 mm broad sterile layer, rarely not entirely sterile; cheilocystidia usually not in chains, (12-)15-26 × 9-20(-24) mm, globose, soon collapsed, rarely with short chains of rectangular elements of 5-11 × 3-6 µm, sometimes agglutinated. Pileipellis a slightly irregular cutis of sometimes branched, slightly interwoven, 4.0-8.5(-13.5) mm wide hyphae with cylindrical, rarely slightly inflated up to 8.5 mm wide elements, with cylindrical terminal elements, gradually passing into pileitrama, with yellowish parietal, sometimes intracellular pigment. Squames consisting of sometimes branched, curved, interwoven, (4.5-)5.5-12.5 mm wide hyphae with 21-30(-40) mm long, cylindrical elements and subclavate terminal elements, with parietal, sometimes encrusting, yellowish pigment. Stipitipellis a slightly irregular cutis of sometimes branched, 4.0-6.0 mm wide hyphae with cylindrical elements, and slightly ascending, cylindrical, up to 8.0 mm wide terminal elements, with parietal, yellowish pigment.

HABITAT & DISTR. – In groups, saprotrophic, terrestrial on soil or litter in woods or along paths, also in open dunes, usually on moist, humus-rich soil. Rather common in southern Limburg and in the dune region, rather rare in the other parts of the country, but increasing in recent times according to Chrispijn (in Arnolds et al., Overz. Paddest. Nederland: 55. 1995). Sept.-Dec. Widespread in Europe, not very rare. Also known from northern Africa, South America and Asia.

Agaricus koelerionensis, distinguished by Bon on account of the larger spores, is considered synonymous here, since the spore range of the studied collections also encloses the spore size given for that species.

According to Rauschert (in Nova Hedwigia 54: 214. 1992) *Agaricus brunneola* (J. Lange) Pilát (in Acta Mus. nat. Prag. 7B (1): 23. 1951) is also synonymous.

17. Agaricus langei (F. Møller) F. Møller in Friesia 4: 203. 1952. – Fig. 18.

Psalliota langei F. Møller in Friesia 4: 28. 1950. – *Psalliota mediofusca* F. Møller in Friesia 4: 32. 1950; *Agaricus mediofuscus* (F. Møller) Pilát in Acta Mus. nat. Prag. 7B (1): 8. 1951; *Agaricus langei* var. *mediofuscus* (F. Møller) Wasser in Ukr. bot. Zh. 35: 516. 1978.

SEL. ICON.- Cappelli in Boll. Gruppo micol. G. Bres. 26: 24. 1983; Cappelli, Agaricus: pl. 27, 27bis. 1984; Dähncke, 1200 Pilze: 487. 1993.

SEL. DESCR. & FIGS. – F. Møller in Friesia 4: 28-30. 1950.

VERN. NAME – Knolloze boschampignon.

Pileus 35-90 mm, at first conical to convex, expanding to convex with flattened centre or plano-convex, sometimes with slight umbo, with appendiculate margin, at centre brown to reddish or vinaceous brown (Mu. 5 YR 3/2, 3-4/3, 4-5/4, 6-7.5 YR 4/4), fibrillose, for the rest densely covered with relatively broad, appressed, concolorous to centre or slightly paler, fibrillose squamules on paler background, not discolouring on handling; veil present as white appendiculate fringe. Lamellae, L = 70-115, l = 1-3, relatively crowded, free, subventricose to segmentiform, 5-8 mm broad, at first pale pinkish brown, later dark-

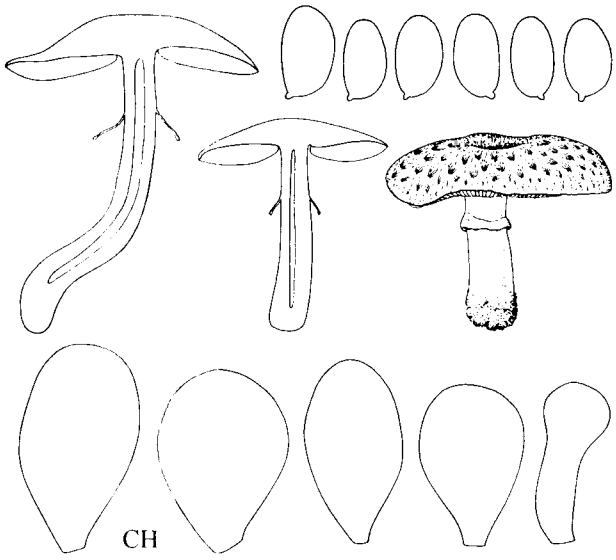

Fig. 18. *Agaricus langei*. (habit × ½).

er pinkish brown (5 YR 6-7/4, 7.5 YR 6/4), finally blackish brown, with entire, sometimes slightly paler edge. Stipe (30-)40-85(-115) × 7-12(-20) mm, annulate, cylindrical to clavate, at base up to 16 mm broad, usually straight, fistulose, whitish to greyish, reddish brown on handling, above annulus smooth or finely striate, below annulus usually fibrillose to sometimes minutely floccose or felted to lanate, at base occasionally with some larger brown squames, without rhizomorphs. Annulus at 0.65-0.75 of height of stipe, 11-17 mm wide, descending, pending to patent, thin to relatively thick, often at margin thicker, persistent, whitish or brownish, at underside brownish, with smooth to striated upperside; underside felted or squamulose. Context 6-11 mm thick in pileus, soft, whitish, discolouring reddish to dark red when cut in upper part of stipe and pileus above lamellae, often immediately, in base of stipe not discolouring or discolouring orange-red. Smell indistinct to acidulous. Taste not known.

Macrochemical reactions: KOH 10% negative (context); Schaeffer-reaction negative (all surfaces).

Spores 7.0-9.0 × 4.0-6.0 mm, on average (7.6-)7.8-8.3 × 4.4-5.4 mm, Q = (1.35-)1.40-1.95(-2.00), Qav = 1.50-1.85, ellipsoid to oblong, without germ pore. Basidia 23 × 8.5-9.0 mm, usually 4-spored, occasionally also 2-spored present. Lamella edge with a 35-50 mm broad sterile layer; cheilocystidia not in chains, 19-46 × 14-20(-26) mm, clavate to globose, hyaline or with brownish contents. Pileipellis a slightly irregular cutis of (3.0-)6.5-11.0 mm wide hyphae with cylindrical, rarely slightly inflated elements, with scattered ascending, cylindrical terminal elements, gradually passing into pileitrama, with intracellular and parietal, pale brown pigment. Stipitipellis a slightly gelatinized cutis of 3.0-8.0 mm wide hyphae with sometimes inflated, up to 12 mm wide elements, with parietal, pale yellow pigment.

HABITAT & DISTR. – Solitary or in small groups, saprotrophic, terrestrial in parks, on dikes planted with trees, in deciduous woods, on nutrient-rich clayey or sandy soil. Rare in the Netherlands, Aug.-Oct. Relatively rare but widespread in Europe. Also recorded from northern Africa and the Americas.

The complex of species around *Agaricus langei*, which is characterized by a reddish brown squamulose pileus and spores larger than 7 mm, is as yet not fully understood. Several species are distinguished by Møller and others in this group, mainly on account of differences in colour, amount of squames and size of the pileus, intensity of the reddish discoloration of the context, and the amount of squames on the stipe. Further study is required, and molecular and experimental research may make the relationships between the taxa more clear.

Agaricus babosi Bohus (in Annls hist.-nat. Mus. natn. hung. 81: 37. 1990) differs from *A. langei* according to Bohus in a longer stipe which is dark fibrillose to squamose below the annulus. None of the studied collections fits the description of Bohus. *Agaricus mediofuscus* (F. Møller) Pilát differs, according to Møller (in Friesia 4: 32. 1950), in the pileus with dark brown squames on the pileus, and the stipe which is dark brown scaly below the annulus. This taxon seems to represent an extreme variant of *A. langei*, and all transitions could be found. Therefore it is regarded as conspecific.

18. Agaricus fuscofibrillosus (F. Møller) Pilát in Acta Mus. nat. Prag. 7B (1): 19. 1951. – Fig. 19.

Psalliota fuscofibrillosa F. Møller in Friesia 4: 27. 1950.

SEL. ICON.- Cappelli in Boll. Gruppo micol. G. Bres. 26: 20. 1983; Cappelli, Agaricus: pl. 21. 1984; F. Møller in Friesia 4: pl 2b. 1950.

SEL. DESCR. & FIGS. – Bohus in Annls hist.-nat. Mus. natn. hung. 61: 152-153. 1969; F. Møller in Friesia 4: 27-28. 1950.

VERN. NAME – Fijnvezelige boschampignon.

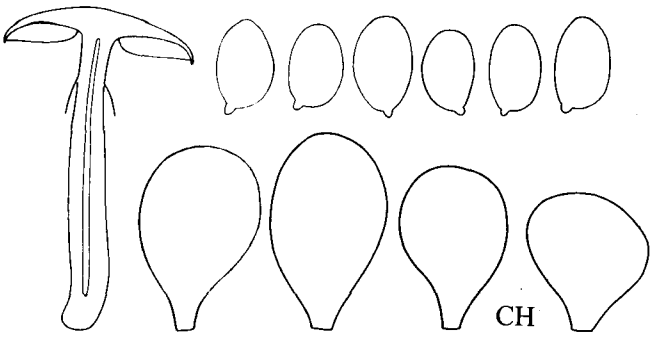

Fig. 19. *Agaricus fuscofibrillosus*. (habit × ½).

Pileus 40-65(-100) mm, convex to plano-convex and subumbonate, dark reddish brown at centre (Mu. 2.5 YR 5/6; 5 YR 5/4; 7.5 YR 3-4/2), fibrillose at centre, for the rest concolorous fibrillose, when drying sometimes fibrillose-squamulose, not discolouring on handling. Lamellae crowded, free, subventricose to segmentiform, up to 9.5 mm broad, at first pink, later dark blackish brown, with paler, entire edge. Stipe 45-105(-150) × 6-14 mm, annulate, cylindrical to subclavate, at base up to 18 mm broad, straight, fistulose, whitish, discolouring brownish to reddish brown on handling, above annulus smooth, below annulus fibrillose, sometimes fibrillose-squamulose. Annulus at 0.70-0.75 of height of stipe, up to 18 mm wide, descending, pending, thin, simple, often evanescent, white, not discolouring, with smooth upperside; underside fibrillose or smooth. Context up to 8 mm thick in pileus, soft, whitish, discolouring slowly and not intensely reddish in upper part of stipe when cut. Smell indistinct. Taste not known.

Macrochemical reactions: Schaeffer-reaction negative.

Spores 6.5-8.5 × 4.0-5.5 mm, on average 6.9-7.7 × 4.3-4.5 mm, Q = 1.45-1.90, Qav = 1.65-1.70, oblong, sometimes ellipsoid, without germ pore. Basidia 4-spored. Lamella edge with a c. 40 µm broad sterile layer; cheilocystidia not in chains, 14-26.5 × (9-)12-20.5 mm, globose, hyaline. Pileipellis a cutis of (5.5-)7.0-12.5 mm wide hyphae with cylindrical elements, gradually passing into pileitrama, with pale yellow to brownish parietal pigment. Stipitipellis a cutis of 4.0-7.5 mm wide hyphae with some inflated, up to 10 mm wide elements, with parietal, pale yellow pigment.

HABITAT & DISTR. – Solitary or in small groups, saprotrophic, terrestrial in coniferous (*Picea*) or deciduous woods on calcareous, humus-rich soil. Rather rare in the Netherlands; Sept.-Oct. Rare but widespread in Europe. Also known from Asia, northern Africa and South America.

The above description is also based on a collection from Belgium, supplemented with the original description by Møller.

Agaricus fuscofibrillosus is distinguished from *A. langei*, apart from the fibrillose instead of squamulose pileus and the less intense discoloration of the context, by the slightly smaller spores.

19. Agaricus benesii (Pilát) Pilát in Acta Mus. nat. Prag. 7B (1): 56. 1951. – Fig. 20.

Psalliota benesii Pilát in Mykologia 2: 49. 1925 (as *P. beneši*). – *Agaricus albosanguineus* Hotson & Stuntz in Mycologia 30: 217. 1938. – *Psalliota squamulifera* F. Møller in Friesia 4: 21. 1950; *Agaricus squamuliferus* (F. Møller) Pilát in Acta Mus. nat. Prag. 7B (1): 7. 1951. – *Agaricus caroli* Pilát in Acta Mus. nat. Prag. 7B (1): 130. 1951; *Agaricus squamuliferus* var. *caroli* (Pilát) Pilát in Pilát & Ušák, Naše Houby 2: 141. 1959 (invalid).

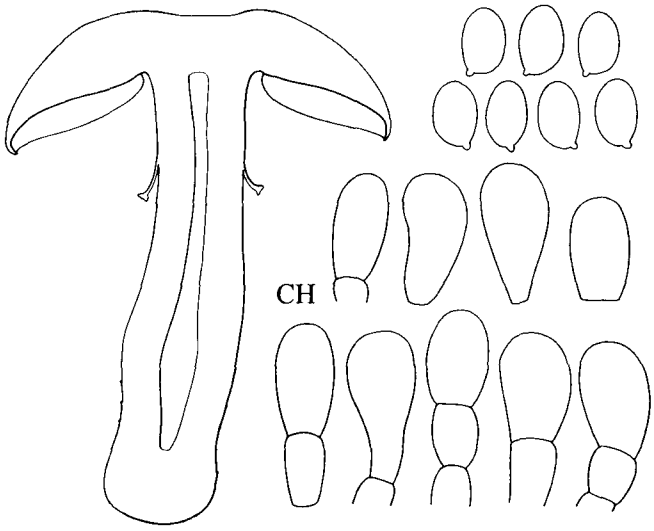

Fig. 20. *Agaricus benesii*. (habit × ½).

SEL. ICON.- Cappelli in Boll. Gruppo micol. G. Bres. 26: 17 & 25 (as *A. squamuliferus*). 1983; Cappelli, Agaricus: pl. 20, 24 & 25 (as *A. squamulifer*). 1984; Wasser in Fung. rar. Ic. col. 10: pl. 75. 1979 (as *A. squamuliferus*).

SEL. DESCR. & FIGS. – F. Møller in Friesia 4: 21-24. 1950 (as *P. squamulifera*); Pilát in Acta Mus. nat. Prag. 7B (1): 56-57. 1951; Wasser in Fung. rar. Ic. col. 10: 3-7. 1979 (as *A. squamuliferus*).

VERN. NAME – Tandringchampignon.

Pileus 45-105 mm, at first hemispherical to convex, expanding to convex or plano-convex, often with depressed centre, with margin slightly exceeding lamellae, whitish to pale greyish brown or yellowish brown (Mu. 7.5 YR 6/4, 10 YR 8/1.5), reddening on handling, intensely red when damaged, at margin often covered with small, whitish to pale greyish brown squamules, sometimes entirely squamulose, later often smooth. Lamellae, L = 130-170, l = 1-3(-9), crowded, free, segmentiform to ventricose, up to 8 mm broad, at first greyish brown to pinkish brown (2.5 YR 5/4), later dark blackish brown, with whitish denticulate edge, reddening when damaged. Stipe 60-130 × 10-27 mm, annulate, cylindrical to subbulbous, at base up to 30 mm broad, straight, fistulose, white, reddening when damaged, above annulus smooth, below annulus fibrillose-squamulose, sometimes with few pale grey-brown squames (7.5 YR 7/4). Annulus at c. 0.80 of height of stipe, 9-10 mm wide, descending, pending to slightly spreading, thick, persistent, white, with smooth upperside; underside with large, pinkish brown, recurved, teeth-like squames, radially arranged near margin as a cogwheel. Context 7-17 mm thick in pileus, hard, whitish, discolouring quickly bright red when cut in pileus and upper part of stipe, in base of stipe not changing or discolouring yellowish white. Smell indistinct to sweetish (perfume). Taste not known.

Macrochemical reactions: Schaeffer-reaction negative (all parts of basidiocarp).

Spores 5.0-7.0 × 3.0-5.0 mm, on average 5.5-6.5 × 3.5-4.5 mm, Q = 1.30-1.65(-1.85), Qav = 1.45-1.55, ellipsoid, sometimes oblong, without germ pore. Basidia 21-26 × 6.5-7.5 mm, 4-spored. Lamella edge with a 60-75 mm broad sterile layer; cheilocystidia in short chains of 2-3 rectangular elements of 9.0-12.0 × 5-6.5 mm, with clavate terminal elements of 15.5-25.5(-28.5) × 7.5-12.5 mm, often with brownish contents. Pileipellis a slightly irregular cutis of 3.5-6.5 mm wide hyphae with cylindrical, sometimes up to 14 mm inflated elements, with sometimes slightly ascending, cylindrical terminal elements, gradually passing into pileitrama, with yellowish parietal pigment. Stipitipellis a slightly gelatinized cutis of 4.0-5.5 mm wide hyphae with cylindrical elements with yellowish, parietal pigment.

HABITAT & DISTR. – Solitary or in small groups, saprotrophic, terrestrial in roadside verges under deciduous trees, in open vegetation under trees on nutrient-rich or calcareous soil. Very rare in the Netherlands (Maarsseveense plassen; Werkhoven, Laan van Beverweerd; Amsterdam, Zwaanswijk). Sept.-Oct. Rare but widespread in Europe. Also recorded from Asia, northern Africa and North America.

The above description is also based on a collection from Denmark.

The colour of the pileus varies from white to pale brown, furthermore the amount of squamules on the pileus is variable within one collection. Since this forms a continuous range *Agaricus squamuliferus* is regarded as a synonym of *A. benesii*. *Agaricus caroli* Pilát, with a brown pileus already when young, is not distinguished as a separate taxon.

20. Agaricus depauperatus (F. Møller) Pilát in Acta Mus. nat. Prag. 7B (1): 18. 1951. – Fig. 21.

Psalliota depauperata F. Møller in Friesia 4: 24. 1950. – *Agaricus deylii* Pilát in Acta Mus. nat. Prag. 7B (1): 131. 1951.

SEL. ICON.- Bohus & Babos in Fung. rar. Ic. col. 8: pl. 58. 1977 (as *A. deylii*); Cappelli, Agaricus: pl. 32. 1984; F. Møller in Friesia 4: pl. 3a. 1950.

SEL. DESCR. & FIGS. – Bohus & Babos in Fung. rar. Ic. col. 8: 3-5. 1977 (as *A. deylii*); F. Møller in Friesia 4: 24-25. 1950; Pilát in Acta Mus. nat. Prag. 7B (1): 53-56, figs. 21-23. 1951.

VERN. NAME – Vale champignon.

Pileus 50-60 mm, convex, with inflexed margin, slightly exceeding lamellae, white to pale brownish to greyish brown with pinkish hue or greyish white, not discolouring on handling, sometimes finally pale brown, entirely fibrillose-squamulose with small, appressed, concolorous squamules on paler background or with faint appressed fibrillose squames (Mu. 10 YR 6-7/2); veil often present as appendiculate fringe, later disappearing. Lamellae, L = 90-105, l = 1-5, crowded, free, subventricose, up to 6 mm broad, at first greyish, finally dark brown, with paler, denticulate edge. Stipe 40-70 × 10-14 mm, annulate, cylindrical, straight, stuffed or narrowly fistulose, white, later with faint brown to reddish brown tinge, sometimes slightly reddening on handling, above

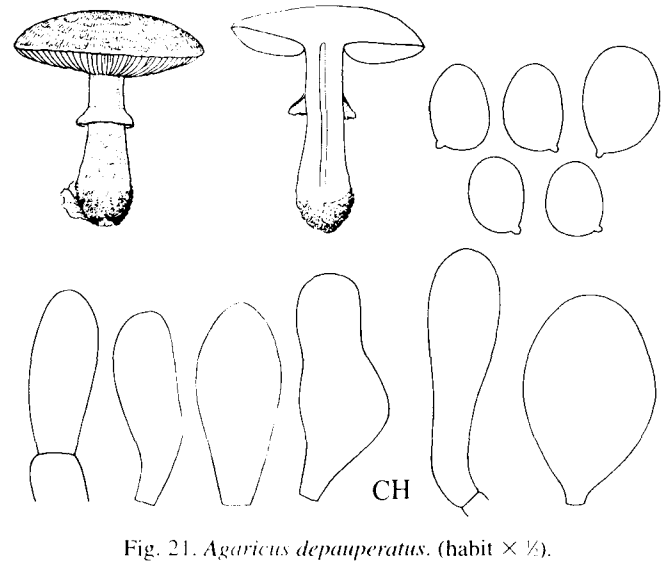

Fig. 21. *Agaricus depauperatus*. (habit × ½).

annulus smooth and later brownish, below annulus somewhat appressed fibrillose, at base with some faint girdles of white squamules, without rhizomorphs. Annulus at c. 0.75 of height of stipe, 6-8 mm wide, descending, pending, relatively thick, persistent, white, sometimes with pale brown tinge, not discolouring, with smooth upperside; underside fibrillose, near edge double and with small brownish warts or larger brownish squames. Context 7 mm thick in pileus, firm, white, discolouring slowly bright but not intense red to vinaceous red when cut in upper half of stipe; colour quickly disappearing; in base of stipe yellowish white, not discolouring. Smell indistinct. Taste not known.

Macrochemical reactions: KOH 10% pale brown (surface of base of stipe); Schaeffer-reaction negative (surface).

Spores 6.0-9.5 × 4.5-6.0 mm, on average 6.9-8.4 × 4.8-5.6 mm, Q = 1.20-2.00, Qav = 1.30-1.75, ellipsoid to oblong, without germ pore. Basidia 18-25 × 7.0-8.0 mm, 4-spored, sometimes 2-spored also present. Lamella edge with a c. 35 µm broad sterile layer; cheilocystidia usually not catenate, sometimes in short chains of 1-2 small, rectangular elements of 5.5-7.0 × 4.0-6.0 µm, with clavate to globose terminal elements of 13.5-28 × 9-17 mm. Pileipellis a cutis of rarely branched, 4.5-8.0 mm wide hyphae with cylindrical, sometimes up to 12 mm inflated elements, gradually passing into pileitrama, with pale yellow, parietal pigment. Stipitipellis a cutis of rarely branched, sometimes curved, (2.5-)4.0-7.0 mm wide hyphae with cylindrical elements, with scattered, up to 12.5 mm inflated elements, and sparse, ascending cylindrical to clavate, up to 9.0 mm wide terminal elements, with yellowish intracellular and parietal pigment.

HABITAT & DISTR. – Usually solitary, sometimes in small groups, saprotrophic, terrestrial in parks, deciduous woods, in woods of *Picea*, or in open dune grassland, usually on sandy humus-rich soil. Rare but probably often wrongly identified in the Netherlands; May, Aug.-Nov. Rare but widespread in Europe. Also known from northern Africa.

The above description is also based on collections from southern England.

According to the type descriptions, *Agaricus depauperatus* and *A. deylii* differ in the colour of the pileus, and the size of the spores. According to A.M. Brand (Leiden; pers. comment), however, who studied authentic material, the spore size is almost the same for both species. Within the collections studied the pileus colour varied from completely white to white with pale brown fibrils, reason enough to consider the species conspecific. Also, the spore size within a collection shows a considerable amount of variation.

Sect. **Arvenses** Konr. & M.

Pileus yellowish on handling, especially on drying; annulus persistent, broad, up to 35 mm wide, with remnants of universal veil as thick flocks or warts at underside; context not discolouring or discolouring slightly yellow or orange to pinkish on exposure or when damaged.

KOH-reaction on context usually positive and yellow; Schaeffer-reaction on pileus orange, rarely doubtful.

Spores ellipsoid to oblong; average spore length > 6.0 mm; Qav = 1.35-1.60; without germ pore; lamella edge sterile; cheilocystidia catenate, forming sterile layer around lamella edge (absent in some taxa not occurring in the Netherlands).

21. Agaricus arvensis Schaeff., Fung. Bavariae 4: 73. 1774. – Fig. 22.

Psalliota arvensis (Schaeff.) Kumm., Führ. Pilzk.: 74. 1871. – *Psalliota fissurata* F. Møller in Friesia 4: 165. 1952; *Agaricus fissuratus* (F. Møller) F. Møller in Friesia 4: 204. 1952. – *Psalliota leucotricha* F. Møller in Friesia 4: 159. 1952; *Agaricus leucotrichus* (F. Møller) F. Møller in Friesia 4: 204. 1952.

EXCL. – *Agaricus arvensis* sensu Cooke, Ill. Brit. Fungi 4: pl. 523. 1885 (= *Agaricus osecanus*).

SEL. ICON. – Cappelli, Agaricus: pl. 33. 1984; Dähncke, 1200 Pilze: 498. 1993; J. Lange, Fl. agar. dan. 4: pl. 138A. 1939; R. Phillips, Paddest. Schimm.: 166. 1981.

SEL. DESCR. & FIGS. – F. Møller in Friesia 4: 161-165, fig. 26, pl. 30; 165-167, pl. 19b (as *P. fissurata*); 159-161, pl. 18a (as *P. leucotricha*). 1952; Wasser, Tr. Agariceae Soviet Union: 85-86. 1989.

VERN. NAME – Gewone anijschampignon.

Pileus (30-)60-105(-150) mm, at first hemispherical to convex, expanding to plano-convex or applanate, with at first involute, later deflexed, sometimes recurved margin, exceeding lamellae, at first white to whitish, soon yellowish to brownish in centre (Mu. 10 YR 8/3-4, 8/6), discolouring yellow on handling, sometimes entirely yellow or yellowish brown (2.5 Y 8/4, 8/6, 10 YR 8/4), minutely fibrillose at first, later smooth, often with appressed concolorous squames near margin, occasionally entirely squamulose or radially fibrillose, later sometimes radially fissurate; veil present when young as appendiculate white floccose remnants. Lamellae, L = 95-185, l = 1-3(-7), very crowded, free, subventricose, up to 14 mm broad, at first whitish to pale pink (7.5 YR 8/4), later greyish pink to reddish brown or brown (5 YR 4/3, 6/2-3, 10 YR 4-5/3) to dark brown, with usually paler,

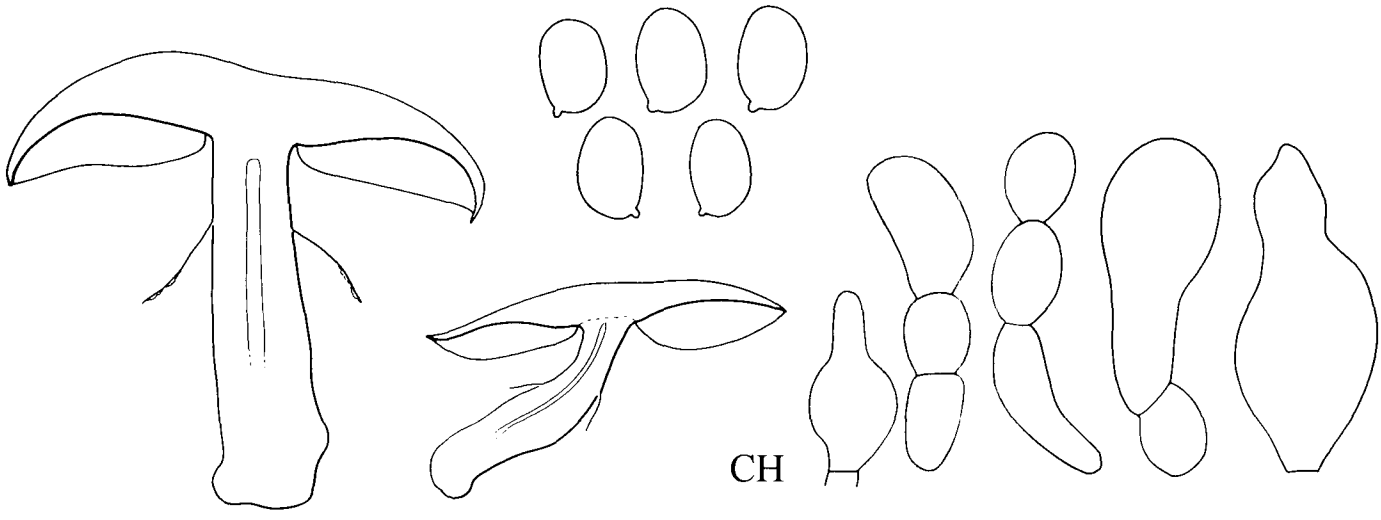

Fig. 22. *Agaricus arvensis*. (habit × ½).

entire, sometimes serrulate, edge. Stipe 55-120 × (8-)10-22 mm, annulate, cylindrical to attenuated towards apex, occasionally subclavate to subbulbous and then at base up to 34 mm broad, often bent or slightly flexuous, narrowly fistulose, white, yellowing below annulus on handling, above annulus glabrous, smooth, often shiny, below annulus smooth to fibrillose or, especially towards base, velutinous to squamulose. Annulus at 0.70-0.80 of height of stipe, (7-)13-25 mm wide, descending, pending to sometimes spreading, thick, cream-coloured, with smooth to fibrillose upperside; underside when young with thick stellate-wise arranged squames (as cogwheel), later with pale reddish yellow to brownish floccose patches or warts. Context 6-15 mm thick in pileus, soft, white, sometimes yellowing in stipe when cut. Smell like anise, but sometimes faintly, or like (sweet) almonds. Taste not known.

Macrochemical reactions: KOH 10% strongly chrome-yellow (surface of pileus and stipe, upperside annulus) or negative to faintly yellow (context); Schaeffer-reaction orange-red (surface of pileus) to faintly orange (surface of stipe).

Spores 7.0-9.0(-9.5) × 5.0-6.0(-6.5) mm, on average 7.9-8.6 × 5.3-5.9 mm, Q = 1.30-1.65, Qav = 1.40-1.55, sometimes aberrant spores present, ellipsoid, without germ pore. Basidia 15-20 × 9.0-11 mm, 4-spored, rarely also 2-spored basidia present. Lamella edge with a 60-110 mm broad, sterile layer; cheilocystidia in chains of globose elements of (8.5-)11-20 × 6.5-18 mm, with clavate to sometimes lageniform or utriform terminal elements of (14-)20-36(-42) × 8.5-12(-18) mm, with 4.0-9.0 mm wide obtuse apex, hyaline or with pale brown contents. Pileipellis a cutis of sometimes slightly gelatinized, 4.0-8.0 mm wide hyphae with cylindrical elements, gradually passing into pileitrama, with pale yellow, intracellular pigment. Stipitipellis a cutis of sometimes gelatinized, 4.0-8.0 mm wide hyphae with often slightly inflated elements, with very pale yellow intracellular pigment.

HABITAT & DISTR. – Solitary or in groups, saprotrophic, terrestrial in meadows, roadside verges, city parks, woods on various soils. Common and widespread in the Netherlands. June-Nov. Common and widespread in Europe. Cosmopolitan.

Agaricus fissuratus is considered an ecological modification of, and therefore conspecific with, *A. arvensis*. Several intermediates were found between *A. leucotrichus* and *A. arvensis*, which is therefore also considered conspecific. For an extensive discussion see Nauta (in Persoonia 17: 458-459. ('2000') 2001).

Agaricus arvensis var. *macrolepis* Pilát & Pouz. (in Acta Mus. nat. Prag. 7B (1): 134. 1951; as *Agaricus macrolepsis*) differs from var. *arvensis* in the coarsely squamose surface of the pileus, abruptly bulbous stipe, which is floccose-squamose below the annulus, and the larger spores. This taxon has not yet been found in the Netherlands. The taxonomical status of this variety needs reconsideration.

22. Agaricus augustus Fr., Epicrisis: 212. 1838. – Fig. 23.

Psalliota augusta (Fr.) Quél. in Mém. Soc. Émul. Montbéliard sér. II, 5: 255. 1872 (Champ. Jura Vosges 1); *Pratella augusta* (Fr.) Gillet, Hyménomycètes: 561. 1878. – *Agaricus perrarus* S. Schulz. in Verh. zool. bot. Ges. Wien 29: 493. 1880; *Psalliota perrara* (S. Schulz.) Bres., Fungi trident. 1: 82. 1887; *Agaricus augustus* var. *perrarus* (S. Schulz.) Bon & Cappelli in Doc. mycol. 13(52): 16. 1983. – *Agaricus peronatus* Mass., Brit. Fungus Fl. 1: 415. 1892, non *Psalliota peronata* Richon & Roze 1885.

MISAPPL. – *Psalliota subrufescens* sensu J. Lange, Fl. agar. dan. 4: 55. 1939.

SEL. ICON. – Cappelli, Agaricus: pl. 49, 50 (as *A. augustus* var. *perrarus*). 1984; Konr. & M., Ic. sel. Fung. 1: pl. 27. 1925; J. Lange, Fl. agar. dan. 4: pl. 135B, pl. 136B (as *P. subrufescens*). 1939; R. Phillips, Paddest. Schimm.: 164. 1981.

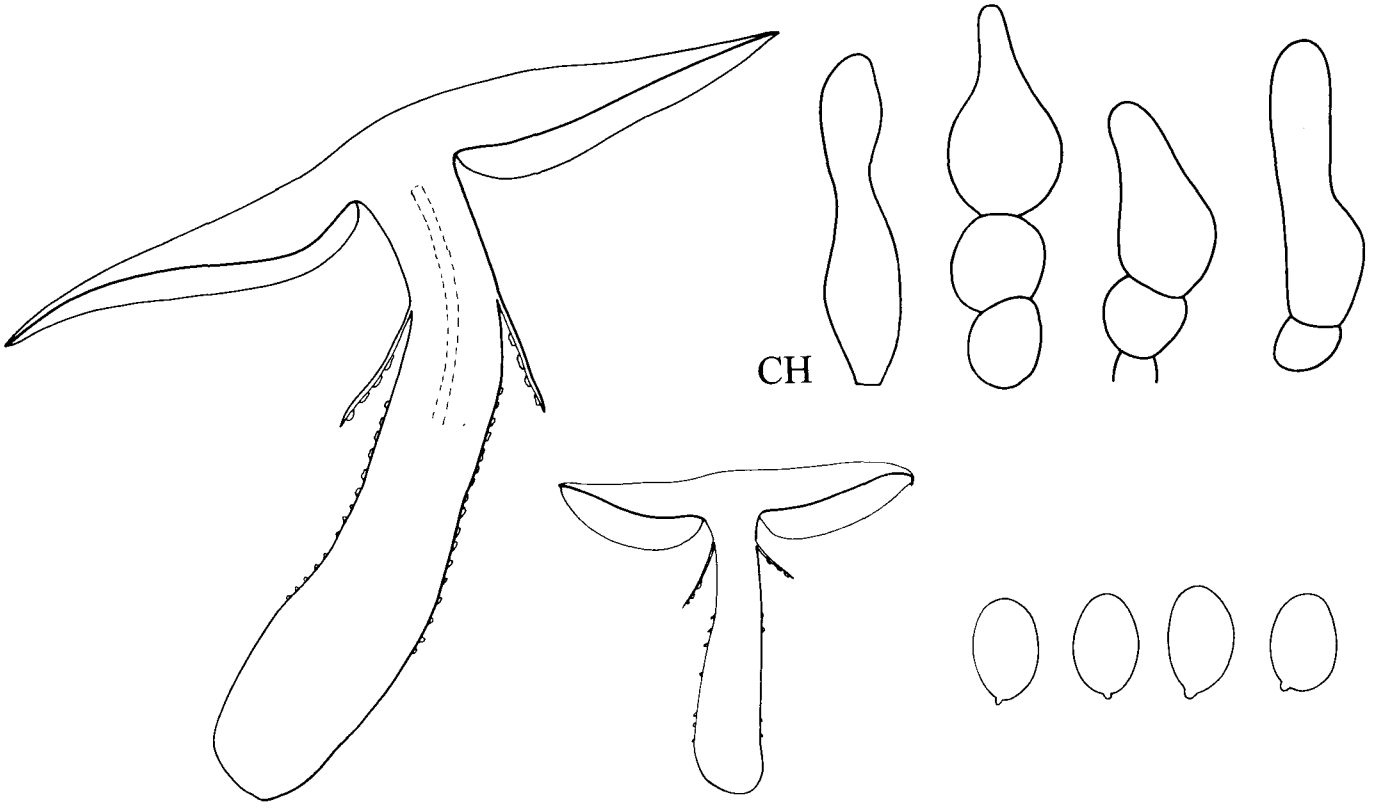

Fig. 23. *Agaricus augustus*. (habit × ½).

SEL. DESCR. & FIGS. – Heinem. in Bull. trimest. Soc. mycol. Fr. 81: 396-397. 1965; F. Møller in Friesia 4: 138-145, fig. 20, pl. 22-25. 1952; Wasser, Tr. Agariceae Soviet Union: 61-63. 1989.

VERN. NAME – Reuzenchampignon.

Pileus (70-)90-220 mm, at first hemispherical, soon expanding to plano-convex, often with depressed centre, rarely subumbonate, with straight margin, densely covered with pointed, mostly appressed, ochre to reddish brown fibrillose squames (Mu. 5 YR 4/4, 7.5 YR 4-5/6, 4-5/4, 10 YR 8/6) on a yellowish white to pale ochraceous yellow or light brown (7.5 YR 7/6, 10 YR 8/6) background, at centre densely squamose and ochraceous yellow to dark reddish brown (5 YR 4/4, 7.5 YR 3/2-3, 10 YR 7/6), more intensely yellow on handling; veil present as whitish appendiculate remnants at margin. Lamellae, L = 140-150, l = 0-1, crowded, free, subventricose, up to 9 mm broad, at first pale greyish cream to flesh-coloured (2.5 Y 8/2, 7.5 YR 6/4), finally dark brown, with entire, whitish to rarely pale sulphur-yellow edge. Stipe 90-140(-175) × (12-)18-26 mm, annulate, subclavate to clavate, at base up to 35 mm broad, straight to curved, fistulose, whitish to pale ochraceous yellow-brown, above annulus glabrous and smooth, below annulus usually densely squamose to floccose with white to yellow recurving squames; towards base squames sometimes with reddish brown tips; often deeply rooting. Annulus at 0.80-0.85 of height of stipe, 17-30(-41) mm wide, descending, pending, thin, easily torn, white, often discolouring yellow on handling, with upperside finely subfloccose to striate; underside with thick ochraceous to brownish floccose warts. Context 10-17 mm thick in pileus, whitish, discolouring yellow or light orange-brown when cut or bruised, in base of stipe sometimes pinkish brown. Smell varying from strongly nutty to faintly or strongly like anise, sometimes like almonds, later unpleasantly sweetish. Taste not known.

Macrochemical reactions: KOH 10% yellow (surface of pileus; also on context according to Møller & Schaeff. in Annls mycol. 36: 79. 1938), brownish orange (context in base of stipe); Schaeffer-reaction usually orange-red, rarely negative (surface of pileus).

Spores 7.5-9.5(-10.0) × 5.5-6.5(-7.0) mm, on average 8.2-8.8(-9.0) × 5.5-5.8 µm, Q = (1.25-)1.30-1.65(-1.70), Qav = 1.40-1.55, ellipsoid to sometimes amygdaliform, without germ pore. Basidia 17-25 × 6.5-8.5 mm, 4-spored. Lamella edge with a 50-70 mm broad, sterile layer; cheilocystidia clustered and protuberant, in chains of mostly subglobose elements of (11-)15-17(-22) × 5.5-11(-16) mm, with subglobose to often irregularly broadly cylindrical, utriform to almost lecythiform terminal elements of (10-)15-22(-35) × (5.5-)6.5-10(-16) mm, with at first hyaline, later yellow to brownish contents. Pileipellis a slightly gelatinized cutis of cylindrical, 4.5-6.5 mm wide hyphae, with pale yellow intracellular pigment, gradually passing into pileitrama. Squames consisting of interwoven, sometimes agglutinated, (3.5-)4.5-11 mm wide hyphae with 25-47 mm long, slightly inflated elements and ascending, mostly clavate, up to 15 mm wide, terminal elements, with intracellular yellowish brown pigment. Stipitipellis a cutis of sometimes branched, 5.5-12 mm wide hyphae of cylindrical, slightly inflated elements. Squames on stipe consisting of interwoven, often curved, 5.5-11 mm wide hyphae with up to 40 µm long inflated elements, with often clavate to subglobose, up to 17 µm wide terminal elements.

HABITAT & DISTR. – Solitary to gregarious, saprotrophic, terrestrial, mostly in deciduous woods or in roadside verges under deciduous trees, also in coniferous woods, on sandy to clayey humus rich soil; rather common in the Netherlands, rare in the Pleistocene regions. Aug.-Sept. Widespread in Europe, cosmopolitan.

Agaricus perrarus S. Schulz. is considered conspecific. For an extensive discussion see Nauta (in Persoonia 17: 459. ('2000') 2001). The very pale-coloured variant which was provisionally named by Moser var. *albus* nom. prov. (Röhrlinge Blätterpilze, 3. Aufl.: 191. 1967) is probably not of taxonomical importance.

23. Agaricus osecanus Pilát in Acta Mus. nat. Prag. 7B (1): 133. 1951.

Psalliota nivescens F. Møller in Friesia 4: 155. 1952; *Agaricus nivescens* (F. Møller) F. Møller in Friesia 4: 204. 1952. – *Psalliota nivescens* var. *parkensis* F. Møller in Friesia 4: 158. 1952; *Agaricus nivescens* var. *parkensis* (F. Møller) F. Møller in Friesia 4: 204. 1952.

MISAPPL. – *Agaricus arvensis* sensu Cooke, Ill. Brit. Fungi 4: pl. 523. 1885.

SEL. ICON. – Cappelli, Agaricus: pl. 35. 1984 (as *A. nivescens*); Cooke, Ill. Brit. Fungi 4: pl. 523. 1885 (as *A. arvensis*); Essette, Psalliotes: pl. 35. 1964 (as *P. nivescens*).

SEL. DESCR. & FIGS. – F. Møller in Friesia 4: 155-158, Fig. 24, pl. 18b, 19. 1952 (as *P. nivescens*); Pilát in Acta Mus. nat. Prag. 7B (1): 81-83, Figs. 41-42. 1951; Wasser, Tr. Agariceae Soviet Union: 79-80 (as *A. nivescens*), 86-87. 1989.

VERN. NAME – Sneeuwwitte anijschampignon.

KEY TO THE VARIETIES

1. Stipe below annulus smooth to longitudinally striate, only near base with scattered squames ..... **23a. var. osecanus**
1. Stipe below annulus floccose-squarrose .... **23b. var. squarrosipes**

23a. var. **osecanus.** – Fig. 24a

Pileus (40-)80-175(-190) mm, at first obtusely broadly conical to hemispherical, expanding to convex or plano-convex, sometimes irregularly shaped, with inflexed, rarely reflexed margin, white, slightly and slowly yellowing on handling, finally yellowish (K. & W. 2A4) to light yellow-brown (Mu. 10 YR 6/4), at centre yellow (10 YR 8/6), usually entirely minutely fibrillose-squamulose at first, later usually smooth and silky at centre, floccose-squamose at margin, sometimes remaining entirely but minutely fibrillose-squamulose, rarely fissurate; veil usually present when young as appendiculate, thick denticles, later disappearing or rarely present as short fringe. Lamellae, L = 95-120(-190), l = 1-4(-7), crowded, rarely partly anastomosing, free, subventricose, up to 13 mm broad, at first very pale brown (10 YR 8/2-7/3), later pinkish grey to reddish brown (7.5 YR 7/4, 5/2; 5 YR 5/3, 8/4), finally dark brown, with entire, sometimes slightly paler edge. Stipe (65-)80-120(-155) × (9-)15-28 mm, annulate, cylindrical to gradually enlarged downwards, sometimes tapering downwards, rarely subbulbous and then at base 21-24 mm wide, straight to curved, solid to narrowly fistulose, white, yellow to pale brown near base and on handling, above annulus glabrous, smooth, silky striate to shiny, below annulus at first often minutely lanate to squamulose, later smooth to finely longitudinally striate or fibrillose, near base occasionally fibrillose-squamulose; squames sometimes brown and arranged in girdles; sometimes with rhizomorphs. Annulus at (0.50-)0.70-0.80 of height of stipe, 18-33 mm wide, descending, pending to slightly spreading, thick, persistent, white, sometimes discolouring yellow on handling, with smooth upperside; underside with thick creamy buff to reddish yellow squames, usually arranged as a cogwheel along margin. Context (6.5-)10-16 mm thick in pileus, soft, white, hardly discolouring when cut, rarely with slightly yellowish patches, in base of stipe occasionally slowly ochraceous-brownish to sordid pinkish brown. Smell nutty, sometimes like almonds, at first pleasant, of cut basidiocarps more intense, finally unpleasant. Taste faintly to strongly nutty, pleasant.

Macrochemical reactions: KOH 10% yellow (surface of pileus and stipe), yellow to faintly yellow (context); Schaeffer-reaction orange-red (surface of pileus).

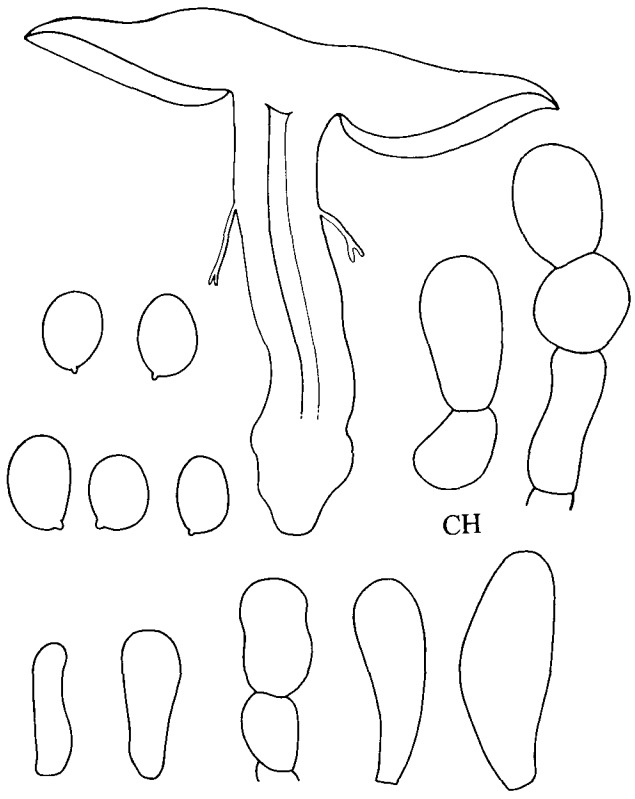

Fig. 24a. *Agaricus osecanus* var. *osecanus*. (habit × ½).

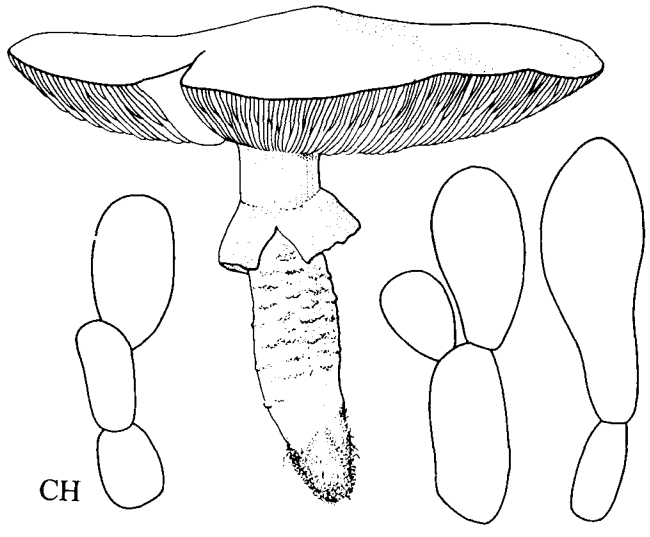

Fig. 24b. *Agaricus osecanus* var. *squarrosipes*. (habit × ½).

Spores (6.0-)6.5-8.0(-9.0) × 4.5-5.5(-6.0) mm, on average (6.5-)6.8-7.5 × 4.8-5.3(-5.5) mm, Q = (1.20-)1.25-1.50(-1.65), Qav = 1.35-1.45, ellipsoid, without germ pore, often also aberrant spores present, differing in size and/or shape. Basidia 16-21 × 7.0-8.0 mm, 4-spored, rarely partly 2-spored. Lamella edge with a 35-60(-100) mm broad, sterile layer; cheilocystidia in sometimes agglutinated chains of globose to clavate elements of 6.0-15 × (4.0-)6.0-10 mm, with clavate to cylindrical or narrowly utriform terminal elements of 15-31 × (5.5-)6.5-12 mm, mostly with yellowish brown contents. Pileipellis a cutis of 4.5-10(-12) mm wide hyphae with cylindrical, sometimes slightly inflated elements, with very pale intracellular pigment, with scattered slightly ascending, cylindrical to subclavate terminal elements; gradually passing into pileitrama. Stipitipellis a cutis of sometimes irregular, 5.5-14.5 mm wide hyphae with often inflated elements, with pale intracellular yellow pigment.

HABITAT & DISTR. – Solitary to gregarious, saprotrophic, terrestrial in grasslands, lawns, city parks, along avenues and, more rarely, in woods, on relatively nutrient-rich soil, often on clay. Rather rare, but may have been confused in the past with *Agaricus arvensis*. Probably widespread in the Netherlands. Jun.-Nov. Rather common and widespread in Europe, also in the Mediterranean area. Also known from Asia.

Agaricus nivescens and *A. osecanus* are considered conspecific, for an extensive discussion see Nauta (in Persoonia 17: 460. ('2000') 2001).

23b. var. **squarrosipes** (Bon & Collin) Nauta in Persoonia 17: 460. ('2000') 2001. – Fig. 24b.

Agaricus nivescens var. *squarrosipes* Bon & Collin in Doc. mycol. 17(67): 11. 1987

SEL. DESCR. & FIGS. – Collin in Bull. trimest. Soc. mycol. Fr. 109, Atlas: pl. 272. 1993 (as *A. nivescens* var. *squarrosipes*); Grilli in Micol. Veget. medit. 9: 3-8. 1994 (as *A. nivescens* var. *squarrosipes*).

CHARACTERISTICS – Differing from the typical variety in the covering of the stipe which is clearly, white-squarrose below the annulus.

Microscopical characters as in typical variety.

HABITAT & DISTR. – Solitary, saprotrophic, terrestrial, occurring in the same kind of habitats as var. *osecanus*, on relatively nutrient-rich soil. Very rare in the Netherlands (Bergen; Utrecht; Willemstad); May, Aug.-Sept. Reported from garden in France, also recorded from Italy.

24. Agaricus pseudoumbrella Bohus in Mikol. Közlem. 34: 26. 1995. – Fig. 25.

Agaricus arvensis var. *umbrelloideus* Bohus in Annls hist.-nat. Mus. natn. hung. 66: 82. 1974.

SEL. DESCR. & FIGS.– Bohus in Mikol. Közlem. 34: 26. 1995.

Pileus 65-95 mm, regularly convex, white, slowly yellowing on handling, at first entirely finely fibrillose-floccose to squamulose, later only at margin; veil present as appendiculate white remnants. Lamellae pinkish brown to greyish with pink tinge. Stipe 50-80 × 8-18 mm, annulate, clavate or with a round bulb, at base (13-)20-26 mm, white, sometimes yellowing, above annulus smooth, below annulus finely fibrillose to striate, sometimes at base squamulose. Annulus at 0.60-0.75 of height of stipe, 10-22 mm wide, descending, pending, thick and persistent, with smooth upperside; underside with large brownish squames arranged as a cogwheel. Context white, hardly discolouring, becoming faintly yellowish to orange in base of stipe. Smell faintly like anise, sweetish. Taste not known.

Macrochemical reactions: Schaeffer-reaction orange (surface of pileus).

Spores 6.0-8.0 × 4.5-5.5 mm, on average 6.5-7.2 × 4.5-5.0 mm, Q = 1.30-1.70, Qav = 1.40-1.55, ellipsoid, sometimes oblong, without germ pore. Lamella edge with c. 60 µm broad sterile layer; cheilocystidia catenate, in chains of cylindrical to globose elements of 10-19 × 7.5-8.5 µm, with globose to clavate or cylindrical, sometimes utriform terminal elements of (12-)15-28 × 8.5-11 mm. Pileipellis a slightly gelatinized cutis of 3.5-7.5 mm wide hyphae with cylindrical elements, with pale yellow intracellular pigment, gradually passing into pileitrama. Stipitipellis a cutis of rarely branched, 3.0-8.0 µm wide hyphae with cylindrical elements, with pale yellow intracellular and parietal pigment.

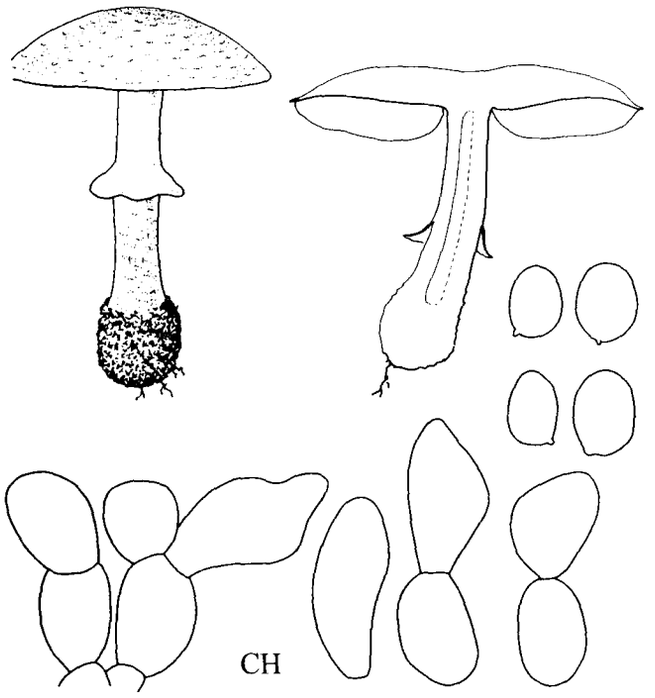

Fig. 25. *Agaricus pseudoumbrella*. (habit × ½).

HABITAT & DISTR. – Solitary or in small groups, saprotrophic, terrestrial in deciduous or coniferous woods or in verges of woods on calcareous soil. Very rare in the Netherlands, only found in southern Limburg (Bunderbos; Cadier & Keer, Riesenberg; Wijlre). Sept.-Oct. Originally described from *Robinia*-woods. Rare in Europe, but probably widespread in southern and eastern Europe.

The macroscopical notes of the Dutch collections studied are incomplete, therefore no extensive macroscopical description can be given.

This species can be mistaken for *A. sylvicola*. *Agaricus pseudoumbrella* is more slowly yellowing on handling, has an entirely fibrillose-floccose to squamulose pileus when young, slightly larger spores, and cheilocystidia of a more irregular form.

25. Agaricus sylvicola (Vitt.) Peck in Ann. Rep. N. Y. State Bot. 23: 97. 1872. (as *A. silvicola*). – Fig. 26.

Agaricus campestris var. *sylvicola* Vitt., Descr. Funghi mang. Italia: 213. 1832; *Psalliota sylvicola* (Vitt.) Richon & Roze, Atl. Champ. comest. vénéneux: pl. 7, figs. 13-16. 1885. – *Pratella flavescens* Gillet, Hyménomycètes: 564. 1878; *Agaricus flavescens* (Gillet) Britz. in Ber. naturh. Ver. Augsburg 27: 168. 1883, non *A. flavescens* Wallr. 1833. – *Agaricus essettei* M. Bon in Doc. mycol. 13(49): 56. 1983.

MISAPPL. – *Agaricus abruptibulbus* sensu F. Møller in Friesia 4: 151 1952; sensu Heinem. in Sydowia 30: 21. ('1977') 1978.

VERN. NAME – Slanke anijschampignon.

KEY TO THE VARIETIES

1. Stipe below annulus fibrillose, towards base sometimes minutely squamulose ..... 25a. var. **sylvicola**
1. Stipe below annulus strikingly squarrose ... 25b. var. **squarrosus**

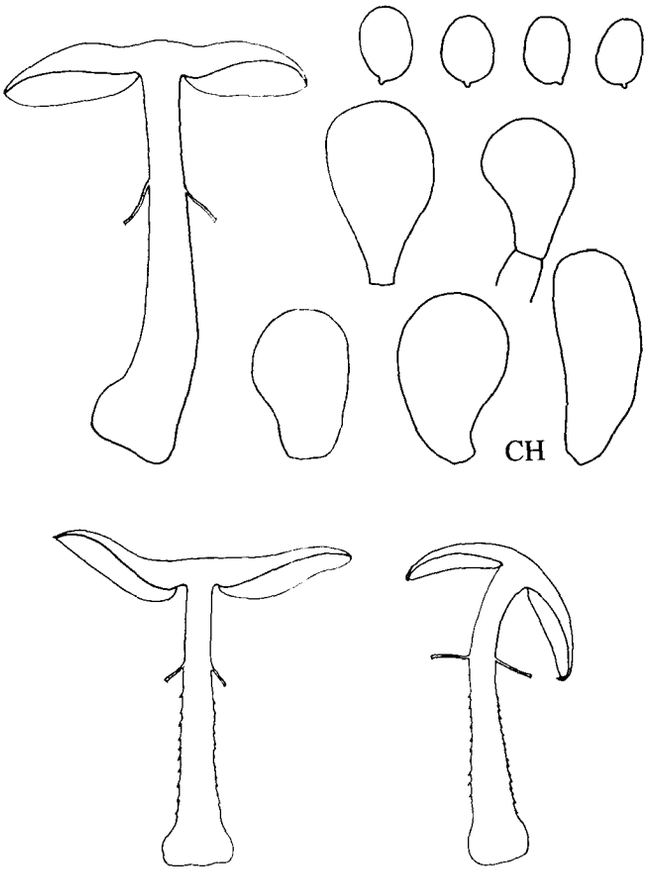

Fig. 26. *Agaricus sylvicola* var. *sylvicola* and var. *squarrosus* (lower figs.) (habit × ½).

25a. var. **sylvicola**

SEL. ICON. – Cappelli, Agaricus: pl. 42. 1984; R. Phillips. Paddest. Schimm.: 168. 1981; Dähncke. 1200 Pilze: 496, 497 (as *A. essettei*). 1993; J. Lange, Fl. agar. dan. 4: pl. 138B. 1939.

SEL. DESCR. & FIGS. – F. Møller in Friesia: 146-148, fig. 21, pl. 26; 151-153, fig. 23, pl. 27 (as *P. abruptibulba*). 1952; Wasser, Tr. Agariceae Soviet Union: 73-74. 1989.

Pileus (55-)70-110 mm, at first hemispherical, later expanding to plano-convex or applanate with often low umbo, sometimes with depressed centre with low umbo, with straight margin, exceeding lamellae, at first white, usually very soon yellow (K. & W. 2A3, 3A3; Mu. 1.5 Y 8/6), soon discolouring yellowish to, especially in centre, brownish on handling, later with yellowish brown spots on damaging, usually smooth or minutely fibrillose towards margin, sometimes radially fibrillose or, especially when young, minutely appressed to sometimes patently squamulose to fibrillose-squamulose, later sometimes areolate-rimose; veil present when young as appendiculate white floccules at margin, later disappearing. Lamellae, L = 80-120, l = 1-9, crowded, sometimes furcate, free, young segmentiform, later subventricose, up to 11 mm broad, at first white to pale grey, later greyish pink (K. & W. 6C2, 6D4) to pale brown to finally greyish dark brown, with whitish, eroded edge. Stipe (45-)70-100(-135) × 7-13(-15) mm, annulate, usually abruptly bulbous or marginately bulbous with flattened underside, sometimes only slightly enlarged at base or subbulbous, at base (12-)15-25 mm broad, often slightly bent, fistulose, at first white to greenish yellow above annulus, finally slightly

brownish, below annulus white, soon discolouring yellow to orange-yellow on handling, later brownish yellow, above annulus glabrous, smooth, sometimes silky striate, below annulus often fibrillose to velutinous or sometimes lanate, towards base often minutely white-squamulose to minutely squarrose, sometimes arranged in girdles, rarely with a thick white fibrillose to velutinous sock, rarely with white or yellowish basal tomentum, often with short, whitish rhizomorphs. Annulus at (0.40-)0.65-0.75 of height of stipe, 9-15(-20) mm wide, descending, patent or pending, thin, easily torn, white, with smooth to fibrillose upperside which is sometimes discolouring yellow; underside white-squamulose, with c. 13 squames, to lanate-floccose; squames sometimes patent and arranged as cogwheel some distance from margin. Context 7-9 mm thick in pileus, white, hardly discolouring, sometimes faintly yellowing in base of stipe when cut. Smell when fresh strongly like anise, later faint and only slightly like anise. Taste not known.

Macrochemical reactions: KOH 10% yellow (surface of pileus, surface of stipe), negative to yellow (context); Schaeffer-reaction strongly orange (surface of pileus, surface of stipe).

Spores 5.5-7.5(-8.0) × 3.5-5.0 mm, on average 6.0-6.7 × 4.1-4.7 mm, Q = 1.25-2.00, Qav = 1.35-1.60, ellipsoid to oblong, rarely broadly ellipsoid, dark brown, without germ pore. Basidia 17-21 × 6.5-7.0 mm, 4-spored. Lamella edge with a 50-60 mm broad sterile layer; cheilocystidia in short chains of globose to cylindrical elements of (8.5-)11-14(-20) × 8.5-12 mm, with predominantly globose or broadly clavate terminal elements of (8.5-)14-26 × (5.5-)10-20 mm, usually with yellow contents. Pileipellis a cutis of 3.5-7.0 mm wide, sometimes furcate hyphae with cylindrical elements, with pale yellow intracellular pigment gradually passing into pileitrama. Stipitipellis a cutis of 4.5-10 mm wide hyphae with cylindrical, sometimes slightly inflated elements, and ascending cylindrical terminal elements. Squames consisting of interwoven, 4.5-11 mm wide hyphae with slightly inflated elements of 17-37 mm long, with clavate to sometimes irregularly shaped terminal elements of 21-44 × 8.0-14 mm.

HABITAT & DISTR. – Solitary or gregarious, saprotrophic, terrestrial in coniferous and deciduous woods on nutrient-rich or calcareous soil. Rather rare but widespread in the Netherlands, Sept.-Oct. Common and widespread in Europe. Cosmopolitan.

Agaricus essettei is often regarded as a separate species, differing from *A. sylvicola* in the stipe with a more abrupt, marginate bulb and slightly larger spores. Since all intermediate variants can be found *A. essettei* is considered conspecific with *A. sylvicola*.

25b. var. **squarrosus** Nauta in Persoonia 17: 461. ('2000') 2001.

CHARACTERISTICS – Differing from the typical variety in the distinctly squarrose stipe below the annulus.

Microscopical characters as in typical variety.

HABITAT & DISTR. – In deciduous and coniferous woods on nutrient-rich soil. Very rare in the Netherlands (Bloemendaal; Noordoostpolder, Kuinderbos; Nijmegen, estate Oosterhout), but probably more widespread. Aug.-Oct. Not yet recorded outside the Netherlands.

26. Agaricus macrocarpus (F. Møller) F. Møller in Friesia 4: 204. 1952. – Fig. 27.

Psalliota macrocarpa F. Møller in Friesia 4: 153. 1952.

SEL. ICON. – Breitenb. & Kränzl., Pilze Schweiz 4: pl. 182. 1995; Cappelli, Agaricus: pl. 45. 1984.

SEL. DESCR. & FIGS.– F. Møller in Friesia 4: 153-155, pl. 28. 1952; Wasser, Tr. Agariceae Soviet Union: 74-75. 1989.

VERN. NAME – Forse anijschampignon.

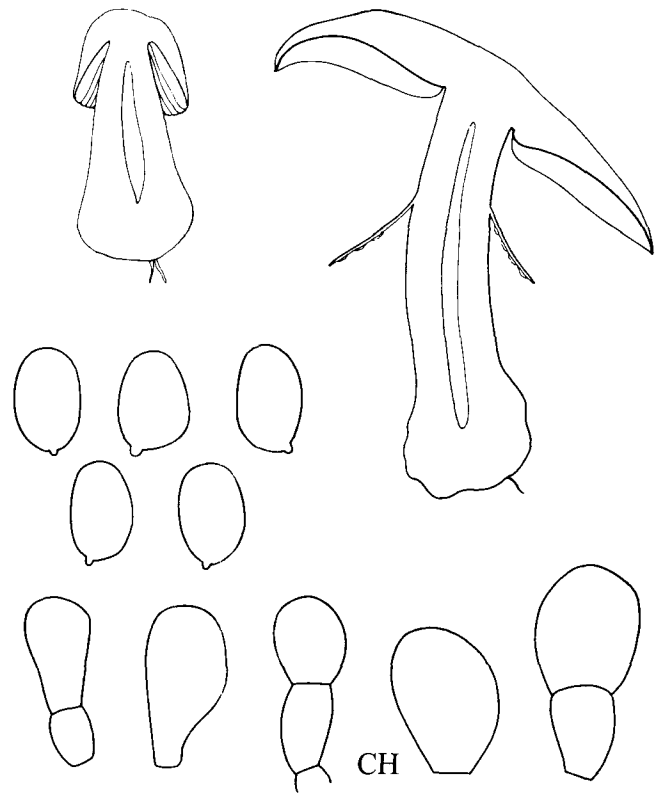

Fig. 27. *Agaricus macrocarpus*. (habit × ½).

Pileus 120-170 mm, at first paraboloid to hemispherical, expanding to convex or plano-convex, with inflexed margin exceeding lamellae, white, usually gradually but intensely yellowing on handling, finally yellow (Mu. 10 YR 8/5) to yellowish white, sometimes with brownish spots where touched, young radially fibrillose to silky, later smooth, fibrillose or fibrillose-squamulose to flocculose near margin; partial veil present when young as white appendiculate teeth, later as irregular fringe; universal veil when young present as white patches on surface near margin, later disappearing. Lamellae, L = 110-122, l = 1-2(-5), crowded, free, segmentiform to subventricose, up to 11 mm broad, at first pale grey, later pale greyish pink (K. & W. 7C2, 7D2-3) to pinkish brown, with entire, white edge. Stipe 100-200 × (15-)20-30 mm, annulate, cylindrical to subclavate, usually abruptly bulbous with flattened underside, at base up to 45 mm broad, straight, fistulose, at first white, later downwards yellowing to yellowish brown or orange on handling, above annulus smooth, below annulus when young usually entirely floccose-squamulose, later with smooth zone, below that minutely squamulose and near base white-lanate to white-fibrillose, sometimes with some short rhizomorphs. Annulus at 0.70-0.80 of height of stipe, 20-25 mm wide, descending, pending to slightly patent, thick, persistent, white, with smooth upperside; underside usually with many thick, cream to coloured ochraceous, fibrillose squames, sometimes arranged as a cogwheel. Context 9-13 mm thick in pileus, white, hardly discolouring when cut, sometimes reddish brown or faintly yellowing in base of stipe. Smell strongly to faintly like anise, sometimes unpleasant. Taste not known.

Macrochemical reactions: Schaeffer-reaction orange (surface of pileus).

Spores (6.5-)7.0-9.0(-9.5) × 5.0-6.5 mm, on average 7.7-8.4 × 5.4-5.8 mm, Q = 1.30-1.65, Qav = 1.40-1.45, ellipsoid, without germ pore. Basidia 16-23 × 6.5-8.5 mm, usually 4-spored, often partly 2-spored, rarely for the greater part 2-spored. Lamella edge with a 50-60

mm broad, mainly sterile layer of slightly agglutinated elements; cheilocystidia usually in short chains of subglobose to cylindrical elements of (5.0-)8.5-16(-20) × (4.0-)6.0-12(-15) mm, with mostly globose, to cylindrical terminal elements of 14-25 × (8.0-)9.0-16.5 mm, mostly with brown contents. Pileipellis a slightly gelatinized cutis of 3.5-8.5 mm wide hyphae with cylindrical to inflated elements up to 13 mm wide, with scattered ascending cylindrical to clavate terminal elements up to 10 mm, gradually passing into pileitrama, with pale yellow parietal pigment. Stipitipellis a slightly gelatinized cutis of sometimes branched, 3.5-8.0(-13) mm wide hyphae with cylindrical elements and scattered ascending clavate terminal elements up to 25 mm wide. Squames consisting of interwoven, curved 8.0-10.0 mm wide hyphae with up to 18 mm wide terminal elements, with yellow parietal pigment.

HABITAT & DISTR. – Solitary or gregarious, saprotrophic, terrestrial in coniferous woods on nutrient-rich, calcareous soil. Rather rare, mainly in the new polders. Aug.-Oct. Rare but widespread in Europe, also occurring in Asia (former Soviet Union).

27. Agaricus urinascens (Møller & Schaeff.) Sing. in Lilloa 22: 431. ('1949') 1951. – Fig. 28.

Psalliota urinascens Møller & Schaeff. in Annls mycol. 36: 79. 1938. – *Psalliota arvensis* subsp. *macrospora* Møller & Schaeff. in Annls mycol. 36: 78. 1938; *Agaricus macrosporus* (Møller & Schaeff.) Pilát in Acta Mus. nat. Prag. 7B (1): 78. 1951, non *A. macrosporus* Mont. 1837; *Psalliota macrospora* (Møller & Schaeff.) F. Møller in Friesia 4: 181. 1952; *Agaricus albertii* M. Bon in Doc. mycol. 18(72): 63. 1988. – *Psalliota straminea* Møller & Schaeff. in Annls mycol. 36: 78. 1938; *Agaricus stramineus* (Møller & Schaeff.) Sing. in Lilloa 22: 432. ('1949') 1951, non *A. stramineus* Scop. 1772; *Agaricus macrosporus* var. *stramineus* (Møller & Schaeff.) M. Bon in Doc. mycol. 15(60): 25. 1985; *Agaricus substramineus* Courtecuisse in Doc. mycol. 16(61): 49. 1985; *Agaricus stramineosquamulosus* Rauschert in Nova Hedwigia 54: 215. 1992 (superfluous).– *Psalliota collina* Velen., Novit. mycol. nov.: 82. 1947. –*Psalliota excellens* F. Møller in Friesia 4: 178. 1952; *Agaricus excellens* (F. Møller) F. Møller in Friesia 4: 204. 1952; *Agaricus macrosporus* subsp. *excellens* (F. Møller) Bohus in Annls hist.-nat. Mus. natn. hung. 70: 105. 1978, non *A. stramineus* Scop. 1772; *Agaricus macrosporus* var. *excellens* (F. Møller) Bohus in Annls hist.-nat. Mus. natn. hung. 81: 41. 1990, non *A. stramineus* Scop. 1772; *Agaricus albertii* var. *excellens* (F. Møller) Bohus in Annls hist.-nat. Mus. natn. hung. 82: 51. 1990 (superfluous). – *Agaricus kuehnerianus* Heinem. in Bull. mens. Soc. linn. Lyon, No. spéc. 43: 183. 1974.

KEY TO THE VARIETIES

1. Pileus soon with yellowish tinges; ratio of pileus width and stipe length usually > 1; surface of stipe below annulus floccose-squamose; in grasslands. ..... 27a. var. **urinascens**
1. Pileus whitish; ratio of pileus width and stipe length usually < 1; surface of stipe below annulus smooth and striate, towards base squamose; in woods. ..... 27b. var. **excellens**

27a. var. **urinascens**

SEL. ICON. – Cappelli, Agaricus: pl. 41. 1984 (as *A. macrosporus*); R. Phillips, Paddest. Schimm.: 165. 1981 (as *A. macrosporus*); Dähncke, 1200 Pilze: 500. 1993 (as *A. macrosporus*).

SEL. DESCR. & FIGS. – F. Møller in Friesia 4: 178-181, fig. 29, pl. 33 (as *P. macrospora*); 177-178. pl. 19A (as *P. straminea*). 1952.

VERN. NAME – Grootsporige champignon.

Pileus 105-265 mm, at first obtusely conical to conico-convex, later expanding to plano-convex or applanate, subumbonate or with slightly depressed centre, with inflexed margin, at first white to cream-white, yellow to yellowish brown on handling, pinkish yellow on scratching, finally pale yellow to yellow-brown (Mu. 2.5 Y 8/4, 8/3-4, 10 YR 8/6), in centre pale brown, at first entirely squamulose, later centre smooth and towards margin squamulose or entirely silky with scattered squames, often only near margin, or entirely fibrillose, sometimes areolate-rimose; squames at first often white, later often partly pale yellowish brown to pale brown (7.5 YR 7/6, 10 YR 8/4); veil when young present as appendiculate teeth, later mostly disappearing but sometimes remaining as white irregular veil patches near margin. Lamellae, L = 165-220, l = 2-4, very crowded, free, linear to segmentiform, sometimes undate, sometimes furcate, up to 21 mm broad, at first pinkish white to pale pink or grey-lilacinous (7.5 YR 8/2, 5 YR

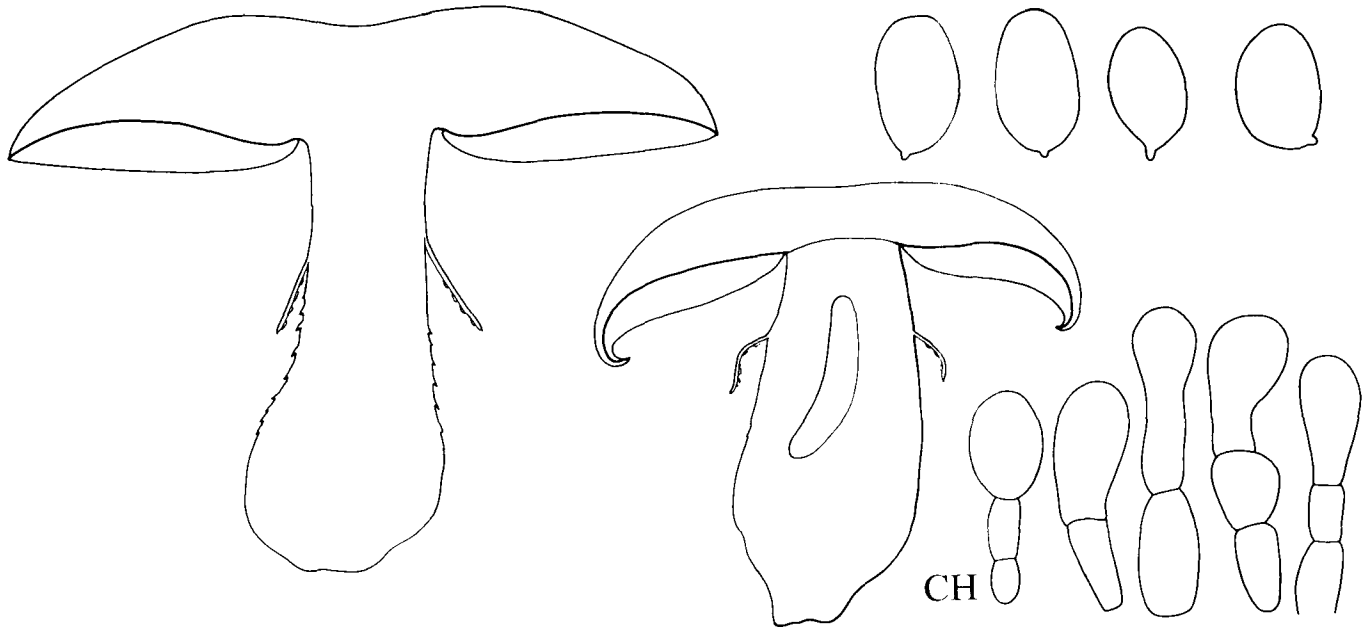

Fig. 28. *Agaricus urinascens*. (habit × ½).

7/4, 8/3), later dark grey lilacinous (5 YR 6/4), finally dark reddish brown to dark brown (5 YR 3-4/3, 7.5 YR 3/2), with paler to white, mostly irregular to minutely serrate edge. Stipe 80-180 × 18 - 55 mm, annulate, mostly clavate to bulbous and at base up to 53 mm broad, sometimes tapering towards base, mostly straight, fistulose to stuffed, at first creamy white, later with brownish tinges, above annulus mostly glabrous to silky, sometimes minutely squamulose, below annulus floccose to strongly squamose, with mostly concolorous, sometimes very pale brown, sometimes pointed squames; squames sometimes arranged in girdles, later sometimes disappearing. Annulus at 0.70-0.80 of height of stipe, 30 mm wide, descending, pending, thick, white, with smooth, sometimes minutely sulcate upperside; underside strongly floccose with concolorous squames; sometimes along margin thick, yellow to brownish yellow squames present, arranged as a cogwheel. Context 20-31 mm thick in pileus, soft, white, not discolouring to discolouring pinkish to pale reddish brown in centre of pileus and base of stipe when cut, sometimes yellow in base of stipe. Smell fresh faintly like almonds, soon unpleasant. Taste nutty, pleasant.

Macrochemical reactions: KOH 10% pale yellow (surface of pileus), yellow (context of base and surface of stipe), negative (context of pileus; upperside annulus), faintly yellow (underside annulus); Schaeffer-reaction negative to orange (surface of pileus), red to purple-red (surface of stipe).

Spores (9.0-)9.5-11.5(-12.0) × 6.0-7.5(-8.0) mm, on average 10.1-10.7 × 6.5-7.2 mm, Q = 1.35-1.70(-1.80), Qav = 1.50-1.60, ellipsoid, sometimes oblong, without germ pore. Basidia 20-32 × 8.5-10.5 mm, clavate, 4-spored, sometimes 2-spored, sometimes with brownish contents. Lamella edge with a 55-70 mm broad, sterile layer; cheilocystidia in often slightly agglutinated chains of cylindrical to subglobose elements of (7.0-)8.0-13.5(-16) × (5.0-)6.0-9.0 mm, with clavate, rarely irregularly shaped, terminal elements of (10-)15-28(-32) × 6.5-13 mm, often with yellowish contents. Pileipellis a sometimes irregular cutis of 3.5-6.5 mm wide, sometimes branched, hyaline hyphae with cylindrical elements, with pale yellow intracellular pigment, with often ascending, cylindrical to narrowly clavate, up to 7 mm wide, terminal elements, gradually passing into pileitrama. Squames consisting of interwoven hyphae with ascending, clavate, 5.0-8.0 mm wide, terminal elements, with intracellular, mostly pale yellowish brown pigment. Stipitipellis a cutis of sometimes branched, 3.5-5.0 mm wide hyphae of cylindrical, slightly inflated elements. Squames consisting of chains of inflated to globose elements, 20-38 × 6.5-16 mm.

HABITAT & DISTR. – Solitary or gregarious, saprotrophic, terrestrial, mostly in grasslands, sometimes in roadside verges (rarely planted with trees), on nutrient-rich or calcareous soil. Rather rare in the Netherlands, July-Oct. Widespread but rare in Europe. Also known from Asia.

For an extensive discussion of the synonymy see Nauta (in Persoonia 17: 461-463. ('2000') 2001.

Agaricus macrosporoides Bohus (in Annls hist.-nat. Mus. natn. hung. 66: 84. 1974) is a species which macroscopically resembles *A. urinascens* in every aspect, but differs in the smaller spores of 8.0-9.5 × 5.3-6.0 mm. According to Bohus it occurs in saline pastures.

27b. var. **excellens** (F. Møller) Nauta in Persoonia 17: 462. ('2000') 2001.

Psalliota excellens F. Møller in Friesia 4: 178. 1952; *Agaricus excellens* (F. Møller) F. Møller in Friesia 4: 204. 1952; *Agaricus macrosporus* subsp. *excellens* (F. Møller) Bohus in Annls hist.-nat. Mus. natn. hung. 70: 105. 1978, non *A. stramineus* Scop. 1772; *Agaricus macrosporus* var. *excellens* (F. Møller) Bohus in Annls hist.-nat. Mus. natn. hung. 81: 41. 1990, non *A. stramineus* Scop. 1772; *Agaricus albertii* var. *excellens* (F. Møller) Bohus in Annls hist.-nat. Mus. natn. hung. 82: 51. 1990 (superfluous).

SEL. ICON.– R. Brown in Mycologist 13(1): front cover. 1999; Cappelli, Agaricus: pl. 41. 1984; R. Phillips, Paddest. Schimm.: 167. 1981.

SEL. DESCR. & FIGS.– F. Møller in Friesia 4: 178-181, fig. 29, pl. 33. 1952; Wasser, Tr. Agariceae Soviet Union: 67-68. 1989.

VERN. NAME – Statige champignon.

CHARACTERISTICS – Differing from var. *urinascens* in the whiter pileus, the slender habit, stipe mostly longer than pileus width, and the surface of the stipe which is striate or smooth directly below the annulus instead of squamose as in var. *urinascens*.

Microscopical characters as in typical variety.

HABITAT & DISTR. – Solitary, saprotrophic, terrestrial in coniferous and deciduous woods. Very rare in the Netherlands (Hoogmade), but probably more widespread; Sept.-Oct. Known from nearby countries as Denmark, Germany, but rare.

Sect. **Minores** Fr.

Pileus strongly yellowing when touched or on drying; annulus narrow, thin, up to 10 mm wide; sometimes absent, fibrillose, without flocks or warts at underside; context discolouring slightly yellow, orange-yellow or yellowish brown on exposure or when damaged.

KOH-reaction yellow to orange; Schaeffer-reaction on surface of pileus strongly orange.

Spores ellipsoid; average spore length < 6.5 mm; Qav = 1.35-1.60; without germ pore; lamella edge sterile; cheilocystidia shortly catenate or not.

Although sect. *Minores* seems to form a homogeneous group, the delimitation of the species is far from clear. The species have been distinguished on account of size of spores, and amount and size of cheilocystidia, but these characters have shown to be variable. Also, colours of the pileus are likewise variable, with often vinaceous fibrils soon fading. Modern methods are required to come to a more balanced taxonomy within this group and judge the taxonomical value of the morphological characters like pileus surface and amount of purple. Here a practical approach is chosen, and the nomenclature and interpretation of the taxa follow the original descriptions as closely as possible.

28. Agaricus dulcidulus S. Schulz. in Kalchbr., Ic. sel. Hymenomyc. Hung.: 29. 1874. – Fig. 29.

Psalliota purpurella F. Møller in Friesia 4: 193. 1952; *Agaricus purpurellus* (F. Møller) F. Møller in Friesia 4: 204. 1952.

MISAPPL. – *Agaricus semotus* sensu Bohus in Mikol. Közlem. 34: 21. 1995; sensu M. Bon in Doc. mycol. 15(60): 22. 1985; *Psalliota semota* sensu F. Møller in Friesia 4: 194. 1952. – *Psalliota amethystina* sensu J. Lange, Fl. agar. dan. 4: 135A. 1939.

EXCL. – *Agaricus dulcidulus sensu* J. Lange in Dansk bot. Ark. 4(12): 11. 1926, Fl. agar. dan. 4: 61, pl. 135C. 1939.

SEL. ICON.- Breitenb. & Kränzl., Pilze Schweiz 4: pl. 191. 1995 (as *A. semotus*); J. Lange, Fl. agar. dan. 4: 135A, 137A. 1939 (as *P. amethystina* and *P. semota* resp.).

SEL. DESCR. & FIGS. – F. Møller in Friesia 4: 195-196, pl. 17. 1952 (as *P. semota*).

VERN. NAME – Wijnkleurige champignon.

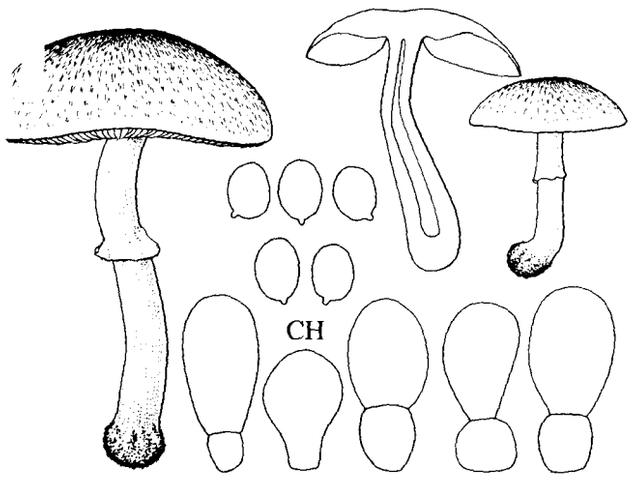

Fig. 29. *Agaricus dulcidulus*.

P us (20-)30-60(-70) mm, at first conico-convex or truncately conic , later convex with flattened centre to plano-convex, sometimes with depressed centre, at first with slightly inflexed margin, later revolute, usually with vinaceous to purple-brown or pinkish grey dense-l ibrillose to fibrillose-squamulose centre (Mu. 7.5 R 7/4, 5 YR 3/3, 4 , 6/3-4), towards margin paler and there whitish to yellowish brown (10 YR 7/6), sometimes greyish brown, occasionally only with s ne reddish brown fibrils at centre; purple colours often fading, ( )ecially towards margin; sometimes later entirely yellowish brown or ochraceous brown, rather strongly yellowing on handling or scratching; margin young with c. 2 mm rim exceeding lamellae, later th or without appendiculate veil remnants. Lamellae, L = 55-75, l 1(-3), crowded, free, subventricose, up to 9 mm broad, at first pale greyish to greyish brown (10 YR 7/3, 5 YR 6-7/4, 6/1-2), later pinkish brown (10 YR 5/3), finally dark brown (5 YR 4/3), with whitish paler, crenulate edge. Stipe (15-)20-45(-80) × (2-)4-7(-10) mm, ..nulate, cylindrical with bulbous base to clavate, at base up to 11(-13) mm broad, straight, narrowly fistulose, white to whitish, often)wards base yellowish to yellowish brown (2.5 Y 8/8, 10 YR 6-7/8), uickly yellowing on handling, above annulus glabrous, silky, below annulus at first flocculose, later fibrillose to smooth, near base velutinous, occasionally with several small short branched white rhi-.omorphs. Annulus at 0.65-0.75 of height of stipe, narrow, (1-)2-3 nm wide, descending, pending to slightly spreading, thin, fragile, fibrillose, whitish, often discolouring yellowish, with smooth or striate to sometimes sulcate upperside; underside flocculose to fibrillose-floccose. Context 3-4.5(-7) mm thick in pileus, whitish, discolouring slightly yellowish to ochraceous with orange tinge in stipe when cut. Smell like almonds, sometimes also anise, often not strong. Taste pleasant, like nuts, or like almonds.

Macrochemical reactions: KOH 10% & 40% orange (base of stipe), yellow (surface of pileus); Schaeffer-reaction orange (surface of pileus and stipe).

Spores 4.5-6.0 × 3.5-4.0 mm, on average 5.1-5.6 × 3.4-3.7 mm, Q = 1.35-1.65, Qav = 1.35-1.50, ellipsoid, without germ pore. Basidia 17-23 × 6.0-8.0 mm, 4-spored. Lamella edge with a 40-50 mm broad, usually sterile layer; cheilocystidia usually in short chains of globose to quadrangular elements of 4.0-5.5 × 5.0 mm, with clavate, sometimes globose terminal elements of (10-)14-21(-30) × (7.0-)9.5-14(-17.5) mm, often with yellowish contents; sometimes intermixed with some basidia. Pileipellis a sometimes slightly gelatinized cutis of slightly irregularly arranged, unbranched, 3.5-6.5(-11) mm wide hyphae with cylindrical elements, with cylindrical terminal elements, with yellowish, intracellular pigment, gradually passing into pileitrama. Squames consisting of curved, up to 7.0 µm wide hyphae with brownish intracellular pigment. Stipitipellis a cutis of sometimes branched, 2.5-6.0 mm wide hyphae with cylindrical elements, with pale, intracellular pigment.

HABITAT & DISTR. – Solitary or gregarious, saprotrophic, terrestrial in deciduous and coniferous woods, city parks, gardens, on humus-rich soil, also in open dunes. Rather rare, common in coastal areas and southern Limburg; July-Nov. Widespread but not common in Europe. Also known from Asia, northern Africa and the Americas.

This taxon is in modern literature often known as *Agaricus semotus*. However, the original description of Fries (Monogr. Hymenomyc. Sueciae 2: 347. 1863) and his later plate (Ic. sel. Hymenomyc.: t. 131. 1879) of *A. semotus* are very doubtful, showing a stipe covered with reddish veil. These do not refer to the present taxon, and probably not even to an *Agaricus*.

Agaricus purpurellus is a small variant of *A. dulcidulus*, not worth distinguishing as a separate taxon. It is based on a plate by Lange (Fl. agar. dan. 4: pl. 135A. 1939), which shows a basidiocarp with purple-fibrillose pileus. The differences according to Møller with *A. semotus* are a more purple pileus and smaller basidiocarps. No original material of Møller has been preserved.

Agaricus lutosus (F. Møller) F. Møller (in Friesia 4: 204. 1952) differs, according to Møller, in the cylindrical stipe which is tapering towards the base, and the pileus which is yellowish and with some vinaceous fibrils at the centre only when young.

29. Agaricus luteomaculatus (F. Møller) F. Møller in Friesia 4: 204. 1952. – Fig. 30.

Psalliota luteomaculata F. Møller in Friesia 4: 192. 1952. – *Agaricus lutosus* var. *macrosporus* Parra in Bol. Soc. micol. Madrid 23: 98. 1998 (invalid).

SEL. ICON.- F. Møller in Friesia 4: pl. 21b. 1952; Parra in Bol. Soc. micol. Madrid 23: 99. 1998.

SEL. DESCR. & FIGS. – F. Møller in Friesia 4: 192. 1952; Parra in Bol. Soc. micol. Madrid 23: 98-99. 1998 (as *A. lutosus* var. *macrosporus*).

VERN. NAME – Okerbruine dwergchampignon.

Pileus 55-65 mm, convex, yellowish brown, at centre purple brown fibrillose (Mu. 9 YR 6/6), quickly yellowing on handling, later entirely ochraceous brown; with margin exceeding lamellae with 1 mm broad white rim. Lamellae crowded, free, ventricose, 5.5-7 mm broad, at first pinkish grey, later brown (5 YR 4/3), with whitish, fimbriate edge. Stipe 60-85 × 11-12 mm, annulate, cylindrical to subclavate, at base sometimes up to 16 mm broad, straight, narrowly fistulose, whitish to yellowish (10 YR 7/8), near base yellowish brown, yellowing on handling, above annulus smooth to fibrillose, below annulus fibrillose, sometimes with rhizomorphs. Annulus at c. 0.60 of height of stipe, up to 8 mm wide, descending, pending, thin, white, yellowing, with smooth upperside; underside fibrillose-flocculose. Context 7 mm thick in pileus, whitish, discolouring yellowish brown, sometimes with orange tinge in stipe. Smell hardly distinct, slightly like anise or almonds. Taste not known.

Macrochemical reactions: ammonia yellow (surface of pileus); KOH 10% yellow (surface of pileus); Schaeffer-reaction orange (surface of pileus).

Spores 5.5-6.5 × 4.0-5.0 mm, on average 6.2-6.3 × 4.5-4.7 mm, Q = 1.25-1.50, Qav = 1.35-1.40, ellipsoid, without germ pore. Basidia 20-23 × 6.0-8.0 mm, 4-spored. Lamella edge almost sterile; cheilocystidia not in chains, 14-21 × 10-13 mm, clavate, with

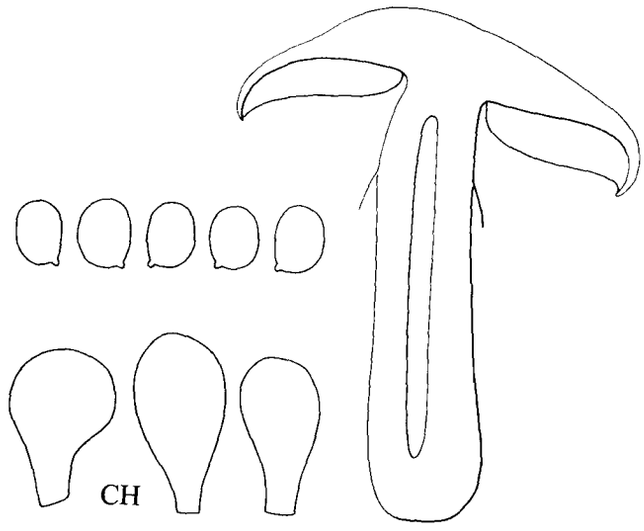

Fig. 30. *Agaricus luteomaculatus.*

yellowish contents. Pileipellis a sometimes slightly gelatinized cutis of 3.0-5.0 mm wide hyphae with cylindrical elements, with some ascending, clavate terminal elements up to 8.5 µm wide, with yellowish intracellular pigment, gradually passing into pileitrama. Stipitipellis a cutis of unbranched, 5.0-6.5 mm wide hyphae with cylindrical, sometimes up to 8.5 µm inflated elements, with yellowish intracellular pigment.

HABITAT & DISTR. – Solitary or in small groups, saprotrophic, terrestrial in deciduous woods on calcareous sandy soil (according to Møller (in Friesia 4: 192. 1952) in *Picea*-woods). Very rare, probably confined to dune region (Wassenaar, Bierlap; Overveen, Elswout). Oct.-Nov. Very rare but widespread in Europe. Also known from Africa and southern South America.

The macroscopic description is incomplete because of the rare occurrence of the taxon. The two collections examined differ from Møller's description in the slightly larger pileus and the longer stipe which is at most subclavate.

Agaricus luteomaculatus differs, according to the original description by Møller, from the other species in sect. *Minores* in the shorter, more floccose stipe below the ring, and in the slightly larger spores of 5.5-6 µm. Although Møller's plate and description show a species with a clavate stipe this character is not considered of taxonomical importance. The examined collections had a cylindrical to subclavate stipe. *Agaricus lutosus* var. *macrosporus* refers to the same taxon, although again with cylindrical instead of clavate stipe.

The recently described *A. pseudolutosus* (Moreno et al.) Moreno et al. (in Micol. Veget. medit. 14: 60. 1999) is, judging from the plate and description, without doubt closely related to the above described taxon. The only difference is the absence of cheilocystidia in *A. pseudolutosus* and the cylindrical stipe instead of the subclavate stipe of *A. luteomaculatus* on the original plate of Møller.

30. Agaricus comtulus Fr., Epicrisis: 215. 1838. – Fig. 31.

Agaricus niveolutescens Huijsman in Persoonia 1: 321. 1960.

SEL. ICON.- Cappelli, Agaricus: pl. 52, pl. 57 (as *A. niveolutescens*). 1984; J. Lange, Fl. agar. dan. 4: pl. 136A. 1939.

SEL. DESCR. & FIGS. – Huijsman in Persoonia 1: 321-322, figs. 1 & 2. 1960 (as *A. niveolutescens*); F. Møller in Friesia 4: 185-186. 1952.

VERN. NAME – Kleine champignon.

Pileus 17-35(-40) mm, at first convex with slightly flattened centre, expanding to plano-convex with depressed centre, rarely with low umbo, white to whitish (Mu. 10 YR 7/2), rarely with some faint purplish hue at centre, soon yellowish or brownish yellow (10 YR 7/8, 7/10), discolouring quickly yellow on handling; surface minutely velutinous-fibrillose; remarkably orange in dried material. Lamellae, L = 55-70, l = 1-3, crowded, free, subventricose to linear, up to 3.5 mm broad, at first pale pinkish grey to brownish grey (10 YR 6/2), later darker greyish brown, finally brown, with entire to minutely fimbriate white edge. Stipe 20-55 × 2-6 mm, annulate, cylindrical to subclavate, at base 5-8(-10) mm broad, straight to curved, stuffed to fistulose, white, strongly yellow on handling, below annulus ochraceous with orange tinge, above annulus glabrous, smooth; below annulus fibrillose to flocculose-fibrillose, without or with short white rhizomorphs. Annulus at 0.62-0.70 of height of stipe, narrow, 1.5-3 mm wide, descending, pending, thin, fragile, white, discolouring yellow, with smooth upperside; underside fibrillose to velutinous. Context 2-3(-4.5) mm thick in pileus, whitish, not discolouring when cut except for base of stipe which slowly discolours faintly yellowish orange. Smell like almonds. Taste pleasant, like nuts.

Macrochemical reactions: KOH 40% yellow (surface of pileus, context in base of stipe); Schaeffer-reaction strongly orange (surface of pileus, surface of base of stipe).

Spores 4.5-5.5(-6.0) × 3.5-4.0 mm, on average 5.2-5.3 × 3.6-3.7 mm, Q = 1.30-1.60, Qav = 1.40-1.45, ellipsoid, without germ pore. Basidia 17-18 × (4.5-)6.5-7.0 mm, 4-spored. Lamella edge with a mixture of basidia and usually a minority of cheilocystidia, cheilocystidia sometimes scarce; cheilocystidia in short chains of inflated rectangular elements of 7-11 × 4.5-6.0(-7.0) mm, with clavate terminal elements of (11-)16.5-24 × (6.0-)7.5-10.5(-16) mm, sometimes with yellow contents. Pileipellis a cutis of (2.5-)3.5-6.0 mm wide hyphae with cylindrical, sometimes up to 8 µm elements, with slightly ascending, clavate terminal elements, with yellowish, intracellular pigment, gradually passing into pileitrama. Stipitipellis a cutis of unbranched, 4.0-8.0 mm wide hyphae with cylindrical elements, with some ascending terminal elements, with yellowish intracellular pigment.

HABITAT & DISTR. – Usually solitary, saprotrophic, terrestrial in lawns, or roadside verges, on sandy or clayey soil. Rather rare but widespread in the Netherlands, mainly in dune region and southern Limburg; probably under-recorded. Sept.-Oct. Rather rare but widespread in Europe. Also known from the Americas, the Philippines and southern South America.

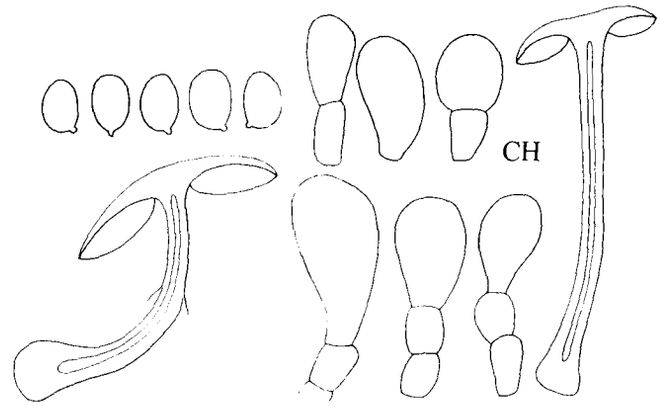

Fig. 31. *Agaricus comtulus.*

Agaricus comtulus is rarely collected and described from the Netherlands, therefore the above description is also based on descriptions of British material, and on French material by Huijsman (in Persoonia 1: 321-322. 1960). The flesh-coloured lamellae which are mentioned in the typical description by Fries (Epicrisis: 215. 1838), could not be found in the Dutch material. Lange (Fl. agar. dan. 4: 62. 1939) claims that this taxon lacks cheilocystidia. This could not be confirmed, although sometimes the cheilocystidia are very scarce.

The identity of *Agaricus rusiophyllus* Lasch (in Linnaea 3: 37. 1828), which is sometimes mentioned in connection with the above described taxon, is doubtful.

31. Agaricus xantholepis (F. Møller) F. Møller in Friesia 4: 204. 1952. – Fig. 32.

Psalliota xantholepis F. Møller in Friesia 4: 191. 1952.

SEL. ICON.- Cappelli, Agaricus: pl. 58. 1984; F. Møller in Friesia 4: pl. 21c. 1952.

SEL. DESCR. & FIGS. – F. Møller in Friesia 4: 191. 1952; Huijsman in Persoonia 1: 323, figs. 3-5. 1960; Wasser, Tr. Agariceae Soviet Union: 103-104. 1989.

VERN. NAME – Geelschubbige satijnchampignon.

Pileus 40-70(-85) mm, at first hemispherical, expanding to convex or plano-convex, occasionally with umbo, with deflexed margin, whitish to yellow to yellowish brown (Mu. 2.5 Y 8/4-6, 10 YR 8/2, 7/6), sometimes with darker, brownish centre (7.5 YR 6/5, 8.5 YR 6.5/6, 10 YR 6/6), fibrillose, usually breaking up into appressed squamules, especially at centre, discolouring brightly yellow on handling; veil present when young as appendiculate white remnants. Lamellae, L = 90-100, l = 1-7, crowded, free, subventricose, up to 8 mm broad, at first grey to pinkish grey (10 YR 7/2), later greyish brown (7.5 YR 7/2-6/4, 10 YR 5/2), finally brown (5 YR 4/2-3/3), with paler to white, serrulate edge. Stipe 45-60 × 6-12 mm, annulate, sometimes without annulus, cylindrical to subclavate or subbulbous, at base up to 14(-23) mm broad, rarely tapering towards base, straight to curved, fistulose, white, yellowing on handling, at base often strongly discolouring yellow to orange-brown, above annulus smooth to silky, below annulus fibrillose, sometimes locally minutely white-squamulose or floccose-squamulose. Annulus at 0.65-0.75 of height of stipe, up to 8 mm wide, descending, pending to slightly spreading, thin, fragile, easily torn, white, edge discolouring strongly yellow, with smooth or striate upperside; underside fibrillose. Context c. 5 mm thick in pileus, white, discolouring slowly faintly orange when cut. Smell strongly like bitter almonds, sometimes with anise component. Taste like nuts.

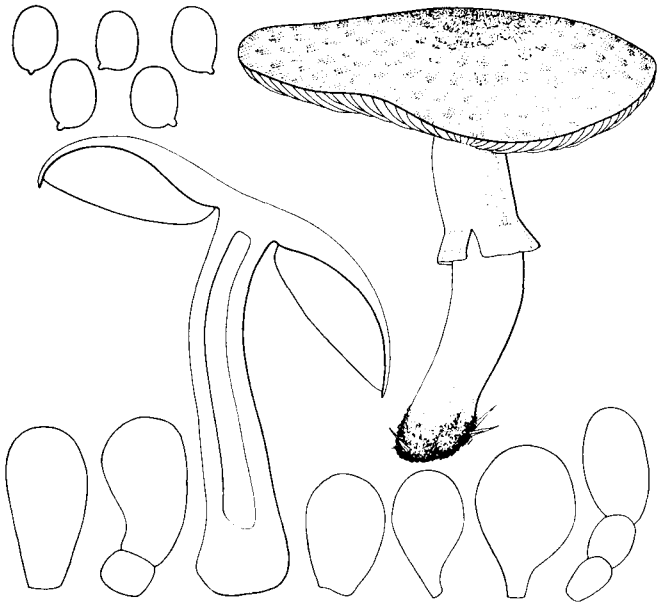

Fig. 32. *Agaricus xantholepis*.

Macrochemical reactions: KOH 10% yellow (surface) or negative to pale orange (context); Schaeffer-reaction strongly orange (surface of pileus).

Spores 4.5-6.0 × 3.5-4.5 mm, on average 5.2-5.6 × 3.7-4.2 mm, Q = 1.20-1.50(-1.55), Qav = 1.35-1.40, ellipsoid, sometimes broadly ellipsoid, without germ pore. Basidia (13-)16-21 × 5.5-7.5 mm, 4-spored. Lamella edge sterile or almost sterile, consisting of cheilocystidia and some basidia; cheilocystidia sometimes in short chains of rounded, rectangular elements of 5-7 × 4.5-6.5 mm, with clavate terminal elements of 15-21.5(-29) × 8-15 mm, often with yellow contents. Pileipellis a cutis of sometimes branched, 3.0-5.5 mm wide hyphae with cylindrical elements, sometimes constricted at septa, with cylindrical terminal elements, with yellowish, parietal and intracellular pigment, gradually passing into pileitrama. Fibrils consisting of similar, curved hyphae with intracellular, brownish pigment. Stipitipellis a cutis of 4.0-7.0 mm wide hyphae with cylindrical elements, with yellowish intracellular pigment.

HABITAT & DISTR. – Solitary or in small groups, saprotrophic, terrestrial in mixed or deciduous woods on calcareous soil, also in open calcareous dunes. Very rare in the Netherlands, occurring in the calcareous dune region and in southern Limburg (Vogelenzang, Huis te Vogelenzang; Vogelenzang, AWD; Gronsveld, Savelsbos). Aug.-Oct. Rare but widespread in Europe. Also known from Asia and South America.

The above description is also based on collections from southern England and western Germany.

Agaricus comtulus Fr. is very close, differing in smaller size, fibrillose covering and white to yellow colours of the pileus, and the less bulbous stipe.

Agaricus lutosus (F. Møller) F. Møller (in Friesia 4: 204. 1952) seems to differ only in the presence of a faint purplish brown tinge in the squames on the pileus when young, and the stipe which is tapering towards the base. It seems likely that this taxon is very close or conspecific, considering the variability of the distinguishing characters.

33. Agaricus porphyrizon P.D. Orton in Trans. Br. mycol. Soc. 43: 174. 1960. – Fig. 33.

Agaricus arvensis var. *purpurascens* Cooke, Ill. Brit. Fungi 4: pl. 584. 1885; *Psalliota purpurascens* (Cooke) F. Møller in Friesia 4: 187. 1952; *Agaricus purpurascens* (Cooke) Pilát in Acta Mus. nat. Prag. 7B (1): 10. 1951, non *A. purpurascens* A. & S. 1805:Fr.

SEL. ICON.- M. Bon in Doc. mycol. 19(76): pl. 2. 1989; Cappelli, Agaricus: pl. 51, 51bis. 1984; Dähncke, 1200 Pilze: 502. 1993.

SEL. DESCR. & FIGS. – M. Bon in Doc. mycol. 19(76): 76. 1989; F. Møller in Friesia 4: 187-188, pl. 21a, 35. 1952 (as *Psalliota purpurascens*).

VERN. NAME – Purperen champignon.

Pileus (20-)50-90 mm, at first convex with obtuse centre or truncately conical, expanding to convex, sometimes with depressed centre, or plano-convex, at centre greyish brown or vinaceous brown to purplish brown (Mu. 10 R 4-5/4, 5/7, 5 YR 3/3, 7.5 YR 5/4), covered with fibrillose, pointed, appressed, purple squames (10 R 3/3-4, 5/3, 2.5 YR 5/4), occasionally on pale, brownish background, usually towards margin more fibrillose; later sometimes purple colours fading and pileus

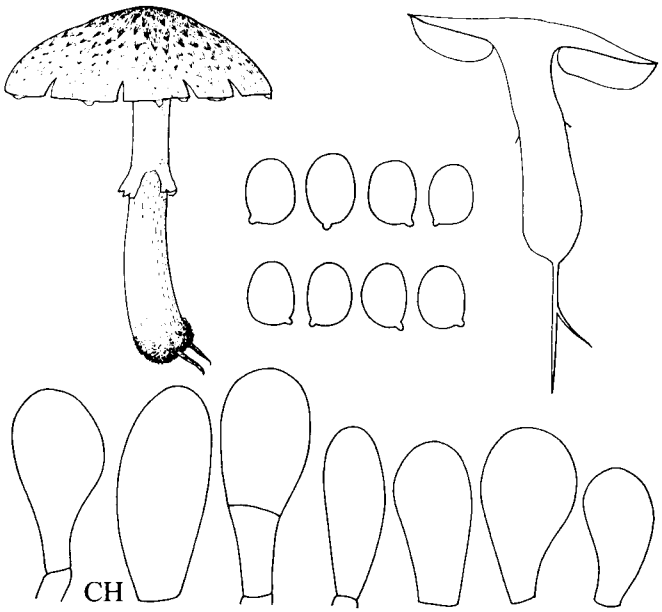

Fig. 33. *Agaricus porphyrizon*.

entirely reddish brown (2.5 YR 3/4, 5 YR 5/4, 7.5 YR 5/4-6, 10 YR 4/4); (slowly) yellowing on handling, especially at centre; pellis easily peeled off; margin exceeding lamellae, with appendiculate whitish, sometimes yellowing, veil remnants, later sometimes incised. Lamellae, L = 90-120, l = (1-)3-7, crowded, free, segmentiform to subventricose, up to 10 mm broad, pinkish grey at first (5 YR 7/2; 10 YR 5/2), later pinkish brown to pinkish grey or greyish pink (2.5 YR 4-5/2, 5 YR 4/2, 7.5 YR 7/2, 10 YR 5/2), finally brown (5 YR 2.5/2, 7.5 YR 3/2), with paler or white, entire or denticulate to crenulate edge. Stipe (30-)40-80(-110) × 7-11 mm, usually annulate, clavate or cylindrical with subbulbous base, at base up to 19 mm broad, straight, stuffed or narrowly fistulose, white, sometimes with reddish tinge, yellowing on handling, especially at base, above annulus squamulose-fibrillose, below annulus fibrillose or fibrillose-squamulose, later entirely glabrous and smooth, occasionally with short white rhizomorphs or white pseudorhiza. Annulus at (0.40-)0.50-0.65 of height of stipe, (3-)5-10 mm wide, descending, pending to patent, thin, easily torn, sometimes absent, white, with smooth upperside; underside smooth to slightly fibrillose, or slightly flocculose at margin, quickly yellowing on handling. Context 6-8 mm thick in pileus, soft, white, not discolouring to discolouring pale orange, orange-yellow or yellowish brown, rarely with pinkish blush, in stipe when cut. Smell like almonds when cut, sometimes strongly, occasionally with anise-compound. Taste not known.

Macrochemical reactions: Schaeffer-reaction strongly orange (surface of pileus and base of stipe).

Spores 5.0-6.0 × 3.5-4.0(-4.5) mm, on average 5.4-5.8 × 3.7-4.2 mm, Q = 1.30-1.65, Qav = 1.35-1.55, ellipsoid, without germ pore. Basidia 21-22 × 6.5-7.0 mm, 4-spored, sometimes also 2-spored basidia present. Lamella edge with a 40-75 mm broad sterile layer; cheilocystidia not in chains, sometimes in clusters, (17.5-)20-33 × 9.5-13(-20.5) mm, clavate, with colourless or brownish contents. Pileipellis a cutis of 4.0-7.0(-10) mm wide hyphae with cylindrical, sometimes slightly inflated elements, gradually passing into pileitrama, with pale yellow, intracellular pigment. Squames and fibrils consisting of curved, up to 8 mm wide hyphae with short, slightly inflated elements, with brownish intracellular pigment. Stipitipellis a cutis of sometimes branched, 3.0-5.0 mm wide hyphae with cylindrical, sometimes up to 8 μm inflated elements, with pale yellow intracellular pigment, with slightly ascending, clavate, up to 9 μm wide terminal elements.

HABITAT & DISTR. – Solitary or in small groups, saprotrophic, terrestrial, on humus-rich sandy soil in deciduous woods, dune scrub, dune grasslands. Rather common in the coastal dune region, rather rare in the rest of the Netherlands. Sept.-Nov. Rather rare but widespread in Europe. Also known from Asia, the Americas and northern Africa.

On account of the size this taxon is by some authors placed in sect. *Arvenses*. However, the structure of the annulus, in combination with the strong yellow discoloration, calls for placement in sect. *Minores*.

Sect. **Xanthodermi** Sing.

Pileus not discolouring or sometimes yellow on scratching, disappearing on drying, rarely slightly pink; stipe usually annulate; annulus fragile and thin, at underside near margin thickened or with squames; surface of and context in base of stipe usually strongly bright yellow on exposure or when handled, damaged or cut.

KOH-reaction in context of base of stipe positive and yellow to orange; Schaeffer-reaction on surface of pileus and base of stipe negative.

Spores (broadly) ellipsoid to oblong, spore length < 6.5 mm on average; Qav = (1.20-)1.30-1.60(-1.70); without germ pore; lamella edge sterile; cheilocystidia catenate or not.

33. Agaricus xanthodermus Genev. in Bull. Soc. bot. Fr. 23: 32. 1876. – Fig. 34.

Psalliota xanthoderma (Genev.) Richon & Roze, Atl. Champ. comest. vénéneux: 53. 1885. – *Psalliota flavescens* Richon & Roze, Atl. Champ. comest. vénéneux: 42, pl. 17, fig. 17-21. 1885; *Agaricus pseudocretaceus* M. Bon in Doc. mycol. 15(60): 34. 1985. – *Agaricus jodoformicus* Speg. in An. Mus. nac. Hist. nat. B. Aires 6: 141. 1899. – *Agaricus xanthodermus* var. *lepiotoides* Maire in Bull. trimest. Soc. mycol. Fr. 24: LVIII. 1909. – *Psalliota xanthoderma* var. *grisea* A. Pears. in Trans. Br. mycol. Soc. 29: 204. 1946; *Psalliota grisea* (A. Pears.) Essette, Psalliotes: pl. 42. 1964 (invalid); *Agaricus xanthodermus* var. *griseus* (A. Pears.) Bon & Cappelli in Doc. mycol. 13(52): 16. 1983.

SEL. ICON.- Cappelli, Agaricus: pl. 59 & 60. 1984; Marchand, Champ. Nord Midi 2: pl. 113. 1973; J. Petersen in Svampe 28: fig. 2. 1993.

SEL. DESCR. & FIGS. – Cappelli, Agaricus: 313-324. 1984; F. Møller in Friesia 4: 168-169. 1952.

VERN. NAME – Karbolchampignon.

Pileus (60-)70-150 mm, at first hemispherical to truncately conical, expanding to convex, plano-convex or plano-concave, with inflexed, later reflexed margin, white to cream-coloured (Mu. 2.5 Y 9/2), later occasionally pale greyish brown to grey-brown (7.5 YR 7/2, 10 YR 5/2, 6/2-4/3, 6-8/3), at centre often darker, when fresh often brightly chrome-yellow on scratching, at margin sometimes discolouring yellowish on handling, but colour soon fading away; when young minutely squamulose at centre, later smooth, sometimes breaking up into squames, near margin often radially fibrillose and becoming slightly fissurate; margin exceeding lamellae, veil present when young as brownish patches at centre. Lamellae, L = 120-145, l = 0-3, moderately crowded, free, ventricose, up to 11 mm broad, at first pinkish to pinkish grey (5 YR 8/2.5, 7.5 YR 8/2), later reddish brown (5 YR 4/3, 7.5 YR 3/2, 7/2), finally dark brown (7.5 YR 3/4), with concolorous or whitish, entire to minutely den-

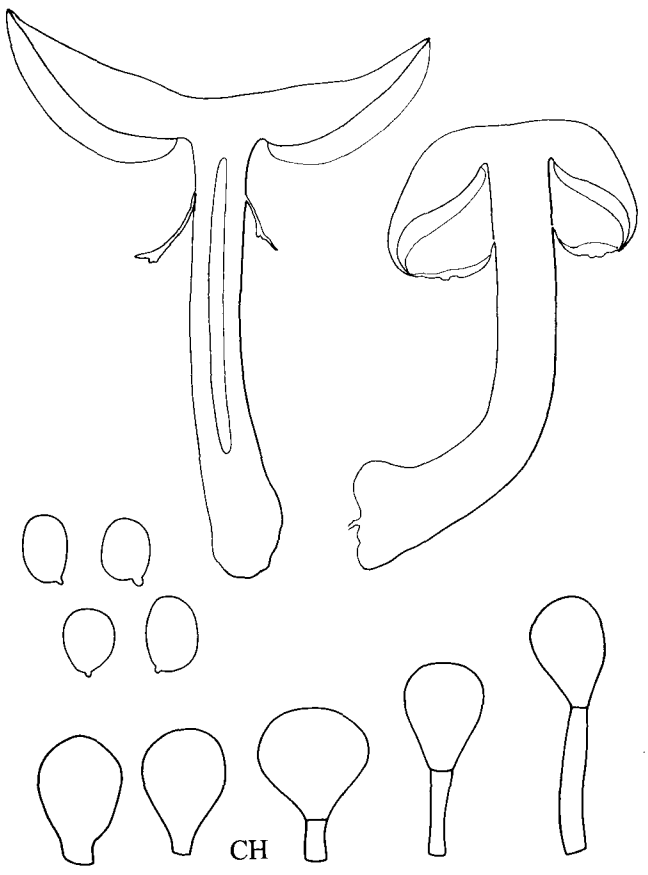

Fig. 34. *Agaricus xanthodermis*. (habit × ½).

ticulate edge. Stipe 60-125 × 10-18 mm, annulate, cylindrical to subclavate, often with a bulbous base up to 30 mm broad, straight to slightly flexuose or curved, broadly fistulose, shiny and white, with reddish tinges at lower part of stipe on handling, sometimes faintly yellowing, above annulus glabrous and smooth, lengthwise striate, sometimes greyish, below annulus smooth, sometimes fibrillose; surface at base of stipe discolouring strongly yellow on scratching; sometimes deeply rooted in soil. Annulus at 0.70-0.90 of height of stipe, 11-20 mm wide, descending, pending to slightly spreading, rather thin and floppy, near margin thicker, white, with smooth, sometimes striate upperside; underside fibrillose and near margin with several, large squames. Context 8-15 mm thick in pileus, white, sometimes discolouring faintly yellow when cut, in base of stipe strongly yellow, soon fading. Smell faintly unpleasant, rather strongly carbolic when cut. Taste not known.

Macrochemical reactions: KOH 10% yellow (context in and surface of base of stipe), Schaeffer-reaction negative (surface and context of pileus and stipe).

Spores 4.5-6.5(-7.0) × 3.5-5.5(-6.0) mm, on average 5.3-6.3 × 3.9-4.6(-5.1) mm, Q = 1.15-1.45, Qav = (1.20-)1.30-1.40, broadly ellipsoid to ellipsoid, without germ pore. Basidia 17-21 × 6.0-7.0 mm, mostly 4-spored, often also in part 2-spored. Lamella edge with a c. 50 mm broad sterile, often agglutinated layer; cheilocystidia not in chains, 15-26.5 × 10-19.5(-24) mm, sphaeropedunculate to broadly ellipsoid or broadly clavate, easily collapsing, hyaline, developed from hyphae consisting of long, slightly inflated, up to 5.0 mm wide elements. Pileipellis a cutis of slightly interwoven, sometimes branched, 4.0-9.0 mm wide hyphae with cylindrical to sometimes inflated elements up to 14.5 mm wide, with ascending, clavate terminal elements, gradually passing into pileitrama, with pale yellow parietal pigment. Stipitipellis a slightly gelatinized cutis of 3.5-4.5 mm wide hyphae with cylindrical elements, at surface gradually passing into somewhat interwoven, curved, sometimes branched, 5.0-5.5 mm wide hyphae with 16-28 mm long, irregularly inflated elements and free, up to 6.5 mm wide terminal elements, with pale yellow intracellular pigment.

HABITAT & DISTR. – Solitary to gregarious, saprotrophic, terrestrial in deciduous woods, parks, roadside verges, rich grasslands, but also in open dunes and dune grasslands on nutrient-rich or calcareous sandy or clayey soils. Widespread, rather common in the west and south-east of the Netherlands, rare in the rest of the country. June-Nov. Widespread in Europe. Cosmopolitan.

Although the majority of the collections has a bulbous stipe, several specimens with a cylindrical stipe were found in the dunes. These specimens do not differ in any other character from the typical ones, therefore no taxonomical importance was attached to this feature. The variety *lepiotoides* Maire with an areolate pileus is considered without taxonomical meaning and caused by ecological circumstances like drought.

The variety *griseus*, supposedly differing from var. *xanthodermus* in the greyish instead of whitish pileus could not be distinguished. Although some collections have only white colours, many collections consist partly of specimens with a grey pileus.

34. Agaricus pilatianus (Bohus) Bohus in Annls hist.-nat. Mus. natn. hung. 66: 78. 1974. – Fig. 35.

Agaricus xanthodermus var. *pilatianus* Bohus in Annls hist.-nat. Mus. natn. hung. 63: 80. 1971.

SEL. ICON. – Cappelli in Svampe 28: 17. 1993; Cappelli in Boll. Gruppo micol. G. Bres. 28: 172. 1985.

SEL. DESCR. & FIGS. – Bohus in Annls hist.-nat. Mus. natn. hung. 66: 78-79. 1974.

VERN. NAME – Kraagchampignon.

Pileus 35-40 mm, broadly truncately conical, at first white, later pale greyish brown with slightly pinkish tinge (Mu. 10 YR 7/3-4), smooth to very minutely felted, when young bright yellow on scratching. Lamellae very crowded, free, at first pale brownish yellow (10 YR 8/3-4), later reddish brown (5 YR 4/3), with a concolorous entire edge. Stipe 35-40 × 7-9 mm, annulate, cylindrical to tapering towards base, straight, fistulose, white at first, later turning pale yellowish brown in lower half, slightly yellowing on scratching, above and below annulus glabrous and smooth. Annulus at c. 0.7 of height of stipe, 5-7 mm wide, descending, patent, thin, white, at margin double and more or less split in two, forming a kind of triangle in transverse section; with

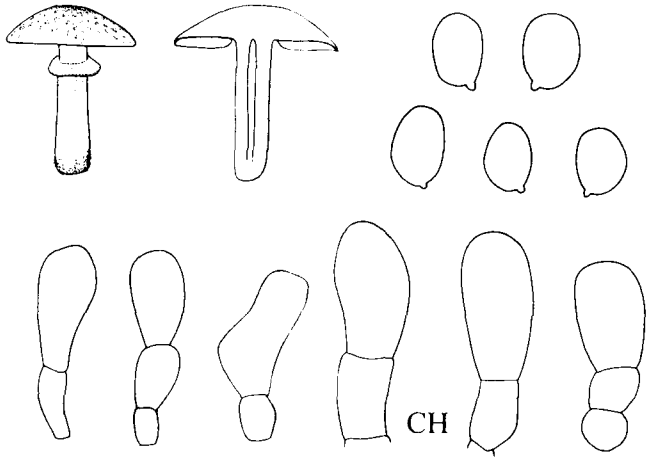

Fig. 35. *Agaricus pilatianus*. (habit × ½).

smooth upperside; underside with pale brown, sometimes split rim near edge. Context white, in base of stipe quickly chrome-yellow when cut; colour fading away soon; elsewhere not discolouring. Smell faintly unpleasant, strongly when cut. Taste very unpleasant.

Macrochemical reactions: NaOH 30% bright yellow on base of stipe; Schaeffer-reaction negative (surface of pileus; context).

Spores 5.5-7.0 × 4.0-5.0 mm, on average 5.8-6.0 × 4.5 mm, Q = 1.25-1.45, Qav = 1.30-1.35, ellipsoid, sometimes broadly ellipsoid, without germ pore. Basidia 17-21 × 5.5-6.5 mm, 4-spored. Lamella edge not entirely sterile; cheilocystidia in chains of broadly cylindrical to clavate elements of 5.0-17 × 3.5-7.0 mm, with clavate terminal elements of 13-22 × 6.5-12 mm. Pileipellis a slightly irregular cutis of 2.5-5.5 mm wide hyphae with cylindrical elements, with scattered slightly ascending, clavate terminal elements of 13-17 × 5.0-5.5 µm, gradually passing into pileitrama, with intracellular, very pale yellowish pigment. Stipitipellis a cutis of slightly gelatinized, 3.0-6.0 mm wide hyphae with sometimes slightly inflated elements up to 8 µm wide, with intracellular, pale yellowish pigment.

HABITAT & DISTR. – Gregarious, saprotrophic, terrestrial in mixed deciduous wood on clayey soil or under scrub on calcareous sandy soil in the coastal dune area. Very rare in the Netherlands (Wassenaar, Meijendel; Grootebroek); Oct. Rare in Europe, mainly occurring in eastern and southern regions.

The above description is based on two collections, of which only was provided with macroscopical notes. The basidiocarps are unusually small compared to the original description of Bohus, and probably represent a small variant of this species. In the original description the basidiocarps have a pileus diameter of 60-120 mm, and a stipe of 45-80 × 20-30 mm (Bohus in Annls hist.-nat. Mus. natn. hung. 63: 80. 1971). Decisive characters are the brownish-pinkish discoloration of the pileus on handling, the partly fertile lamella edge with tufts of narrow, clavate cheilocystidia which are catenate, and the cylindrical stipe with a triangular annulus.

35. Agaricus pseudopratensis (Bohus) Wasser in Ukr. bot. Zh. 33: 250. 1976. – Fig. 36.

Psalliota pseudopratensis Bohus in Borbásia 1: 114. 1939; *Agaricus pseudopratensis* (Bohus) Bohus in Annls hist.-nat. Mus. natn. hung. 63: 81. 1971 (invalid). – *Agaricus pseudopratensis* var. *niveus* Bohus in Annls hist.-nat. Mus. natn. hung. 72: 94. 1980.

SEL. ICON.- Cappelli, Agaricus: pl. 68. 1984; Cappelli in Boll. Gruppo micol. G. Bres. 28: 180. 1985.

SEL. DESCR. & FIGS. – Bohus in Annls hist.-nat. Mus. natn. hung. 63: 81-82. 1971.

CHARACTERISTICS – Pileus 25-80 mm, convex with flattened centre, whitish or greyish white with a brown centre, soon breaking up into large, appressed brownish to reddish brown squames at centre, towards margin more fibrillose-squamulose; lamellae free, up to 4 mm broad, at first pinkish, later dark brown; stipe 20-65 × 7-15 mm, annulate, cylindrical or clavate, sometimes tapering towards base, whitish, above annulus greyish brown, smooth; annulus at 0.50-0.65 of height of stipe, 2-3 mm wide, descending, pending, moderately thick, with thickened edge, rather persistent, white, with smooth upperside; underside smooth to fibrillose; context white, discolouring yellow in base of stipe, after several minutes reddish; smell faintly carbolic, phenolic; taste not known.

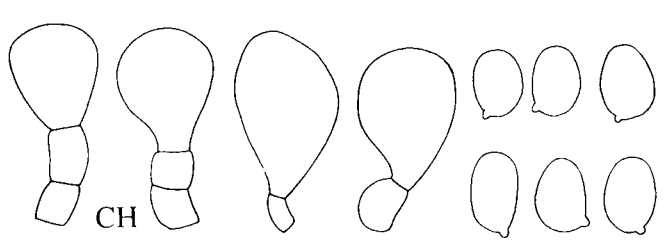

Fig. 36. *Agaricus pseudopratensis*.

Macrochemical reactions: not known.

Spores 5.0-7.0 × (3.5-)4.0-5.0 mm, on average 5.7-5.8 × 3.9-4.0 mm, Q = (1.35-)1.40-1.65(-1.75), Qav = 1.45, ellipsoid, sometimes oblong, without germ pore; basidia 4-spored; lamella edge almost sterile; cheilocystidia in short chains, with clavate terminal elements of 17-24 × (6-)8-12(-14) mm. Pileipellis a slightly irregular cutis of sometimes branched, 3.5-7.5 mm wide hyphae with cylindrical to somewhat inflated elements up to 9 µm wide, with parietal, pale brownish or yellowish pigment, gradually passing into pileitrama.

HABITAT & DISTR. – Solitary or in groups, saprotrophic, terrestrial in gardens, woods or along roadsides on sandy soil. Not in the Netherlands. Very rare in Europe, occurring in England, the Balkan area and mediterranean countries.

The above characteristics are extracted from the description by Bohus and notes accompanying collections from southern England. Var. *niveus* Bohus (in Annls hist.-nat. Mus. natn. hung. 72: 95. 1980) is distinguished from the typical variety by the smooth pileus, which remains white and does not break up into squames.

The species has not yet been recorded from the Netherlands, but the typical variety is known from southern England. The record from Sweden (Knudsen in Jordstjärnan 18: 36-39. 1997) is based on a misidentification (pers. comm. H. Knudsen, Copenhagen).

Because of the habit it can be confused with *A. pilatianus* or species in the sect. *Spissicaules*. It differs from sect. *Spissicaules* in the more sturdy annulus with thicker margin.

36. Agaricus moelleri Wasser in Nov. Sist. vyssh. nizsh. Rast. 13: 77. 1976. – Fig. 37.

Agaricus xanthodermus var. *obscuratus* Maire in Bull. trimest. Soc. mycol. Fr. 26: 192. 1910; *Psalliota meleagris* var. *obscurata* (Maire) F. Møller in Friesia 4: 173. 1952; *Agaricus meleagris* var. *terricolor* F. Møller in Friesia 4: 208. 1952 (nom. illeg.); *Agaricus praeclaresquamosus* var. *terricolor* (F. Møller) Bon & Cappelli in Doc. mycol. 13(52): 16. 1983. – *Psalliota meleagris* J. Schaeff. in Z. Pilzk. 4: 28. 1925; *Agaricus meleagris* (J. Schaeff.) Imbach in Mitt. naturf. Ges. Luzern 15: 15. 1946, non *A. meleagris* Sow. 1798; *Agaricus praeclaresquamosus* A.E. Freeman in Mycotaxon 8: 90. 1979 (superfluous); *Agaricus moelleri* var. *meleagris* (J. Schaeff.) Rauschert in Nova Hedwigia 54: 214. 1992

MISAPPL.– *Agaricus placomyces* sensu Mos., Röhrlinge Blätterpilze, 4. Aufl.: 234. 1978.

SEL. ICON.- Cappelli, Agaricus: pl. 62. 1984; J. Petersen in Svampe 28: fig. 7. 1993 (as *A. praeclaresquamosus*); R. Phillips, Paddest. Schimm.: 169. 1981 (as *A. meleagris*).

SEL. DESCR. & FIGS. – Cappelli, Agaricus: 325-332. 1984 (as *A. praeclaresquamosus*); F. Møller in Friesia 4: 172-173. 1952 (as *P. meleagris*).

VERN. NAME – Parelhoenchampignon.

Pileus (50-)60-120(-140) mm, at first convex, expanding to plano-convex to applanate, sometimes with depressed centre, mostly with umbo, with at first involute, later straight margin, densely covered with minute, appressed, brown to dark greyish brown fibrillose squamules on a white to later pale brown or light greyish brown background (Mu. 7.5 YR 8/2), at centre uniformly brown or yellowish brown to dark grey-brown or

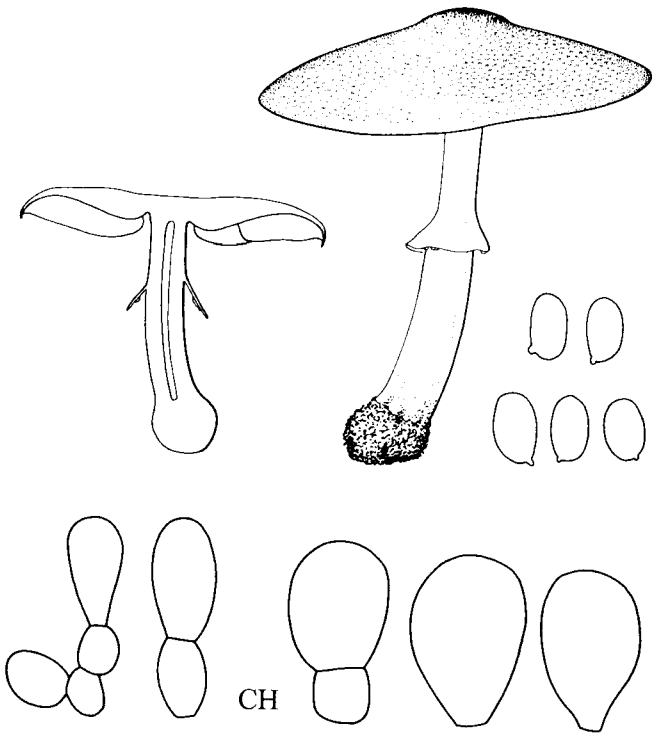

Fig. 37. *Agaricus moelleri*. (habit × ½).

blackish brown (5 YR 2.5/2, 7.5 YR 4/2, 10 YR 3/1-2, 4/3-3/2, 5/4), rarely slightly yellowing when rubbed; veil present when young as narrow white fringe at margin. Lamellae, L = 135-150, l = 1-3, crowded, free, segmentiform to subventricose, up to 10 mm broad, at first whitish to pale greyish pink, later pinkish brown to brown (7.5 YR 4/2-4, 10 YR 5/3), finally greyish chocolate-brown, with serrulate, whitish edge. Stipe (50-)60-115(-140) × 7-15(-18) mm, annulate, clavate to cylindrical with an abruptly bulbous base, at base up to 22 mm broad, straight to slightly curved near base, fistulose, dirty white, at base strongly yellowing on handling, sometimes only yellowish brown, later with pinkish brown spots, above annulus glabrous, shiny, smooth, sometimes finely striate, below annulus glabrous and smooth, at base slightly fibrillose, sometimes tomentose, sometimes with pseudorhiza. Annulus at 0.75 - 0.90 of height of stipe, 7-12 mm wide, descending, pending to slightly patent, thin to thick with mostly thickened margin, white, with smooth or often striate upperside; underside smooth to fibrillose, thickened near margin or, occasionally, with some radially arranged, sometimes brownish squames near the margin. Context 6-11 mm thick in pileus, white, slightly discolouring yellow when cut, later with pale reddish brown patches, especially in pileus, in base of stipe slightly to strongly chrome-yellow. Smell varying from weak to strong, unpleasant: like metal, ink, iodoform, carbolic. Taste slightly bitter or sour, unpleasant.

Macrochemical reactions: KOH 10% & 40% (bright) yellow (context of stipe; surface of pileus); Schaeffer-reaction negative (surface of pileus; surface of base of stipe).

Spores 4.5-6.5 × 3.0-4.0 mm, on average 5.4-5.6(-6.1) × 3.5-3.7 mm, Q = 1.40-1.90, Qav = 1.50-1.60(-1.70), ellipsoid to oblong, without germ pore. Basidia 14-20 × 4.5-6.5 mm, mostly 4-spored, occasionally a minority of 2-spored basidia present. Lamella edge with a 75-105 mm broad, almost sterile layer; cheilocystidia often in slightly agglutinated chains of subglobose elements of 6-14 × 5-8 mm, with globose to clavate, hyaline terminal elements of 11-23 × 7-15 mm, occasionally with brownish contents. Pileipellis a slightly irregular cutis of sometimes branched, 3.5-9.5(-17) mm wide hyphae with cylindrical to somewhat inflated elements, with slightly ascending, cylindrical terminal elements, gradually passing into pileitrama, with intracellular, pale brown pigment. Squames consisting of curved, 7.5-14.5 mm wide hyphae with 17-43 mm long elements and clavate, up to 14 mm wide terminal elements, with intracellular dark brown pigment. Stipitipellis a sometimes irregular cutis of occasionally gelatinized, 4.0-8.0 mm wide hyphae with frequently slightly inflated elements, and somewhat protruding, curved cylindrical terminal elements.

HABITAT & DISTR. – Usually gregarious, saprotrophic, terrestrial, in mixed deciduous woods on humus-rich, calcareous soil. Fairly common in the calcareous dunes and in southern Limburg, very rare in the rest of the Netherlands. May-Nov. Widespread but rare in Europe. Also recorded from the Americas. Asia and northern Africa.

This species has been confused in the past with the American species *A. placomyces* Peck. According to Freeman (in Mycotaxon 8: 90. 1979) the latter concerns a different species without cystidia.

The species was originally described by Schaeffer as having a usually black squamose, sometimes brown squamose, pileus covering. Møller described the dark variant as a new variety, var. *obscuratus*, based on *Agaricus xanthodermus* var. *obscurata* Maire, and changed it later into var. *terricolor*. The dark variant was for nomenclatural reasons renamed as *A. moelleri*, necessitating a new name for the brown variety, viz. var. *meleagris*.

In the Dutch specimens no two such forms could be recognized.

37. Agaricus phaeolepidotus (F. Møller) F. Møller in Friesia 4: 204. 1952. – Fig. 38.

Psalliota phaeolepidotus F. Møller in Friesia 4: 170-172. 1952. – *Agaricus meleagris* var. *perdicinus* Pilát in Acta Mus. nat. Prag. 7B (1): 108. 1951 (invalid); *Agaricus perdicinus* Pilát in Acta Mus. nat. Prag. 9B (2): 24. 1953.

SEL. ICON. – Cappelli, Agaricus: pl. 64. 1984; F. Møller in Friesia 4: pl. 20b. 1952; J. Petersen in Svampe 28: fig. 8. 1993.

SEL. DESCR. & FIGS. – F. Møller in Friesia 4: 170-172, pl. 32. 1952; Pilát in Acta Mus. nat. Prag. 9B (2): 24-28, fig. 30-34. 1953 (as *A. perdicinus*).

VERN. NAME – Hazelhoenchampignon.

Pileus 55-120 mm, at first truncately conical to convex, expanding to plano-convex, sometimes with slightly depressed centre or low umbo, with deflexed margin, at centre uniformly light brown to brown (Mu. 7.5 YR 5-6.5/4, 5.5/3, 6/4), sometimes reddish brown (2.5 YR 2.5/4), with appressed, pale brown fibrillose squames on a white to isabella

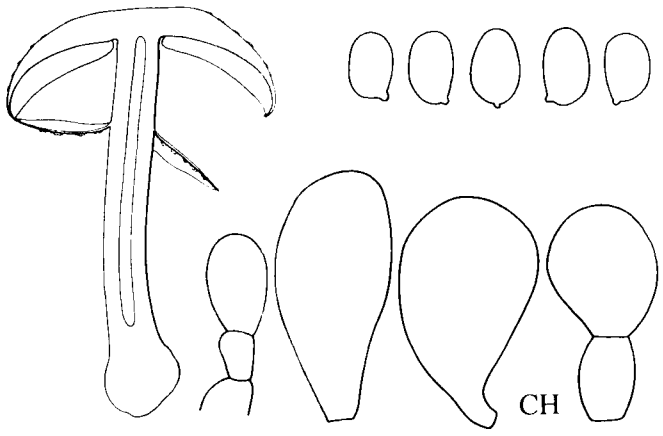

Fig. 38. *Agaricus phaeolepidotus*. (habit × ½).

background (7.5 YR 3/4, 8/2, 10 YR 6/4), towards margin more minutely squamulose-fibrillose, not discolouring on handling, finally at margin sometimes with pinkish tinge; veil sometimes present when young as pale, fibrillose squamules. Lamellae, L = (105-)135-160, l = 1-3, crowded, free, segmentiform to ventricose, 7-10 mm broad, at first pinkish white or pale pinkish grey (5 YR 8/2, 7/3), later dark brown to chocolate-brown (7.5 YR 4/2, 3/4), with entire to denticulate, often whitish edge. Stipe (45-)60-130 × 7-14 mm, annulate, cylindrical to clavate, often with bulbous base with flattened underside, at base up to 27 mm broad, straight to curved, fistulose, white, later with pale brown or pinkish grey tinges, especially at apex, brownish on scratching, sometimes pale yellow at base, above annulus silky, smooth, below annulus lengthwise fibrillose to satiny striate, shiny, smooth, at base sometimes with dispersed whitish fibrillose squames; sometimes with whitish rhizomorphs. Annulus at (0.65-)0.80-0.90 of height of stipe, 10-24 mm wide, descending, pending to slightly spreading, moderately thin, sometimes torn, white, sometimes discolouring yellow, with smooth to minutely striate upperside; underside with some, often brownish, rectangular, radially arranged squames at margin, occasionally arranged as cogwheel, often with brownish exudate. Context 7-8 mm thick in pileus, soft, white, not discolouring or turning slowly brownish in some patches when cut, in base of stipe at first pale yellow, sometimes hardly discolouring, later slightly brownish to whitish brown or brownish with pinkish tinge. Smell when cut clearly ink-like, to weakly carbolic, or like canned apple-sauce, disagreeable. Taste fungoid.

Macrochemical reactions: KOH 10% yellow to orange (especially at base of stipe; also often at surface and context); Schaeffer-reaction negative (at all parts of basidiocarp).

Spores 5.0-6.0 × 3.5-4.5 mm, on average 5.3-5.7 × 3.7-4.0 mm, Q = 1.30-1.70, Qav = 1.40-1.50, ellipsoid, sometimes oblong, without germ pore. Basidia 14-16 × 6.5-8.0 mm, 4-spored, sometimes with a few 2-spored basidia. Lamella edge with a 75-85 mm broad, almost sterile layer; cheilocystidia hyaline, in short chains of 2-3, broadly cylindrical to subglobose elements of 8.5-13.0 × 7.0-8.0 mm, with clavate, obovoid to globose or cylindrical terminal elements of 15-43 × (6.5-)8.0-20(-23) mm. Pileipellis a cutis of 4.5-6.5 mm wide hyphae with cylindrical, sometimes slightly inflated, hyaline elements, gradually passing into pileitrama. Squames consisting of interwoven, 5.5-9.5 mm wide hyphae with 25-52 mm long, inflated elements and ascending, cylindrical terminal elements, with parietal pale yellowish brown pigment, gradually passing into pileipellis. Stipitipellis a slightly gelatinized cutis of 4.5-9.0(-10.0) mm wide hyphae with cylindrical, slightly inflated elements.

HABITAT & DISTR. – Gregarious, saprotrophic, terrestrial in deciduous woods on nutrient-rich, calcareous clayey or sandy soil. Rare, predominantly in the river region, southern Limburg and the inner dune area. Aug.-Oct. Widespread, but rare in Europe. Also known from Asia and southern South America.

The description is partly based on collections from Denmark.

Sect. **Spissicaules** (Heinem.) Kerrigan

Pileus often slightly yellowing; annulus relatively thin, evanescent or relatively persistent, underside smooth or flocculose; base of stipe with yellowing rhizomorphs; context in base of stipe usually yellow, elsewhere usually faintly reddish.

KOH-reaction negative; Schaeffer-reaction on surface of pileus negative, usually orange on base of stipe.

Spores (broadly) ellipsoid to oblong, Qav (1.30-)1.35-1.60, without germ pore; lamella edge sterile or fertile; cheilocystidia either globose to clavate or inconspicuous (basidioliform), sometimes scarce.

38. Agaricus litoralis (Wak. & Pears.) Pilát, Klíč urč. Hub hřib. bedl.: 403. 1951. – Fig. 39.

Psalliota litoralis Wak. & Pears. in Trans. Br. mycol. Soc. 29: 206. 1946. – *Psalliota spissa* F. Møller in Friesia 4: 53. 1950; *Agaricus spissicaulis* F. Møller in Friesia 4: 203. 1952. – *Agaricus maskae* Pilát in Česká Mykol. 8: 165. 1954. – *Agaricus maskae* var. *imrehii* Bohus in Annls hist.-nat. Mus. natn. hung. 66: 83. 1974.

SEL. ICON.- Cappelli, Agaricus: pl. 37 (as *A. spissicaulis*), pl. 38 (as *A. maskae*). 1984; Daniel-Arranz in Bol. Soc. micol. Madrid 22: 148, fig. 5. 1997 (as *A. maskae*); F. Møller in Friesia 4: pl. 3b. 1950 (as *P. spissa*); Wasser in Fung. rar. Ic. col. 10: pl. 75. 1979 (as *A. spissicaulis*).

SEL. DESCR. & FIGS. – Cappelli, Agaricus: 454-456. 1984 (as *A. spissicaulis* and *A. maskae* resp.); F. Møller in Friesia 4: 53. 1950 (as *P. spissa*); Wasser in Fung. rar. Ic. col. 10: 7-8. 1979 (as *A. spissicaulis*).

VERN. NAME – Plompe champignon.

Pileus (50-)60-125(-135) mm, at first hemispherical to convex, expanding to irregularly convex or plano-convex, with flattened or sometimes depressed centre, with margin young incurved, later largely appendiculate and exceeding lamellae, whitish, greyish white or pale brown (Mu. 10 YR 6/3, 8/4, 9/2), occasionally with yellowish or brownish spots, often slightly yellowish (2.5 Y 8/4, 8/5; K. & W. 2A6) on handling, fibrillose, with often faintly delimited, large, light grey to greyish brown or yellowish brown appressed fibrillose squames at centre; veil present when young as whitish fringe or arachnoid flocks at margin, later as appendiculate remnants. Lamellae, L = 90-120, l = 1-3, moderately crowded, free, arcuate to undate, (5-)6-10 mm broad, at first pink or pinkish brown to pale brown with pinkish tinge or brownish grey (10 YR 5/3, 7/3), only later dark blackish brown (7.5 YR 4/2-3/2, 10 YR 2/1), with paler, entire edge. Stipe (25-)35-60(-70) × (11-)14-19(-23) mm, annulate, fusoid to irregularly cylindrical, tapering at base, at widest halfway up to 28 mm broad, slightly curved, stuffed to narrowly fistulose, white, at base occasionally faintly ochraceous, often with brownish tinge, sometimes finally entirely slightly browning on handling, above annulus minutely fibrillose-striate and sometimes greyish or brownish, below annulus merely fibrillose to lanate-fibrillose, with

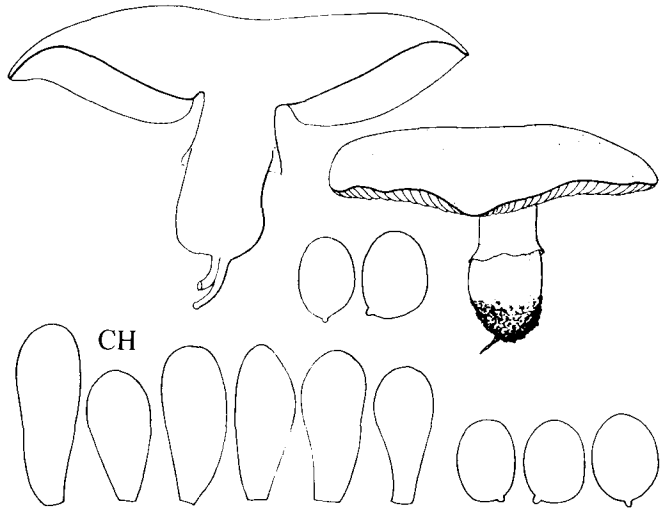

Fig. 39. *Agaricus litoralis*. (habit × ½).

1-3, thick, white, yellow discolouring (10 YR 8/8) rhizomorphs. Annulus at 0.50-0.60(-0.80) of height of stipe, 3-5 mm wide, descending, pending, thin, easily torn, simple, white, not discolouring, with smooth to slightly striate upperside; underside smooth to fibrillose. Context (8.5-)13-20(-24) mm thick in pileus, relatively firm, white, often with brownish tinge, sometimes with a reddish tinge, occasionally slowly and faintly discolouring to faintly pinkish brown to brownish-reddish or slightly orange-red, in base of stipe pinkish orange to brownish when cut, in pileus faintly brownish or greyish. Smell faint, often indistinct, sometimes like anise, of context when freshly cut slightly like almonds, later faintly unpleasant. Taste faintly like nuts.

Macrochemical reactions: KOH 10% negative (all parts); Schaeffer-reaction usually negative (surface of pileus and stipe), sometimes slightly orange (surface of pileus), or orange (surface of base of stipe; rhizomorphs).

Spores (6.5-)7.0-8.5 × (4.5-)5.0-6.5 mm, on average (7.1-)7.4-8.0 × (5.2-)5.5-5.8 mm, Q = (1.15-)1.20-1.55(-1.65), Qav = 1.35-1.45, ellipsoid to broadly ellipsoid, without germ pore. Basidia (21-)23-28(-31) × 7.0-10.0(-11) mm, usually 4-spored, sometimes also 2-spored present. Lamella edge not entirely sterile, usually composed of basidia and a minority of usually inconspicuous basidioliform clavate cheilocystidia of (14-)16.5-22(-28) × (4.5-)6-10(-13) µm; sometimes lamella edge almost sterile; rarely with conspicuous, clavate cheilocystidia up to 13 µm wide. Pileipellis a cutis of 4.0-5.5 mm wide hyphae with cylindrical elements, with slightly erect, clavate terminal elements of 18-24 × 5.5-6.5 µm, gradually passing into pileitrama, with pale yellow, parietal pigment. Stipitipellis a slightly irregular cutis of 3.0-6.5 mm wide hyphae with cylindrical elements, with curved, up to 8 mm wide, cylindrical terminal elements; with yellowish parietal pigment.

HABITAT & DISTR. – Solitary or in groups, saprotrophic, terrestrial, often in dry pastures, or lawns on sandy soil, in mossy areas in dry coastal dunes; sometimes along roads in grass. Widespread and rather rare in the Netherlands, June-Nov. Widespread and rare in Europe, probably more common in the Balkan area. Also known from North America and northern Africa.

Agaricus litoralis is considered synonymous with *A. maskae* and *A. spissicaulis*, on account of studies of the type and original material (Nauta in Persoonia 17: 227. 1999).

For an extensive discussion on the synonymy see Nauta (in Persoonia 17: 227. 1999).

39. Agaricus lanipes (Møller & Schaeff.) Sing. in Lilloa 22: 432. ('1949') 1951. – Fig. 40.

Psalliota lanipes Møller & Schaeff. in Annls mycol. 36: 65. 1938. – *Agaricus luteolorufescens* P.D. Orton in Trans. Br. mycol. Soc. 43: 182. 1960. – *Psalliota lanipes* var. *verecunda* F. Møller in Friesia 4: 26. 1950; *Agaricus lanipes* var. *verecundus* (F. Møller) F. Møller in Friesia 4: 203. 1952.

SEL. ICON.- Cappelli, Agaricus: pl. 23. 1984; Cappelli in Boll. Gruppo micol. G. Bres. 26: 24. 1983.

SEL. DESCR. & FIGS. – Cappelli, Agaricus: 188-189. 1984; F. Møller in Friesia 4: 25-26, pl. 10. 1950; Nauta in Persoonia 17: 222-224, fig. 1. 1999.

VERN. NAME – Breedschubbige champignon.

Pileus 50-100(-140) mm, at first convex, expanding to plano-convex, often with depressed centre, with margin exceeding lamellae, when young evenly brown and fibrillose, soon in centre densely dark brown fibrillose-squamose (Mu. 6 YR 5/3, 7.5 YR 5/4, 10 YR 3-4/2), towards margin with broad, appressed, fibrillose, brown to yellowish brown squames (6 YR 4-5/3, 10 YR 4-7/4, 6/3) on a paler background, not

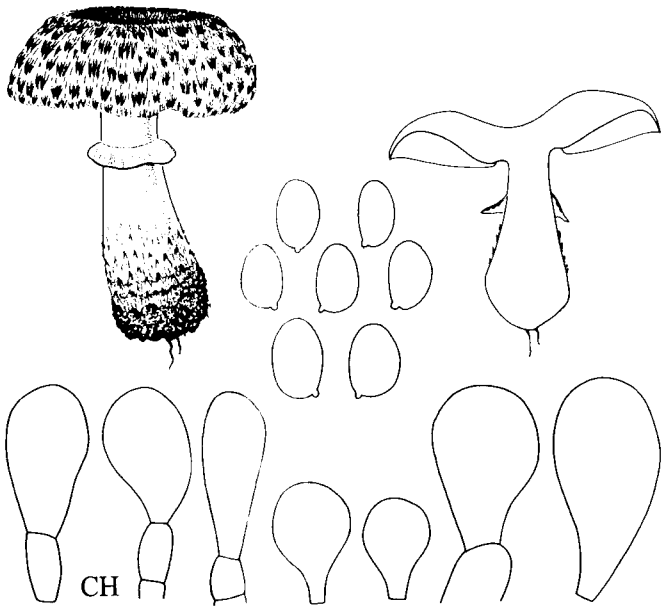

Fig. 40. *Agaricus lanipes*. (habit × ½).

discolouring on handling; veil present when young as whitish appendiculate fringe. Lamellae, L = 80-120, l = 1-5, crowded, free, subventricose to undate, up to 9.5 mm broad, at first beige to pinkish grey (2.5 YR 6/3, 7.5 YR 7/2-4, 10 YR 7/3), later blackish brown (7.5 YR 3/2, 4/2), with whitish serrulate to denticulate edge. Stipe 40-70(-85) × (8-)10-18 mm, annulate, broadly clavate, at base up to 29 mm broad, straight to slightly curved, stuffed, often yellow or brownish yellow at base on handling, sometimes slowly pale brownish red on scratching, usually elsewhere not discolouring on handling, above annulus white to later greyish, smooth to very minutely squamulose, below annulus velutinous or fibrillose to floccose, whitish, towards base usually with some girdles of brownish, fibrillose, appressed squames, often at base smooth again; sometimes entire surface of stipe brownish (5 YR 6/3, 7/3; 7.5 YR 6/4, 10 YR 6/3); usually with one or a few short to long whitish, yellowing rhizomorphs. Annulus at (0.60-)0.70-0.75 of height of stipe, (5-)10-18 mm wide, descending, slightly spreading to patent, thin, relatively persistent, whitish to yellowish brown (10 YR 6/4), with smooth to striate upperside; underside floccose to squamose or lanate. Context 6-9 mm thick in pileus, whitish to pale brown, hardly discolouring to discolouring slowly and slightly reddish or brown when cut in upper part of stipe and pileus, occasionally yellowish in base of stipe. Smell like nuts to somewhat like almonds when cut, especially in base of stipe. Taste not known.

Macrochemical reactions: KOH 10% negative (surface of pileus) or yellowish (base of stipe), NaOH negative (surface of pileus) or brownish to yellowish (context in base of stipe); Schaeffer-reaction negative (surface of pileus and stipe) or sometimes orange (surface of base of stipe), usually in connection with a yellow discoloration there.

Spores 5.5-8.0 × 3.5-5.5 mm, on average (5.8-)6.6-7.1 × (3.6-)4.4-4.7(-5.0) mm, Q = 1.30-1.75(-2.00), Qav = (1.40-)1.45-1.60, ellipsoid to oblong, without germ pore. Basidia 16-17.5 × 5.5-6.5 mm, usually 4-spored, often some 2-spored also present. Lamella edge with a 75-80 mm broad sterile layer; cheilocystidia usually in short chains of more or less rounded rectangular elements of 9-13 × 6 mm, with globose to clavate hyaline terminal elements of (12-)14-30 × 9-16(-22) mm. Pileipellis a cutis of 4.0-9.5 mm wide hyphae with cylindrical, slightly inflated elements, gradually passing into pileitrama and into squames,

with parietal pigment; squames consisting of curved, up to 11 mm wide hyphae with 25-35 mm long elements, sometimes with slightly thickened walls, and cylindrical, up to 11 mm wide terminal elements, with parietal pigment. Stipitipellis a cutis of slightly gelatinized, 3.5-4.5 mm wide hyphae with cylindrical elements with parietal pigment; squames consisting of curved, 4.5-6.5 mm wide hyphae with 12-28.5 mm long, slightly inflated elements and slightly clavate, up to 11 mm wide terminal elements, with parietal and sometimes intracellular pigment.

HABITAT & DISTR. – Gregarious to sometimes caespitose, saprotrophic, terrestrial in mixed woods or gardens on nutrient-rich sandy or clayey soil. Rather rare in the Netherlands, restricted to regions on nutrient-rich soil as the new polders, southern Limburg, river region and the western part of the country. Aug.- Oct. Rare but widespread in the rest of Europe.

Møller (in Friesia 4: 26. 1950) described var. *verecunda* as differing from the typical variety in the more gracile habit with a pileus up to 8 cm in diameter, the more diluted brown squames, the stipe with pale squames instead of brownish below the ring, and the annulus which is completely white at the underside. These characters are not considered sufficient for distinguishing a taxon, therefore the name is included in the synonyms.

Agaricus luteolorufescens appeared to be conspecific with *A. lanipes* (Nauta in Persoonia 17: 224. 1999). *Agaricus vinosobrunneus* P.D. Orton (in Trans. Br. mycol. Soc. 43: 183. 1960) is, according to Orton, closely related to *A. lanipes*, but proved to be conspecific with *A. sylvaticus*.

40. Agaricus bresadolanus Bohus in Annls hist.-nat. Mus. natn. hung. 61: 154. 1969 (as *A. bresadolanus*). – Fig. 41.

Agaricus campestris b *radicatus* Vitt., Descr. Funghi mang. Italia: 42. 1835; *Agaricus radicatus* (Vitt.) Romagn. in Bull. trimest. Soc. mycol. Fr. 53: 129. 1938, non *A. radicatus* Relh. 1785:Fr.; *Agaricus romagnesii* Wasser in Ukr. bot. Zh. 34: 305. 1977. – *Psalliota infida* Alessio in Micol. ital. 4(2): 21. 1975 (invalid); *Agaricus infidus* (Alessio) M. Bon in Doc. mycol. 11(44): 28. 1981 (invalid); *A. romagnesii* var. *infidus* (Alessio) Bon & Cappelli in Doc. mycol. 13(52): 16. 1983 (invalid).

SEL. ICON. – Cappelli, Agaricus: pl. 14, 70 (as *A. romagnesii*). 1984; Cappelli in Boll. Gruppo micol. G. Bres. 28: 184. 1985 (as *A. romagnesii*); D. Reid in Fung. rar. Ic. col. 6: pl. 42. 1972.

SEL. DESCR. & FIGS. – D. Reid in Fung. rar. Ic. col. 6: 6-8, fig. 9. 1972; Nauta in Persoonia 17: 228, fig. 4. 1999.

VERN. NAME – Wortelende champignon.

Pileus 35-85(-100) mm, convex to plano-convex, sometimes with depressed centre, at first white, later greyish white with light brown centre (Mu. 10 YR 5/3, 6/5), fibrillose, later at centre with indistinct darker greyish brown, lanate squames; slightly yellowing on handling, later with yellowish spots; veil present when young as appendiculate fringe, later disappearing. Lamellae, L = 80-95, l = 1-3, crowded, free, up to 10 mm broad, at first greyish pink, finally blackish brown, with concolorous, entire edge. Stipe 30-70(-80) × 7.5-16(-20) mm, annulate, clavate to cylindrical with bulbous base, at base up to 30 mm broad, stuffed, straight, white, discolouring yellow to yellowish brown at base, above annulus striate, below annulus fibrillose to fibrillose-squamulose, with thick yellowing pseudorhiza. Annulus at 0.65-0.75 of height of stipe, narrow, c. 3 mm wide, descending, pending, simple, thin, often evanescent, white, with striate upperside; underside smooth. Context 6-11 mm thick in pileus, white, discolouring faintly reddish when cut, in base of stipe faintly yellow. Smell indistinct or sometimes faintly like iodine. Taste not known.

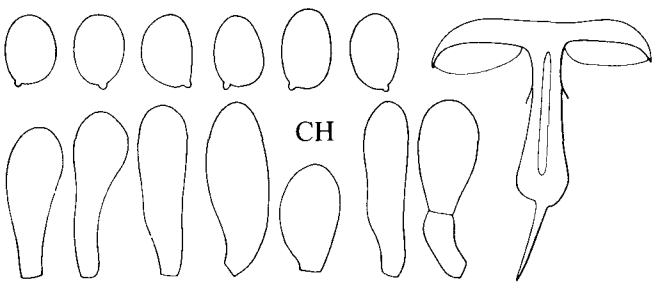

Fig. 41. *Agaricus bresadolanus*. (habit × ½).

Macrochemical reactions: Schaeffer-reaction negative (surface of pileus), orange (surface of base of stipe).

Spores 5.5-7.5 × 4.0-5.0(-5.5) mm, on average 6.0-6.7 × 4.2-4.7 mm, Q = 1.20-1.65(-1.75), Qav = (1.30-)1.40-1.50, ellipsoid, sometimes broadly ellipsoid or oblong, without germ pore. Basidia 17-25 × 7.0-9.0 mm, 4-spored, sometimes some 2-spored. Lamella edge usually fertile, with a variable amount of sterile elements; cheilocystidia usually inconspicuous and resembling young basidia, 13-25 × 7-11(-13) mm, usually clavate, rarely more globose, sometimes in very short chains of rectangular elements of 3.5-7.0 × 3.0-5.0 µm, hyaline, rarely with faintly brownish contents. Pileipellis a regular cutis of radially arranged, 4.5-7.0 mm wide hyphae with cylindrical, sometimes inflated up to 8.5 µm, elements, with clavate, slightly ascending terminal elements, gradually passing into pileitrama, with parietal pale yellow pigment. Stipitipellis a cutis of sometimes curved, 4-8.5 mm wide hyphae with cylindrical elements, with pale yellow, parietal pigment.

HABITAT & DISTR. – Solitary or in small groups, saprotrophic, terrestrial along paths or on grassy spots in deciduous woods or in gardens, sometimes in meadows on nutrient-rich and calcareous soil. Rare in the Netherlands, Apr., Aug.-Nov. Rare in the rest of Europe, probably not occurring in northern Europe. Also recorded from Asia.

The description is based on collections from Great Britain, Hungary, the Netherlands and the type description by Bohus.

For a discussion on the synonymy see Nauta (in Persoonia 17: 229. 1999).

Subgen. **Lanagaricus** Heinem. emend. A.E. Freeman

Veil composed of hyphae with mainly inflated elements up to 11 µm wide, intermixed with loosely connected subglobose elements of 10-20 × 10-17 µm.

The division of *Agaricus* into subgenera requires further study, preferably of morphological and molecular characters. The interpretation of Freeman (in Mycotaxon 8: 72. 1979) may not be the same as Heinemann's. The subgenus is mainly confined to the tropics. The species described below differs so strikingly in the characters of the veil from the other species found in the Netherlands, that it is tentatively placed in subgen. *Lanagaricus*, awaiting further research. It is most closely related to representatives of sect. *Laeticolores* Heinem.

41. Agaricus rufotegulis Nauta in Persoonia 17: 230. 1999. – Fig. 42.

SEL. ICON. – Nauta in Persoonia 17: 335. 1999.

SEL. DESCR. & FIGS. – Nauta in Persoonia 17: 231-232. 1999.

VERN. NAME – Bladhoopchampignon.

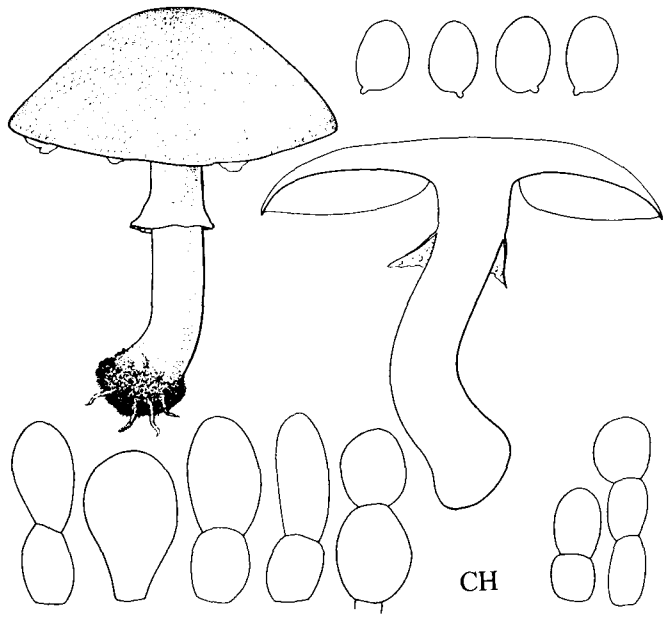

Fig. 42. *Agaricus rufotegulis*. (habit × ½).

Pileus 80-115 mm, at first hemispherical, expanding to slightly irregularly convex with sometimes a depressed centre, with margin exceeding lamellae, young reddish brown (Mu. 5 YR 4/4 diluted), covered with fibrillose squamules, later at centre reddish brown, otherwise densely covered with reddish brown to brown fibrillose squamules on paler background, not discolouring to becoming slightly copper-coloured on handling; veil for a long time connecting pileus and stipe, later present as white fringe at margin of pileus. Lamellae, L = 140-180, l = 1-5, crowded, free, subventricose, up to 10 mm broad, at first pale pinkish brown, later darker, with slightly paler, entire edge. Stipe 60-95 × 12-23 mm, with broad annulus or without annulus, cylindrical to subclavate, young subbulbous, at base up to 25 mm broad, straight to curved, stuffed, white, at base yellowish when scratched, pruinose to minutely squamulose, usually with more or less yellowing, relatively thick rhizomorphs. Annulus at 0.75-0.85 of height of stipe, up to 25 mm wide, descending, pending to slightly spreading, for a long time partly attached to pileus, often evanescent, white, with smooth upperside; underside with numerous often brownish floccose squames. Context 7-10 mm thick in pileus, white, not discolouring when cut, except for a yellowish discoloration in base of stipe. Smell slightly like almonds or anise when cut, sometimes unpleasant. Taste not known.

Macrochemical reactions: Schaeffer-reaction yellowish (surface of pileus) to orange (surface of base of stipe).

Spores 5.0-6.5 × 3.5-5.0 mm, on average 5.7-6.1 × 4.1-4.6 mm, Q = 1.15-1.65, Qav = 1.30-1.45, broadly ellipsoid, without germ pore. Basidia 18-24 × 7.0-8.5 mm, 4-spored. Lamella edge with a 45-50 mm broad sterile layer; cheilocystidia in chains of rounded rectangular to globose elements of 7-12 × 4.5-11 mm, with globose to clavate terminal elements of 9-21 × (6-)8-13 mm. Pileipellis a cutis, pro parte a transition to a trichoderm, of radially arranged, 4.0-8.0 mm wide hyphae with cylindrical and often inflated elements of 16-47 × 11-19 mm, with slightly ascending clavate terminal elements of 20-40 × 20-23 µm, gradually passing into pileitrama, with pale yellow, parietal pigment. Stipitipellis a regular, slightly gelatinized cutis of 4.5-7.5 mm wide hyphae with cylindrical, sometimes slightly inflated elements, with pale yellow, parietal pigment, below annulus intermixed or partly covered with clusters of loosely connected, subglobose elements of 10-20 × 10-17 mm.

HABITAT & DISTR. – Gregarious on heaps of rotting dead leaves in deciduous woods. Very rare in the Netherlands, only known from the type locality (Amersfoort); June-Aug. Also known from one locality in southern England, Aug.-Nov.

The above description is also based on material from England.

2. **Allopsalliota** Nauta & Bas

MARIJKE M. NAUTA

Agaricus sect. *Magici* Bas & Heinem. in Persoonia 13: 113. 1986; *Allopsalliota* Nauta & Bas, in Belg. J. Bot. 131: 189. ('1998') 1999.

SELECTED LITERATURE – Bas & Heinem. in Persoonia 13: 113-121. 1986; Nauta in Belg. J. Bot. 131: 181-190. ('1998') 1999.

Basidiocarps collybioid, large, firm; pileus fleshy, usually fibrillose-squamose; lamellae free, crowded, relatively narrow, pale brown, finally reddish brown, blackening on drying; stipe thick, with remnants of general veil in form of girdles or squames on lower half; context whitish, soon brightly yellow, then slowly vinaceous; spore print reddish brown.

Macrochemical reactions: ammonia green (context); Schaeffer-reaction purple (surface of pileus, stipe).

Spores ellipsoid or oblong to amygdaliform, microscopically yellowish brown in KOH, pale brown to brown in water and ammonia, weakly dextrinoid, congophilous and cyanophilous when young, thick-walled, with apically thickened endospore, smooth, minutely roughened as observed with S.E.M.; pleurocystidia absent; lamella edge sterile; cheilocystidia not in chains, clustered, long, lageniform with capitate apex; hymenophoral trama regular; clamp-connections lacking in all tissues. Development probably monovelangiocarpic, isocarpic or hymenocarpic. – Holotype species: *Agaricus geesterani* Bas & Heinem.

HABITAT & DISTRIBUTION – Saprotrophic, terrestrial in woods and roadside verges, on nutrient-rich soil. Known from The Netherlands, Germany and Israel.

The genus has been created to accommodate *Agaricus geesterani* Bas & Heinem., which is at present the only known species in the genus. This species macroscopically resembles species of *Agaricus*, but is aberrant among other respects in the macrochemical reactions. Microscopically it is more similar to representatives of the tropical genus *Micropsalliota* Höhn. For a more detailed discussion of the differences and similarities of this genus and the genera *Agaricus* and *Micropsalliota* see Nauta (in Belg. J. Bot. 131: 181-190. ('1998') 1999).

1. **Allopsalliota geesterani** (Bas & Heinem.) Nauta & Bas in Belg. J. Bot. 131: 189. ('1998') 1999. – Fig. 43.

Agaricus geesterani Bas & Heinem. in Persoonia 13: 114. 1986.

SEL. ICON. – Bas & Heinem. in Persoonia 13: 121. 1986; Chrispijn, Champ. Jordaan: 68. 1999.

SEL. DESCR. & FIGS. – Bas & Heinem. in Persoonia 13: 114-117. 1986; Bender in Z. Pilzk. 60: 19-20. 1994: Nauta in Belg. J. Bot. 131: 182-183. ('1998') 1999.

VERN. NAME – Toverchampignon.

Basidiocarps developed almost subterranean, in late stage appearing. Pileus (70-)90-150 mm, at first (irregularly) hemispherical to convex, expanding to convex or broadly truncately conical with depressed centre, with irregularly involute margin, later straight, at first whitish, soon reddening, finally becoming reddish brown (Mu. 5 YR 6/4, 5/6, 2.5 YR 4-5/4, 10 R 4/3), often covered with adhering soil, young fibrillose, later often with fibrillose appressed squames. Lamellae, L = 160-200, l = 0-3, crowded, segmentiform, free, up to 6 mm broad, at first pale yellowish brown (10 YR 7/4), later pinkish brown, finally reddish brown (5 YR 4/4-6), with whitish, slightly denticulate edge. Stipe (55-)90-180 × 22-40 mm, irregularly cylindrical to slightly enlarged at base, usually slightly curved, stuffed, white at first, later with pinkish brown tinges, without annulus, fibrillose to squamose with reddish brown squames, lower part often covered with veil girdles; base frequently covered with velar sock; often rooting in soil. Context 20-30 mm thick in pileus, firm, white, immediately bright yellow when cut, after some minutes slowly turning vinaceous red. Smell indistinct to faintly pleasant. Taste indistinct. Spore print reddish grey to reddish brown (5 YR 4/ 2-3).

Macrochemical reactions: ammonia green (context); KOH 5-30% greyish to brownish (context; Bas & Heinem., in Persoonia 13: 116. 1986); Schaeffer-reaction purple to dark pink (surface of pileus, stipe).

Spores 7.0-9.5(-10.0) × 4.5-6.0 µm, on average (7.5-)8.0-8.3(-8.7) × 5.0-5.5 µm, Q = 1.35-1.70(-1.80), Qav = 1.50, ellipsoid or oblong to amygdaliform, without germ pore, with apically thickened endospore. Basidia 27-35 × 6.0-8.0 µm, in majority 4-spored, often in part 2 - spored. Lamella edge sterile; cheilocystidia tufted, not in chains, (40-)50-90 × (4.0-)5.5-7.5(-10.5) µm, with (2.0-)2.5-4.0(-4.5) µm wide neck and (4.0-)5.0-6.5 µm wide apex, filiform to lageniform with capitate apex, near margin of pileus irregularly shaped and up to 40 µm long, hyaline or with yellowish parietal or intracellular pigment. Pileipellis a cutis of radially arranged, sometimes interwoven, (4.5-)6.5-16.0 µm wide hyphae with cylindrical elements, with slightly ascending, occasionally differentiated terminal elements, with usually

intracellular yellowish brown pigment, in upper layer frequently with encrusting yellow-brown pigment. Pileocystidia clavate to lageniform or narrowly utriform, 15-30 μm long. Trama of pileus often with some, relatively thick-walled, 5.0-13 μm wide, scarcely septate hyphae with yellow, oleiferous contents. Stipitipellis a regular cutis of 3.0-15 μm wide hyphae with cylindrical elements with intracellular yellowish pigment. Veil on stipe consisting of curved, interwoven, 4.0-11 μm wide hyphae with slightly inflated elements, and irregularly shaped, usually slightly ascending, up to 14 μm wide terminal elements.

HABITAT & DISTR. – In groups, saprotrophic, terrestrial in mixed deciduous woods and verges of roads on nutrient-rich clayey or sandy soil. Usually on slightly disturbed places. Mainly in Flevoland and the peat region in the western part of the country, occasionally elsewhere, apparently spreading. July-Nov. Also recorded from Germany (Nordrhein-Westfalen) and Israel.

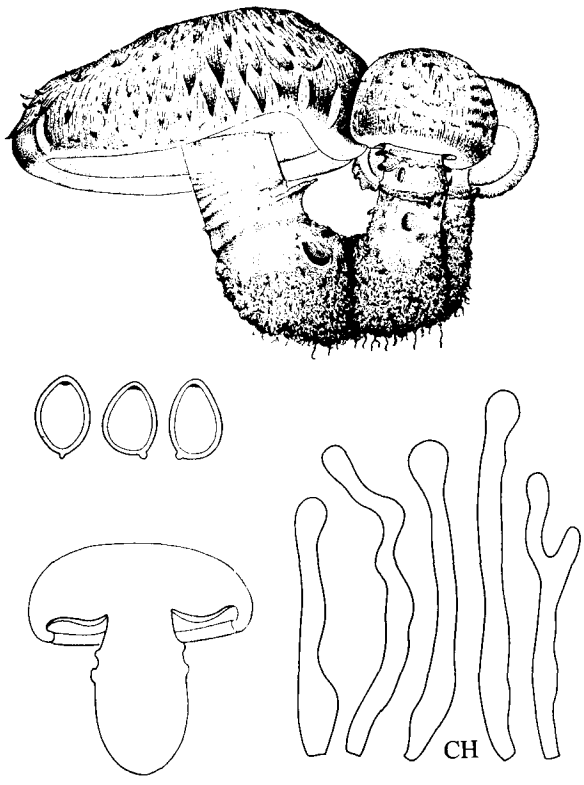

Fig. 43. *Allopsalliota geesterani*. (habit × ½).

3. **Macrolepiota** Sing.

ELSE C. VELLINGA
WITH COLLABORATION OF R.P.J. DE KOK

Macrolepiota Sing. in Papers Mich. Acad. Sc. Arts Letters 32: 141. ('1946') 1948.

SELECTED LITERATURE – M. Bon, Fl. mycol. Eur. 3, Lépiotes: 116-125. 1993; Candusso & Lanzoni, Lepiota: 505-593. 1990; Migl. in Boll. Gruppo micol. G. Bres., n.S. 38: 131-148. 1995.

Basidiocarp pluteoid, with stipe protruding into pileus context, relatively big; pileus with coarse squames to fine granulose squamules; lamellae free and remote from stipe; stipe often with bulbous base; annulus present, in most species made up of partial veil and universal veil; spore print white, cream, or pink.

Spores thick-walled, binucleate, dextrinoid, congophilous, cyanophilous, metachromatic in Cresyl Blue, with walls swelling in ammonia ($NH_{3(aq)}$) and acetic acid ($CH_3COOH_{(aq)}$), with germ pore, with or without hyaline cap over germ pore, glabrous; cheilocystidia always present; pleurocystidia absent; hymenophoral trama trabecular; velum universale on pileus trichodermal or hymenidermal; clamp-connections in most species present, but very often rare and difficult to find. Development bivelangiocarpic, and pileocarpic. – Type species *Macrolepiota procera* (Scop.: Fr.) Sing.

HABITAT & DISTRIBUTION – Gregarious, in fairy rings, saprotrophic, terrestrial, in grasslands, deciduous and coniferous woods and plantations, on roadsides and in nutrient-rich places like compost heaps and landfills. Widespread and world-wide, though absent from arctic and high-alpine habitats.

The genus *Macrolepiota* consists of two groups of species, one characterized by a glabrous stipe, relatively small spores without a hyaline cap over the germ pore and narrowly clavate, tightly packed elements in the pileus covering, and the other by a banded-squamulose or granulose stipe, a hyaline cap over the germ pore and a more loosely arranged trichodermal pileus covering, made up of cylindrical elements. Within those two sections, several well-defined species complexes can easily be recognized: *M. rachodes*-group, *M. procera*-group and *M. mastoidea* and allies; to determine individual species within the complexes, is much more difficult.

The presence or absence of clamp-connections is often difficult to determine. For that reason it is only used as an additional character in the key.

The neutral term 'pileus covering' is used for the covering layers of the pileus, not taking into account their origin.

Some species may cause gastrointestinal problems; many are considered excellent edibles, though individual reactions to them vary greatly.

KEY TO THE SPECIES

1. Stipe with granules, squamulose zig-zag bands, either concolorous with background, or contrasting in colour
   2. Stipe covering not or hardly contrasting with background; pileus with granular squamules or patches or a star-shaped patch covering most of the surface
      3. Annulus thin and simple, white; pileus (pale) brown at centre, pale buff to cream around centre, with a pale star-shaped pattern on whitish background; stipe covering indistinct; clamp-connections often present at base of basidia ..... **5. M. excoriata**
      3. Annulus thick, often with double crown, but upper part not always well developed, with coloured patches on underside; pileus colour variable, with granular aspect, which may form a star-shaped pattern on whitish background; stipe with a banded pattern; clamp-connections rarely present at base of basidia .. **4. M. mastoidea**
   2. Stipe covering dark, brown or greyish; pileus either with a dark brown granulose, patchy covering, or with distinct squames and squamules on top of a radially fibrillose background
      4. Pileus brown granulose, and overall pattern either star-shaped or more irregularly patchy ... **4. M. mastoidea**
      4. Pileus with distinct squames and squamules lying on top of or at the end of radially oriented fibrils

5. Pileus greyish brown to pale beige, strongly radially fibrillose, with loose-lying grey-brown patches of universal veil around centre ..... **3. M. fuliginosa**
5. Pileus with brown to vinaceous brown squamules on pale background, around central calotte with concentrically arranged small squames, at the end of short fibrils
6. Pileus and stipe with brown squamules on whitish background; stipe not reddening on scratching **1. M. procera**
6. Pileus and stipe with dark brown squamules with reddish, vinaceous tinges; stipe becoming red when scratched ..... **2. M. permixta**

1. Stipe smooth, without granules, bands etc.
7. Lamellae and spores of mature specimens green; spores with wide truncate apex **Chlorophyllum molybdites**
7. Lamellae and spores not changing colour with aging; spores with narrow truncate or rounded apex
8. Annulus thin and simple, not thickened with a double edge
9. Pileus pale brown to whitish, with star-shaped granular to slightly squamulose covering on whitish background; spores 11.0-16.0 × (6.5-)7.5-10.5 µm, with rounded apex with hyaline cap over germ pore **5. M. excoriata**
9. Pileus whitish with coarse brown squames; spores 9.5-11.5 × 6.5-8.0 µm, with truncate apex, without hyaline cap ..... **8. M. venenata**
8. Annulus thickened, with double edge (crown), consisting of tissue of the velum universale on the underside, and of the velum partiale fringed on the upperside
10. Stipe context becoming pale brown on exposure; pileus covering with ascending hyphae with loosely arranged terminal, brown, cylindrical elements; cheilocystidia lageniform to narrowly clavate with apical excrescence, colourless; spores with translucent cap on germ pore; clamp-connections absent **Leucoagaricus nympharum**
10. Stipe context discolouring orange-red when cut; pileus covering (velum patches) trichodermal with closely packed, narrowly clavate, terminal elements; cheilocystidia clavate, narrowly clavate or spheropedunculate, often with brown intracellular pigment; spores without translucent cap on germ pore; clamp-connections present at the base of basidia
11. Pileus with contrasting velar squames (brown on white to cream often fibrillose background); spores on average 9.8-11.1 × 6.3-7.7 µm ..... **6. M. rachodes**
11. Pileus squames (velar patches) not contrasting in colour with background fibrils, equally brown or grey-brown in colour; spores on average 8.7-10.0 × 5.8-6.6 µm ..... **7. M. olivieri**

Sect. **Macrolepiota**

Stipe with squamulose or granulose covering; those squamules arranged in bands or girdles, or irregular patches; spores with hyaline cap over germ pore.

1. Macrolepiota procera (Scop.: Fr.) Sing. in Papers Mich. Acad. Sci., Arts Letters 32: 141. 1946. – Fig. 44.

Agaricus procerus Scop., Fl. carn. 2: 418. 1772; *Agaricus procerus* Scop.: Fr., Syst. mycol. 1: 20. 1821; *Lepiota procera* (Scop.: Fr.) S.F. Gray, Nat. Arr. Brit. Pl. 1: 601. 1821; *Mastocephalus procerus* (Scop.: Fr.) Pat., Essai tax. Hym.: 171. 1900; *Lepiotophyllum procerum* (Scop.: Fr.) Locq. in Bull. mens. Soc. linn. Lyon 11: 40. 1942.

EXCL. – *Lepiota procera* sensu Clel., Toadst. Mushr. South Australia: 54. 1935 (= *Macrolepiota clelandii*); *Lepiota procera* sensu Lincoff, Field Guide N. Amer. Mushr.: pl. 172. 1981 (= *Macrolepiota* spec.).

SEL. ICON. – Breitenb. & Kränzl., Pilze Schweiz 4: pl. 254. 1995; Candusso & Lanzoni, Lepiota: pl. 63. 1990; Cetto, Gr. Pilzf., 6. Aufl., 1: pl. 20. 1980; Dähncke, 1200 Pilze: 521. 1993; J. Lange, Fl. agar. dan. 1: pl. 8b. 1935; Migl. in Riv. Micol. 41 (4): back cover. ('1998') 1999; R. Phillips, Paddest. Schimm.: 24. 1981.

SEL. DESCR. & FIGS. – Breitenb. & Kränzl., Pilze Schweiz 4: 218. 1995; Candusso & Lanzoni, Lepiota: 510-512, fig. 113. 1990 (as *M. procera* var. *procera*); Horak in Syn. Gen. Agar.: 363-365. 1968.

VERN. NAME – Grote parasolzwam.

Pileus c. 100-200(-300) mm, when young more or less paraboloid, expanding via campanulate and convex with low umbo to applanate with deflexed margin and low umbo, when very young with completely closed, felted, brown (Mu. 7.5 YR 6-5/4) to pale brown (10 YR 8-7/4) at margin covering; this covering breaks open, leaving a central calotte, and squamules around it; in mature specimen central part c. 30-50 mm in diameter, felted, dark brown (10 YR 4-3/4-6, 7.5 YR 4/6), around central patch first concentrical, small squamular patches, concolorous with calotte, not or slightly uplifted, towards margin bigger and paler brown patches, at the uplifted tips of the cream to pale brown, radially fibrillose-squamose background; in marginal zone only radial fibrils present; margin fringed, whitish cream, exceeding lamellae. Lamellae, L = 120-160, l = 0-3, moderately crowded, free, remote from stipe, subventricose, 8-12 mm broad, white, later creamy brown, with white floccose edge (visible without lens). Stipe c. 100-400 × 10-20 mm, widened at base to a rounded bulb of 25-50 mm wide, cylindrical and slightly widening downwards, hollow, in young specimens dark grey-brown (10 YR 5/3) with very small 'patches' on white background; in older specimens brownish (c. 10 YR 7/4) and with adnate zig-zag bands or adnate squamulose girdles over whole length, but vaguer and less contrasting at apex than in middle part, on whitish background; bulb white tomentose; surface when scratched not or slightly and slowly discolouring yellow. Annulus movable with age, complex, thickened with a broad edge (double crown), upperside creamy and fringed; underside brown as calotte. Context thick in pileus, c. 15 mm high, white and dull, buff-coloured in stipe; stipe protruding into pileus; sometimes slightly

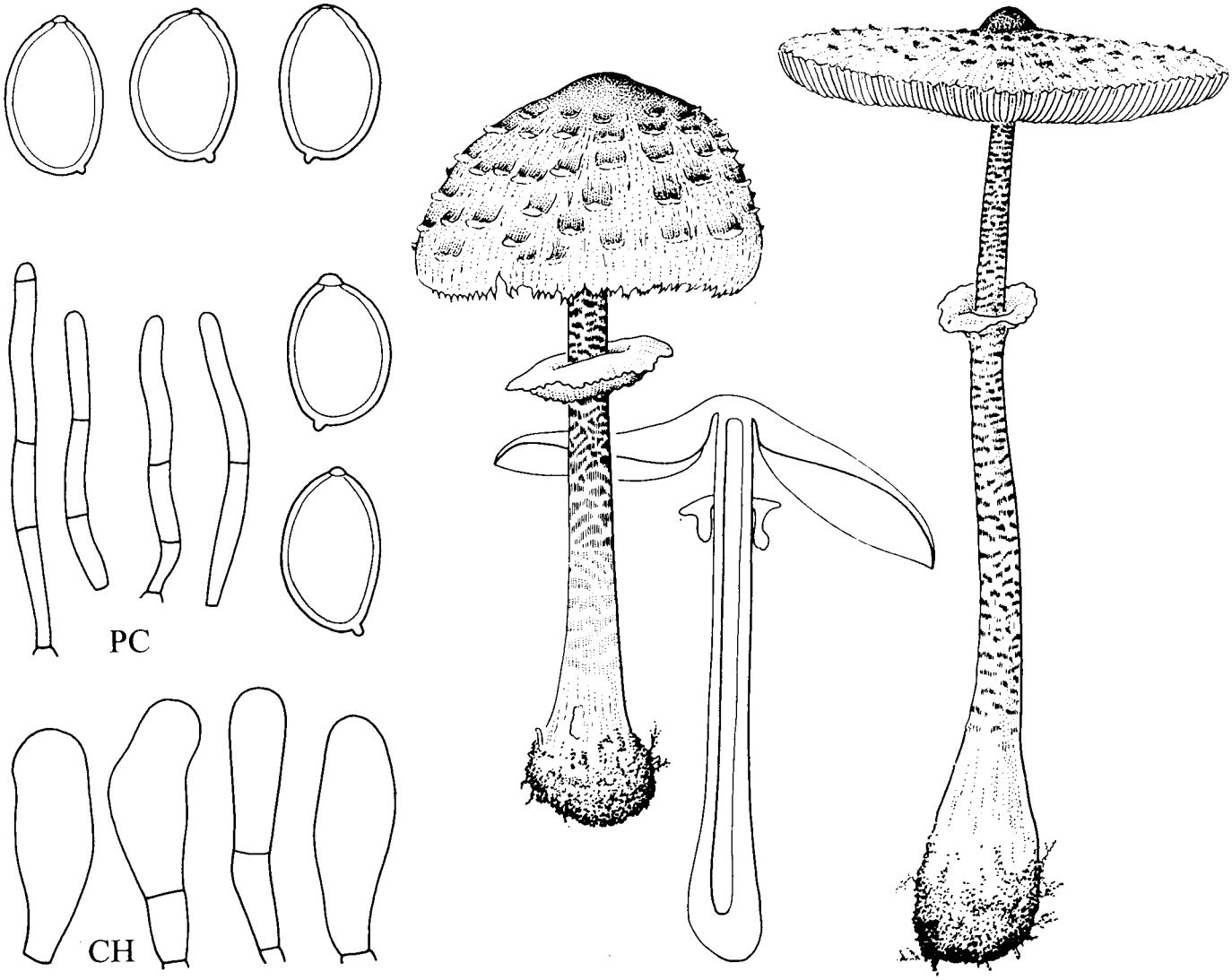

Fig. 44. *Macrolepiota procera.*

discolouring to yellowish red (5 YR 5/6), especially in stipe. Smell indistinct, a bit nutty fungoid, sometimes spermatic. Taste none to fungoid. Spore print pink (Breitenbach & Kränzlin, Pilze Schweiz 4: pl. 254. 1995), but white according to other authors.

Spores 12.5-16.5 × (7.5-)8.0-11.0 µm, on average 13.8-15.7 × 9,2-9.9 µm, Q = 1.4-1.95, Qav = 1.45-1.6, in side-view ellipsoid-amygdaliform, in frontal view ellipsoid to oblong, thick-walled, with apical germ pore and hyaline cap over it, dextrinoid, congophilous, cyanophilous, with pink inner wall in Cresyl Blue. Basidia 38-54 × 10.5-16 µm, 4-spored, with clamp-connection. Lamella edge sterile and forming a broad band. Cheilocystidia 17-62 × 9.0-18 µm, very variable in size and shape, cylindrical, narrowly utriform, irregularly shaped, often catenate, colourless. Pleurocystidia not observed. Pileus covering (in the calotte) a trichoderm, with more and more brown, intracellular pigment towards apex, made up of cylindrical elements, 5.0-12 µm wide, ending in a capitate element; terminal elements on top of these elements, very thick-walled, with brown pigment, with 0-2 thin septa, up to 200 × 8.0-10 µm, with rounded apex; clamp-connections absent. Stipitipellis a cutis with squames and bands of pale brown hyphae, made up of rather short thick elements; terminal elements 5.0-10(-20) µm wide; pigment parietal and sometimes intracellular. Clamp-connections present at base of basidia.

HABITAT & DISTR. – Gregarious, saprotrophic and terrestrial in open places, in dune grasslands, on roadsides, in light woods, etc. Common and widespread in the Netherlands, but avoiding the areas with peat and heavy clay; June-Nov. For more information on ecology and distribution, see Nauta & Vellinga (Atl. Nederl. Paddest.: 202. 1995; including *M. fuliginosa*). Widespread and common in Europe; it has been reported from North America, Africa, Japan, Australia and New Zealand, but several closely related species may be involved.

Macrolepiota procera and the closely related species *M. fuliginosa* and *M. permixta*, are characterized by the peculiar structure of the veil: the velum universale is a trichoderm, made up of erect cylindrical elements, with an increasing amount of pigment towards the top; last elements with widened apex, on which thick-walled brown, cylindrical elements are situated, often with several relatively thin septa. The strength of the connection between the thick-walled and the normal elements, determines whether the veil is loosely lying on the surface or not.

In the Netherlands, two different variants of *M. procera* occur, the 'normal' type, described above, and a greyer variant, with a radially fibrillose pileus, on which loose rather big squames are lying. Both may discolour pink or reddish when scratched. The second variant was known as *M. permixta*, and De Kok & Vellinga (in Persoonia 17: 76-

77. 1998) considered the two identical. However, molecular evidence points clearly to the existence of two taxa, *M. procera*, and a second taxon. The two can be distinguished on morphological grounds, though there are no microscopical differences. It appeared, however, that *M. permixta* is not the correct name for the second taxon, but that the name *M. fuliginosa* is more appropriate. Confusion concerning the name of the species is caused by different opinions in the literature: the Italian authors Bellù (in Boll. Gruppo micol. G. Bres. 25: 115, 117-118. 1982) and Candusso & Lanzoni (Lepiota: 514-521, pl. 64 & 65. 1990) used 'fuliginosa' for a red-brown taxon, and 'permixta' for the more grey-brown specimens. Bon (e.g. Fl. mycol. Eur 3., Lépiotes: 125. 1993) on the other hand, stuck to the original descriptions by Barla (*Lepiota permixta* in Bull. Soc. mycol. Fr. 2: 114. 1886; and *Lepiota procera* var. *fuliginosa* in Champ. Alpes-Maritimes: 21. 1888), and regarded greyish brown specimens as *M. fuliginosa* (hence the name), and reserved the name *M. permixta* for the red-brown species. It is not clear whether *M. permixta* in this sense does occur in the Netherlands, but a short characterization is given to facilitate recognition.

Pázmány (in Not. bot. Horti agrobot. Cluj-Napoca 18-19: 5-22. 1988/1989) described several varieties and formae of *M. procera* from Romania, on account of differences in colour, stature, and squamosity of the pileus; these taxa have not yet been recorded from elsewhere in Europe.

Macrolepiota procera var. *pseudoolivascens* Bellù & Lanzoni (in Beitr. Kenntn. Pilze Mitteleur. 3: 190-191. 1987) differs from the typical variety of *M. procera* in the olivaceous-greenish discoloration of pileus surface and stipe by scratching; the context colour changes into pinkish. This variety has a mediterranean distribution.

Macrolepiota procera var. *mediterranea* M. Bon (in Doc. mycol. 23 (89): 62. 1993) has been described from the Mediterranean, mainly differing from typical *M. procera* in the huge size (pileus up to 40 cm and a stipe reaching 60 cm) and the labile, brown squames on the pileus.

Macrolepiota olivascens Mos. ex Mos. & Sing. (in Schweiz. Z. Pilzk. 39: 154. 1961) resembles *M. procera*, but stipe and pileus turn green when maltreated, and the context discolours reddish; it has a pink spore print. It is a montane species of central Europe and Scandinavia, growing under conifers. More research is needed to establish the value of these intraspecific and specific taxa.

As *M. procera* is often collected for food, it has often been tested for the amount of heavy metals and radioactive material. It appears that *M. procera* is not an accumulator of those elements, but consumption of basidiocarps from contaminated localities (roadsides, landfills, in the neighbourhood of smelters of heavy metals) is to be discouraged (Seeger in Beitr. Kenntn. Pilze Mitteleur. 3: 289-298. 1987; Thomas in Mycologist 6: 195-196. 1992; Kalac et al. in Sc. tot. Env. 177: 251-258. 1996).

Manz (Unters. Kultur Lebensz. Leucoagaricus naucinus, Macrolepiota procera. 1971) was successful in culturing *Macrolepiota procera* from spore to basidiocarp, though it is not an easy procedure.

2. Macrolepiota permixta (Barla) Pacioni in Micol. ital. 8 (3): 13. 1979.

Lepiota permixta Barla in Bull. Soc. mycol. Fr. 2: 114. 1886; *Leucocoprinus permixtus* (Barla) Locq. in Bull. mens. Soc. linn. Lyon 14: 91. 1945; *Macrolepiota permixta* (Barla) Mos., Blätter-, Bauchpilze, 1. Aufl.: 114. 1953 (not valid); *Macrolepiota procera* var. *permixta* (Barla) Candusso in Candusso & Lanzoni, Lepiota: 518. 1990.

EXCL. – *Macrolepiota permixta* sensu Bellù in Boll. Gruppo micol. G. Bres. 25: 115, 117 & 120. 1982; *Macrolepiota procera* var. *permixta* sensu Candusso & Lanzoni, Lepiota: 518-521, pl. 65. 1990 (= *M. fuliginosa*).

MISAPPL. – *Macrolepiota fuliginosa* sensu Bellù in Boll. Gruppo micol. G. Bres. 25: 117-118, 121. 1982; *Macrolepiota procera* var. *fuliginosa* sensu Candusso & Lanzoni, Lepiota: 514-517, pl. 64. 1990.

SEL. ICON. – Bellù in Boll. Gruppo micol. G. Bres. 25: 121. 1982 (as *M. fuliginosa*); Breitenb. & Kränzl., Pilze Schweiz 4: pl. 253. 1995; Candusso & Lanzoni, Lepiota: pl. 64 (based on p. 121 in Boll. Gruppo micol. G. Bres. 25. 1982). 1990 (as *M. procera* var. *fuliginosa*).

SEL. DESCR. & FIGS. – Bellù in Boll. Gruppo micol. G. Bres. 25: 117-118. 1982 (as *M. fuliginosa*); Candusso & Lanzoni, Lepiota: 514-516, fig. 114. 1990 (as *M. procera* var. *fuliginosa*); Pacioni in Micol. ital. 8 (3): 13. 1979.

CHARACTERISTICS – Pileus up to 150-200 mm, applanate with low umbo, with brown reddish to brown blackish centre and small brown squamules concentrically arranged on radially fibrillose background; lamellae often brown-pink discoloured; stipe up to c. 200 × 10 mm, with up to 30 mm wide bulbous base, with brown reddish to dark brown irregular bands, sometimes reddish at bulb; annulus with double crown, whitish on upperside, and dark brown on underside; context reddening in pileus on exposure, becoming red-brown in stipe; spore print white to pinkish cream.

Spores 12-18 × 8.0-11 µm, with germ pore; basidia 4-spored; cheilocystidia clavate to cylindrical, often ending in long excrescences; pileus covering (in calotte) a trichoderm; clamp-connections present at base of basidia.

HABITAT & DISTR. – Gregarious, saprotrophic and terrestrial in open places in woods, city-parks etc. Reported from central and southern Europe, not known with certainty from the Netherlands.

The characteristics given above, are based on the selected descriptions and figures.

The presence of *Macrolepiota permixta* in the Netherlands is not certain. If it occurs, it is a very rare species indeed. The data available indicate that *M. permixta* is a species with a predominantly southern distribution in Europe.

The taxon which was known as *M. permixta* in the Netherlands has to be called *M. fuliginosa* (see for an extensive discussion under *M. procera*).

3. Macrolepiota fuliginosa (Barla) M. Bon in Doc. mycol. 11 (43): 75. 1981. – Fig. 45.

Lepiota procera var. *fuliginosa* Barla, Champ. Alpes-Maritimes: 21. 1888; *Leucocoprinus fuliginosus* (Barla) Locq. in Bull. mens. Soc. linn. Lyon 14: 92. 1945; *Macrolepiota fuliginosa* (Barla) M. Bon in Doc. mycol. 7 (27-28): 20. 1977 (not valid); *Macrolepiota procera* var. *fuliginosa* (Barla) Bellù & Lanzoni in Beitr. Kenntn. Pilze Mitteleur. 3: 190. 1987. – *Lepiota rhodosperma* P.D. Orton in Notes R. bot. Gdn Edinb. 41: 591. 1984 (as *Lepiota 'Macrolepiota' rhodosperma*); *Macrolepiota rhodosperma* (P.D. Orton) Migl. in Boll. Gruppo micol. G. Bres., n.S. 38: 140-141. 1995.

EXCL. – *Macrolepiota fuliginosa* sensu Bellù in Boll. Gruppo micol. G. Bres. 25: 117-118, 121. 1982; *Macrolepiota procera* var. *fuliginosa* sensu Candusso & Lanzoni, Lepiota: 514-517, pl. 64. 1990 (= in both cases *M. permixta*).

MISAPPL. – *Macrolepiota konradii* sensu Breitenb. & Kränzl., Pilze Schweiz 4: pl. 250. 1995; *Macrolepiota permixta* sensu Bellù in Boll. Gruppo micol. G. Bres. 25: 115, 117 & 120. 1982; *Macrolepiota procera* var. *permixta* sensu Candusso & Lanzoni, Lepiota: 518-521, pl. 65. 1990.

SEL. ICON. – Bellù in Boll. Gruppo micol. G. Bres. 25: 120. 1982 (as *M. permixta*); Breitenb. & Kränzl., Pilze Schweiz 4: pl. 250. 1995 (as *M. konradii*); Candusso & Lanzoni, Lepiota: pl. 65. 1990 (as *M. procera* var. *permixta*).

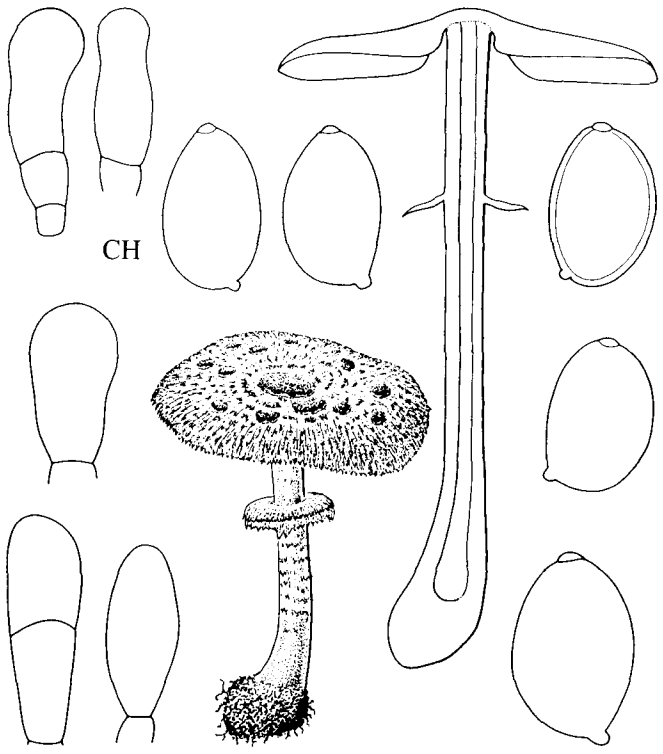

Fig. 45. *Macrolepiota fuliginosa*.

SEL. DESCR. & FIGS. – Bellù in Boll. Gruppo micol. G. Bres. 25: 115, 117. 1982 (as *M. permixta*); Candusso & Lanzoni, Lepiota: 518-520, fig. 115. 1990 (as *M. procera* var. *permixta*); P.D. Orton in Notes R. bot. Gdn Edinb. 41: 592. 1984 (as *Lepiota rhodosperma*).

Pileus 68-220 mm, plano-convex, applanate with shallow depression to subconcave, with low central umbo, with deflexed marginal zone, with a calotte which is grey-brown to rather dark brown (Mu. 7.5 YR 5/4 to 3/4, 2.5 YR 2.5/2), central, round to star-shaped up to 1/3 of radius wide, and felted-subsquamose; around central calotte with rather small, 3-8 mm wide and very easily removable velar patches, with recurving edges on all sides, on a radially coarsely fibrillose or floccose-fibrillose covering of greyish hazel-brown or pale brown or pale beige (7.5 YR 8-7/4, 10 YR 7/4) fibrillose strands on a pallid to pale beige background; margin slightly to distinctly fringed and exceeding lamellae. Lamellae, L = c. 80-120, l = (0-)1-3, moderately crowded to crowded, free and remote from stipe, near stipe often anastomosing, slightly ventricose, up to 12 mm wide, whitish with pinkish sheen, distinctly cream-beige, with age sordid pale cream with sordid vinaceous brown stains along the edges, with white, eroded to flocculose edge. Stipe 95-270 × 4-16 mm with clavate to rather abrupt basal bulb (14-46 mm wide), hollow, with crowded, appressed, dark, slightly pale beige greyish to greyish brown squamules in transverse bands on lower half, but lighter, smaller and very crowded above (7.5 YR 5/4 to 5 YR 5/3-4/4) on pale buff background, often discolouring on scratching (especially at base) to slightly vinaceous pink or red. Annulus not really movable, descending, with cuff around stipe, creamy above; underside concolorous with calotte on pileus; with double crown, but not always obviously so, as upperside may be under-developed. Context thick in pileus, whitish or cream, often with pinkish-brownish tinge, not changing colour or becoming yellow-brown in stipe; stipe context protruding into pileus. Smell indistinct, nutty-fungoid, or slightly rubber-like. Taste like smell. Spore print cream (Breitenbach & Kränzlin, Pilze Schweiz 4: pl. 250. 1995), or pale clay-pink, pale salmon to pale pink (Orton in Notes R. bot. Gdn Edinb. 41: 592. 1984).

Spores (11.5-)12-20 × 7.5-11.5 µm, on average 13.6-15.2 × 8.6-10.5 µm, Q = 1.2-1.85, Qav = 1.4-1.6, ellipsoid to oblong, slightly amygdaliform in side-view, thick-walled, with germ pore and hyaline cap over it, dextrinoid, congophilous, cyanophilous, with pink inner wall in Cresyl Blue. Basidia 30-52 × 10-16 µm, 4-spored, sometimes intermixed with 2-spored basidia, with basal clamp-connection. Lamella edge sterile, with a band of cystidia. Cheilocystidia 16-60 × 7.0-17 µm, very variable in shape and size, narrowly clavate, cylindrical, lageniform, often irregularly shaped, often catenate, rather thin-walled and colourless. Pleurocystidia not observed. Pileus covering (in calotte) a trichoderm of erect cylindrical elements, c. 8.0-12 µm wide, with towards the upperside more brown intracellular pigment, also with bands of brown, encrusting pigment; terminal elements on top of this trichoderm, brown, very thick-walled, with 0-4 thin septa, wavy often lying horizontally on top of the trichoderm, up to 250 × 12 µm, with rounded apex; clamp-connections absent. Stipitipellis a cutis, with bands of squamules of pigmented parallel hyphae; terminal elements 16-50 × 5.0-12 µm, with parietal or encrusting pigment, with rounded apex; thinner cylindrical elements with intracellular pigment present as well. Clamp-connections present, at least at the base of basidia.

HABITAT & DISTR. – Solitary or in small groups, saprotrophic and terrestrial, in deciduous woods on loamy soil, in the dunes, and in roadsides, scattered and rare in the Netherlands, known from southern Limburg, and some localities in the Pleistocene areas, also recorded from the Friesian islands, (July) Sept.-Oct. Widespread in Europe, but everywhere rare.

Macrolepiota fuliginosa is rather variable in size, in its reddening reactions and in the colour of the spore print. Its main characteristics are the rather grey-brown colours of the velar patches on the pileus, which lie loosely on top of a strongly radially-fibrillose, pale grey-brown covering.

Dutch mycological literature and tradition have used the name *M. permixta* for all *M. procera*-like specimens which, by turning red when bruised, did not fit the concept of *M. procera*. *Macrolepiota permixta* is covered in red-brown squamules on a much less fibrillose background, and discolours vinaceous red-brown in all its parts (see selected icones for representative pictures of both species). In Italian literature the name *M. permixta* has been used for *M. fuliginosa* and vice versa (see misapplied and excluded names). The notes under *M. procera* give more information on the two different applications of these names.

Macrolepiota rhodosperma (P.D. Orton) Migl. appeared to be identical with *M. fuliginosa*, though it was originally described because of its striking spore print colour, viz. pale salmon-pink; this, however, is not unusual in the genus (see the spore print colours in Breitenbach & Kränzlin, Pilze Schweiz 4: pl. 252 and 254. 1995).

4. Macrolepiota mastoidea (Fr.: Fr.) Sing. in Lilloa 22: 417. ('1949') 1951. – Fig. 46.

Agaricus mastoideus Fr.: Fr., Syst. mycol. 1: 20. 1821; *Lepiota mastoidea* (Fr.: Fr.) Kumm., Führ. Pilzk.: 135. 1871; *Lepiota excoriata* subsp. *mastoidea* (Fr.: Fr.) Quél., Fl. mycol. France: 301. 1881; *Leucocoprinus mastoideus* (Fr.: Fr.) Sing. in Rev. Mycol. 4: 67. 1939; *Lepiotophyllum mastoideum* (Fr.: Fr.) Locq. in Bull. mens. Soc. linn. Lyon 11: 40. 1942. – *Agaricus gracilentus* Krombh., Naturg. Abb. Beschr. essb. schädl. verd. Schwämme: 8, pl. 24. figs. 13 & 14. 1836; *Lepiota gracilenta* (Krombh.) Quél. in Mém. Soc. Émul. Montbéliard, sér. II, 5: 71. 1872 (Champ. Jura Vosges 1); *Macrolepiota gracilenta* (Krombh.) Mos., Blätter-, Bauchpilze, 1. Aufl.: 114. 1953 (not valid);

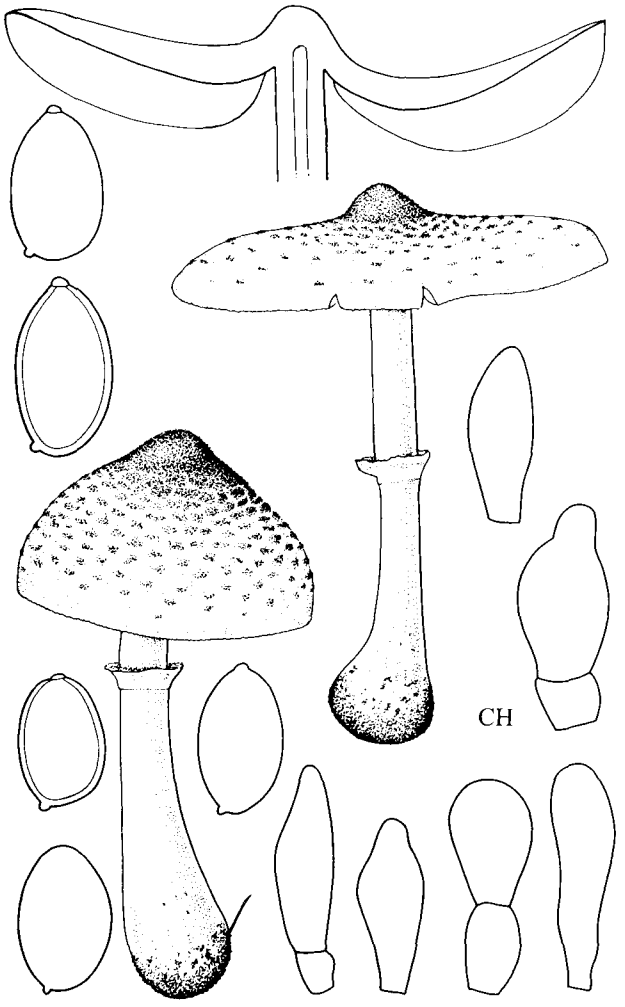

Fig. 46. *Macrolepiota mastoidea*.

Macrolepiota gracilenta (Krombh.) Wasser in Ukr. bot. Zh. 35: 516. 1978. – *Lepiota rickenii* Velen., Novit. mycol.: 47. 1939; *Macrolepiota rickenii* (Velen.) Bellù & Lanzoni in Beitr. Kenntn. Pilze Mitteleur. 3: 196. 1987. – *Lepiota excoriata* var. *konradi* Huijsman in Meded. Ned. mycol. Vereen. 28: 18. 1943 (not valid); *Lepiota konradii* Huijsman ex P.D. Orton in Trans. Br. mycol. Soc. 43: 283. 1960; *Macrolepiota konradii* (Huijsman ex P.D. Orton) Marchand, Champ. Nord Midi 1: 224. 1971 (not valid); *Macrolepiota konradii* (Huijsman ex P.D. Orton) Mos., Röhrlinge Blätterpilze, 3. Aufl.: 185. 1967.

EXCL. – *Macrolepiota konradii* sensu Breitenb. & Kränzl., Pilze Schweiz 4: pl. 250. 1995 (= *M. fuliginosa*).

MISAPPL. – *Macrolepiota excoriata* sensu Breitenb. & Kränzl., Pilze Schweiz 4: pl. 248. 1995; sensu Johnson & Vilgalys in Mycologia 90: 974-976. 1998.

SEL. ICON. – Barla, Fl. mycol. ill.: pl. 11. figs. 1-10. 1889; M. Bon, Champ. Eur. occid.: 291. 1989 (as *M. gracilenta* & *M. konradii*); Breitenb. & Kränzl., Pilze Schweiz 4: pl. 251. 1995; Bres., Iconogr. mycol. 1: pl. 23 & 21. 1927; Candusso & Lanzoni, Lepiota: pl. 73, 74 & 79. 1990 (as *M. mastoidea*, *M. rickenii*, and *M. konradii* resp.); Cetto, Funghi Vero 7: pl. 2597. 1993 (as *M. konradii*); Cooke, Ill. Brit. Fung. 1: fig. 24 (23). 1881 (as *Agaricus mastoideus*); J. Lange, Fl. agar. dan. 1: pl. 8C. 1935 (as *Lepiota umbonata*).

SEL. DESCR. & FIGS. – Candusso & Lanzoni, Lepiota: 552-556, 563-566, 584-586, figs. 123, 126 & 132 (resp. as *M. mastoidea* var. *mastoidea*, *M. rickenii*, and *M. konradii*); Pötz in Carinthia II 181/101: 412. 1991 (as *M. konradii*).

VERN. NAME – Tepelparasolzwam, incl. Donkere parasolzwam.

Pileus 40-120 mm, when young hemispherical to campanulate with inflexed margin, later wide-conical to applanate, with distinct umbo, with margin exceeding lamellae, when very young totally covered in pinkish-greyish-brownish (Mu. 10YR 5-8/3-4(-6); 7.5 YR 5-8/4-6), to dark brown (e.g. K. & W. 7F7) velvety covering, later still with velvety, or plush-like covering at centre, towards margin more and more granulose-patchy, with bigger patches towards margin, sometimes in a distinct star-shaped pattern, brownish yellow, brown or pinkish brown (7.5 YR 7-6/4), to dark brown (7.5 YR 4/4, paler than 6D4 near margin), on cream-coloured to pale to very pale brown (Mu. 10 YR 7-8/2-4), fibrillose-squamulose background, showing white context in between fibrils. Lamellae, L = c. 60-85, l = 0-3, crowded, moderately crowded, free, remote from stipe, segmentiform to ventricose, 6-15 mm wide, some furcate, white, creamy to pale brownish yellow (10 YR 6/4, 2.5 Y 8/1), not discolouring on touch, with even to eroded, whitish edge. Stipe (50-)85-140(-210) × (5-)7-11(-14) mm, bulbous, with 15-23(-35) mm wide bulb, cylindrical to slightly tapering towards apex, hollow, whitish, dark brown after touch (7.5 YR 3/4), with pale brownish, greyish brown, or brownish pink (5AB3), or creamy small bands of patches or floccules over total length of stipe, the palest at apex, sometimes with white tomentose layer on bulb. Annulus mobile with age, with cuff-like part around stipe, either ascending or descending, with double crown, but often without, 12-40 mm in diameter; underside brownish, as pileus covering, or with dark patchy rim; if developed as double crown, cream-coloured at upperside, with fringed margin. Context compact, up to 13 mm thick in pileus, white to cream-coloured, after cutting not discolouring or becoming reddish yellow (5 YR 7/6, 7.5 YR 6/4) in pileus or reddish in stipe; stipe context protruding into umbo of pileus. Smell none, indistinct (also in cut specimens) to slightly unpleasant, or fungoid. Taste faint. Spore print 'white'.

Spores (11.0-)11.5-18.5(-20) × 7.5-12 µm, on average 13.1-14.7 × 8.0-9.5 µm, Q = 1.35-1.8, Qav = 1.45-1.65, ellipsoid to oblong, ovoid, with central germ pore with hyaline cap, with 0.7-0.8 µm thick wall, dextrinoid, congophilous, cyanophilous, metachromatic in Cresyl Blue. Basidia 31-68 × 10-16 µm, predominantly 4-spored, without, rarely with, basal clamp-connection. Lamella edge sterile. Cheilocystidia 11-43 × 6.0-16 µm, clavate, narrowly clavate, (broadly) fusiform to (narrowly) utriform, sometimes cylindrical and/or rostrate, or lageniform, thin-walled, colourless. Pileus covering at centre an intricate trichoderm, made up of cylindrical elements; terminal elements 14-122 × 3.5-10 µm, cylindrical, often lying on surface, with parietal, sometimes intracellular pale to brown pigment, often encrusting at base of elements, and in elements lower down. Stipitipellis a cutis of narrow, cylindrical, colourless elements, 2.0-10 µm in diameter, with clusters of irregularly twisted and shaped hyphae, with terminal elements 20-70 × 8.0-17 µm; pigment pale and diffuse; brown and refractive in an occasional narrow hypha. Clamp-connections absent to rare at the base of basidia.

HABITAT & DISTR. – Solitary, gregarious, never in big groups, saprotrophic and terrestrial in (dune) grasslands, open places in woods, rather rare in the Netherlands, especially on sandy soils (dune area, Pleistocene regions), and in southern Limburg. For more information on ecology and distribution see Nauta & Vellinga (Atl. Nederl. Paddest.: 201. 1995 (as *M. konradii* and *M. mastoidea*)). Sept.-Nov. Widespread in Europe.

Macrolepiota mastoidea in the current sense covers pale variants, formerly recognized as *M. mastoidea*, middle brown variants, formerly

known as *M. rickenii*, and dark brown variants like *M. konradii*. The annulus can be complicated with a double crown to almost simple with the upper part of the crown hardly developed. Contrary to what was found by De Kok (in Coolia 34: 98-101. 1991), clamp-connections were very rarely observed on the basis of basidia in the collections studied. Candusso & Lanzoni (Lepiota: 556, 566. 1990) mentioned that in *M. mastoidea* var. *mastoidea*, and *M. rickenii* resp., clamp-connections are present but difficult to find. Another character thought to distinguish *M. konradii* from *M. mastoidea* was the kind of pigmentation of the velar elements: encrusted in *M. konradii*, and non-encrusted in the paler species. However, incrustations are also found in typical pale *M. mastoidea*-collections. Molecular evidence supports the treatment of this group of species as one taxon.

A discussion on the synonymy of *M. mastoidea* and *M. gracilenta* can be found in De Kok & Vellinga (in Persoonia 17: 74-76. 1998).

Several other taxa are closely related to *M. mastoidea* or might be identical to *M. mastoidea*: *M. affinis* (Velen.) M. Bon (see for a description Candusso & Lanzoni, Lepiota: 545-549. 1990), *M. prominens* (Viv. ex Fr.) Mos. (a description can be found by Bellù & Lanzoni in Beitr. Kenntn. Pilze Mitteleur. 2: 19-26. 1986), and *M. subsquarrosa* (Locq.) M. Bon (in Doc. mycol. 11 (43): 72. 1981). Whether these species are identical to *M. mastoidea* has still to be proven.

Macrolepiota psammophila Guinb. (in Doc. mycol. 24 (102): 2. 1996), described from the southern Atlantic coast in France, belongs here as well, on account of the granular pileus covering, and the absence of clamp-connections at the base of basidia. It is a very robust fungus, growing in calcareous dune sand.

A variety which reddens at the base of the stipe has been described from France: *M. mastoidea* var. *coccineobasalis* (Locq.) M. Bon (in Doc. mycol. 11 (43): 72. 1981). *Macrolepiota mastoidea* var. *atrobrunnea* Dermek (in Fung. rar. Ic. col. 14: 11. 1985) is characterized by dark colours on pileus, and fits well into the present concept of *M. mastoidea*.

To complete the overview of the genus as it is represented in Europe, two species with dark squamulose-fibrillose pileus have to be mentioned, both described from the mediterranean region: *M. fuligineosquarrosa* Malenç. (in Beih. Sydowia 8: 261. 1979) from Morocco, and *M. phaeodisca* Bellù (in Boll. Gruppo micol. G. Bresadola 27: 6. 1984) from Sardinia. See the latter publication for a comparison of the two species, illustrated by photographs. The former has been recorded from Great Britain (Reid in Boll. Gruppo micol. G. Bres., n.S. 40 (2-3): 399-404. ('1997') 1998).

5. Macrolepiota excoriata (Schaeff.: Fr) Wasser in Ukr. bot. Zh. 35: 516. 1978. – Fig. 47.

Agaricus excoriatus Schaeff., Fung. Bavariae 4: pl. 18, 19. 1774; *Agaricus excoriatus* Schaeff.: Fr., Syst. mycol. 1: 21. 1821; *Lepiota excoriata* (Schaeff.: Fr.) Kumm., Führ. Pilzk.: 135. 1871; *Lepiotophyllum excoriatum* (Schaeff.: Fr.) Locq. in Bull. mens. Soc. linn. Lyon 11: 40. 1942; *Leucoagaricus excoriatus* (Schaeff.: Fr.) Sing. in Sydowia 2: 35. 1948; *Macrolepiota excoriata* (Schaeff.: Fr.) Mos. Röhrlinge, Blätter-, Bauchpilze, 2. Aufl.: 130. 1955 (not valid).

EXCL. – *Macrolepiota excoriata* sensu Breitenb. & Kränzl., Pilze Schweiz 4: pl. 248. 1995; sensu Johnson & Vilgalys in Mycologia 90: 974-976. 1998 (= in both cases *Macrolepiota mastoidea*).

SEL. ICON. – Bellù in Boll. Gruppo micol. G. Bres. 25: 103. 1982; Candusso & Lanzoni, Lepiota: pl. 76. 1990; Vellinga & Huijser in Coolia 40: pl. 8. 1997.

SEL. DESCR. & FIGS. – Bellù in Boll. Gruppo micol. G. Bres. 25: 102. 1982; Candusso & Lanzoni, Lepiota: 572-574, fig. 129. 1990 (as *M. excoriata* var. *excoriata*).

VERN. NAME – Rafelige parasolzwam.

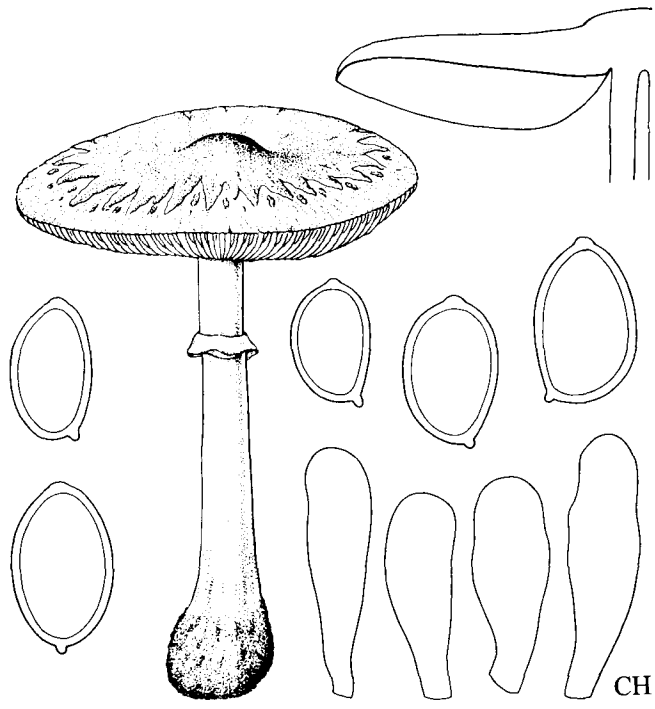

Fig. 47. *Macrolepiota excoriata*.

Pileus 60-100 mm, plano-convex to applanate with umbo and deflexed margin, with utmost margin (velar remnants) exceeding lamellae, brown at centre (Mu. 7.5 YR 5/6, rarely 5/4 or 5/8, 5 YR 4/6), around centre pale cream-buff (c. 10-7.5 YR 8/4), finely tomentose-velutinous, or fine-granulose; covering towards margin breaking up in irregular patches or leaving a star-shaped velar patch; marginal zone, where the veil is not present, cream-coloured to white and radially fibrillose to squamulose. Lamellae, L = c. 120, l = (0-)1-3, moderately crowded, crowded, distinctly free, segmentiform or slightly ventricose, up to 7.5 mm wide, pale greyish-brownish to cream-beige (7.5 YR - 2.5 YR 8/2), with white flocculose edge. Stipe 90-120 × 8-10 mm, cylindrical with slightly bulbous to bulbous base, up to 18 mm wide, hollow, completely pale cream, below annulus whitish tomentose-banded, becoming slightly brown or reddish brown when touched. Annulus thin and simple, vanishing with age, descending; underside concolorous with stipe; upperside paler, or both sides cream with shaggy brownish edge. Context white to white-cream in pileus, thick (up to 12 mm) and dull, whitish to creamy, sometimes red in places; stipe protruding into pileus, context in stipe shiny, dull in base of stipe. Smell none to strong and lepiotoid-fungoid. Taste not known. Spore print 'white'.

Spores 11.0-16.0 × (6.5-)7.5-10.5 µm, on average 11.9-13.6 × 8.1-9.2 µm, Q = 1.3-1.85, Qav = 1.4-1.55, ellipsoid to oblong, slightly amygdaliform in side-view, with adaxial side less convex than abaxial side, thick-walled, with apical germ pore and hyaline cap on pore, dextrinoid, congophilous, cyanophilous, metachromatic in Cresyl Blue. Basidia 35-57 × 11.5-14.5 µm, 4-spored, often with clamp-connection at base. Lamella edge sterile. Cheilocystidia 18-41 × 6.0-13 µm, narrowly clavate, cylindrical, narrowly utriform, not coloured, with hardly thickened wall. Pleurocystidia not observed. Pileus covering at centre a trichoderm made up of cylindrical hyphae; terminal elements 60-145 × 5.0-17 µm, slightly tapered at apex, and lying on surface, colourless; pigment light-brown situated in lower trichodermal hyphae. Stipitipellis a cutis of colourless, cylindrical, hyphae, 3.0-6.0 µm wide, with clusters of irregularly twisted, rather narrow hyphae, 3.0-10 µm

wide, with pale, slightly refractive intracellular pigment. Clamp-connections present at the base of basidia.

HABITAT & DISTR. – Gregarious, solitary, terrestrial and saprotrophic in dune grasslands, on dikes, in roadsides and in other types of nutrient-poor grasslands; in the Netherlands scattered and uncommon, and strongly declined; June-Nov. For more information on ecology and distribution, and changes throughout time, see Nauta & Vellinga (Atl. Nederl. Paddest.: 200. 1995). Widespread in Europe.

The basidia of *M. excoriata* are often provided with a distinct clamp-connection, though several authors explicitly mention the absence of clamp-connections (Candusso & Lanzoni, Lepiota: 580. 1990; Bon, Fl. mycol. Eur. 3, Lépiotes: 117. 1993). However, Kasparek (in Mittbl. Arbeitsgem. Pilzk. Niederrhein 10: 85. 1992) also mentioned the presence of clamp-connections.

Macrolepiota heimii Locq. ex M. Bon (in Bellù in Boll. Gruppo micol. G. Bres. 27: 18. 1984) is also a pale species. That it has clamp-connections was thought to separate it from *M. excoriata*, but this distinction is no longer valid. Both species occur in grasslands, and despite the fact that the pileus covering is hardly star-shaped in *M. heimii*, the two species appear to be identical.

Several varieties of *M. excoriata* have been described. Candusso & Lanzoni (Lepiota: 576-578. 1990) gave a good overview. One in which the context reddens at exposure to air, is called *M. excoriata* var. *rubescens* (Dufour) M. Bon.

Because of changes in farming practice and land use especially in the second half of the 20th century, this species has drastically declined in the Netherlands (Nauta & Vellinga, Atl. Nederl. Paddest.: 200. 1995).

Sect. **Laevistipedes** (Pázmány) M. Bon

Stipe smooth, not covered in granules, squamules, bands etc.; spores without hyaline cap over germ pore; pileus covering with tightly packed narrowly clavate terminal elements.

6. Macrolepiota rachodes (Vitt.) Sing. in Lilloa 22: 417. ('1949') 1951. – Fig. 48.

Agaricus rachodes Vitt., Descr. Funghi mang. Italia: 158. 1835; *Agaricus procerus* var. *rachodes* Rab., Deutschl. Krypt. Fl.: 574. 1844; *Lepiota rachodes* (Vitt.) Quél. in Mém. Soc. Émul. Montbéliard. sér. II, 5: 5. 1872 (Champ. Jura Vosges 1); *Leucocoprinus rachodes* (Vitt.) Pat., Ess. tax. Hym.: 171. 1900 (as *L. rhacodes*); *Lepiotophyllum rachodes* (Vitt.) Locq. in Bull. mens. Soc. linn. Lyon 11: 40. 1942 (as *L. rhacodes*). – *Agaricus subtomentosus* Krombh., Naturg. Abb. Beschr. essb. schädl. verd. Schwämme: 9, pl. 4. 1836; *Agaricus procerus* var. *subtomentosus* (Krombh.) Rab., Deutschl. Krypt. Fl.: 574. 1844. – *Lepiota subprocera* Saut. in Hedwigia 15: 152. 1876. – *Lepiota bohemica* Wichansky in Mykol. Sb., Praha 38: 103. 1961; *Macrolepiota bohemica* (Wichansky) Krieglst. in Z. Mykol. 47: 83. 1981 (not valid); *Macrolepiota bohemica* (Wichansky) Krieglst. & Pázmány in Pázmány in Z. Mykol. 51: 52. 1985; *Macrolepiota rachodes* var. *bohemica* (Wichansky) Bellù & Lanzoni in Beitr. Kenntn. Pilze Mitteleur. 3: 191. 1987.

MISAPPL. – *Lepiota rachodes* var. *hortensis* sensu Pil. & Usák, Nase Houby 1: 111. 1952. – *Lepiota badhamii* sensu Michael & Hennig, Handb. Pilzfr. 3. Aufl., 3: 139, pl. 16. 1964. – *Macrolepiota olivieri* sensu Wasser, Fl. Fung. R.S.S. Ucrainicae, Agaricaceae: 298. 1980; sensu Wasser in Libri bot. 9: 87. 1993.

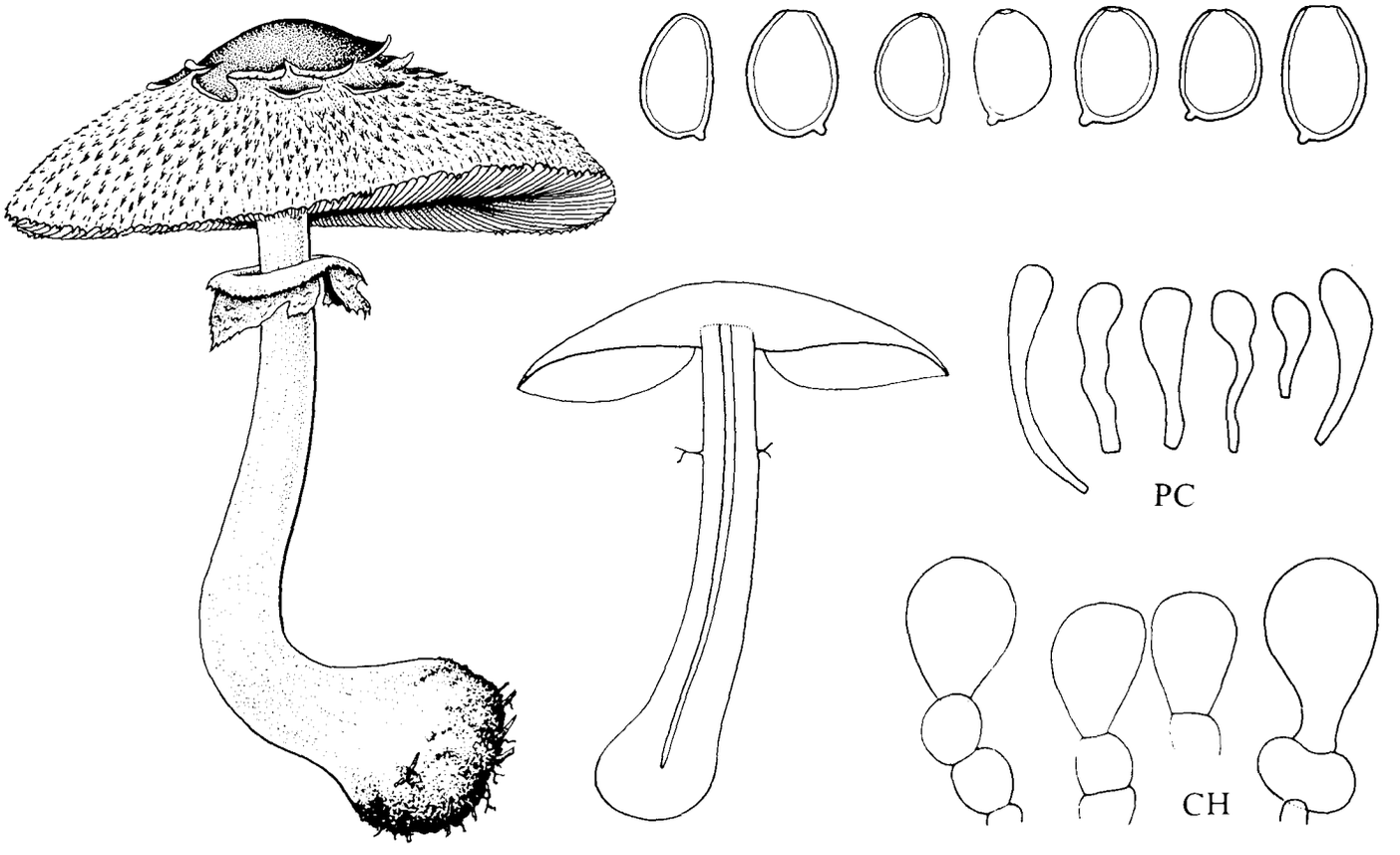

Fig. 48. *Macrolepiota rachodes*.

SEL. ICON. – Barla, Fl. mycol. ill.: pl. 9bis, figs. 1-5. 1889; Bellù in Boll. Gruppo micol. G. Bres. 25: 116. 1982 (as *M. rhacodes* var. *hortensis*); Candusso & Lanzoni, Lepiota: pl. 69 1990 (as *M. rachodes* var. *bohemica*); Cetto, Funghi Vero, Ed. 5, 1: pl. 21. 1975; R. Phillips, Paddest. Schimm.: 25. 1981 (as *M. rhacodes* var. *hortensis*).

SEL. DESCR. & FIGS. – Bellù in Boll. Gruppo micol. G. Bres. 25: 115. 1982 (as *M. rhacodes* var. *hortensis*); Bellù & Lanzoni in Beitr. Kenntn. Pilze Mitteleur. 3: 191, 193, fig. 2. 1987 (as *M. rachodes* var. *bohemica*); Candusso & Lanzoni, Lepiota: 536-540, fig. 120. 1990 (as *M. rachodes* var. *bohemica*); Lavorato in Riv. Micol. 32: 273-274, fig. 1; 276-277, fig. 2. 1989 (as *M. rachodes* var. *rachodes* and *M. rachodes* var. *bohemica* resp.).

VERN. NAME – Knolparasolzwam.

Pileus 42-220 mm, when young globose to hemispherical, expanding to plano-convex, with shallow depression or low broad umbo, when very young completely ochraceous yellow to dark brown, soon with central rounded to star-shaped or radially cracked patch, up to c. 60 mm in diam., surrounded by irregular concentric rings of squamular patches, flat or curved upwards, dark red to yellowish red or (dark) brown (2.5 YR 3/6, 5 YR 3-6/2-8, 10 YR 4-5/3-4, 10 YR 6/3-6, 5/6, 7.5 YR 5/8, 3/4, 6/4, 5/6, 4/4), those patches vanishing towards margin or only present at the tips of radially fibrillose squamules, on cream to (very) light brown or reddish yellow, sometimes light yellow or yellowish red (e.g. 10 YR 8/2, 10 YR 5-8/3-4, 7.5 YR 6/4, 7.5 YR 7/6, 2.5 Y 7/4, 6/6, 5 YR 5/8, 6/4) background, when young more or less smooth, later distinctly radially fibrillose-squamose; margin fringed and exceeding lamellae; background bruising red, turning into black. Lamellae, L = c. 90-100, l = 0-3, moderately crowded to crowded, free, 1-4 mm remote from stipe, sometimes anastomosing or furcate near stipe, (sub)ventricose, 4-18.5 mm wide, white (10 YR 8/3) to cream, when touched reddish yellow (5 YR 7/6) to light red (10 R 6/8), orange (7.5 YR 7/8), or yellow, later brown (7.5 YR 5/4), when young with white, later with brown, even to eroded edge. Stipe 26-160(-225) × 7-30 mm, cylindrical with 17-50 mm wide, sometimes slightly marginate, bulb, hollow, white, pale greyish-brownish, when touched light brown or yellowish red (10 YR 7/4, 5/4, 6/6, 5 YR 5/6, 7.5 YR 6/4, 5/6, 7/6, 4/4, 5/8), smooth or longitudinally striate, sometimes with rhizomorphs at base; bulb white tomentose. Annulus with double crown, 18-57 mm wide, 1-12 mm thick, whitish to buff-brown (5 YR 7/3) above, sometimes adhered, concolorous with pileus centre at underside. Context in pileus 5-18 mm thick, white to whitish, turning brown when aging (7.5 YR 5/4), when cut discolouring, sometimes first turning yellow (10 YR 7-8/6), then reddish yellow (7.5 YR 8-6/6-8, 5 YR 6-7/6-8 or 5 YR 5/8) to weakly red (10 R 5-6/6-8 or 2.5 YR 6/6, 4/8, 6/8), and finally brown (5 YR 3/3, 10 R 5/8). Smell fungoid, earth-like or like rubber, slightly unpleasant. Taste fungoid or earth-like. Spore print probably white to cream.

Spores 9.0-12 × 6.0-7.5 µm, on average 9.8-11.1 × 6.3-7.7 µm, Q = 1.35-1.75, Qav = 1.45-1.6, in side-view ellipsoid-amygdaliform, oblong-amygdaliform, in frontal view ovoid, with rounded to truncate apex, with germ pore, with distinct hilar appendage, thick-walled, dextrinoid, congophilous, cyanophilous, metachromatic in Cresyl Blue. Basidia 32-49 × 8.0-14 µm, 4-spored, rarely 2-spored, often with brown pigment near lamella edge, with clamp-connection. Lamella edge sterile. Cheilocystidia in a broad band, 16-43 × 8.5-25 µm, clavate, broadly clavate, spheropedunculate, often catenate, after a frost-period sometimes rostrate, mostly with brown(ish) intracellular pigment, rarely colourless. Pleurocystidia not observed. Pileus covering in centre of pileus an intricate trichoderm, with clavate terminal elements, 20-65 × 8-14 µm, with pale brown intracellular pigment; some narrow elements with brown refracting pigment present; pigment encrusting in lower elements. Stipitipellis a cutis of 3.5-8.0 µm wide, cylindrical hyphae, colourless; pigment situated in stipititrama. Clamp-connections present, at basidia, cystidia, and trama hyphae.

HABITAT & DISTR. – Solitary or gregarious, in fairy rings and swarms, saprotrophic and terrestrial, on rather nutrient-rich soil, on compost heaps, in gardens, orchards, deciduous and coniferous woods, and on roadsides, also in greenhouses; common, (Apr.-)Sept.-Dec. Widespread in the subtropical to temperate regions of the Northern Hemisphere. Recorded from the Southern Hemisphere, but closely related species might be involved.

Two ways to spell the epithet of this species can be found in the mycological literature: rachodes and rhacodes. The original author, Vittadini (Descr. Funghi mang. Italia: 158. 1835) used the first spelling consistently, though it is without obvious meaning, whereas 'rhacodes' is derived from a Greek word meaning 'rag'. The original author is followed in his spelling of the name.

Macrolepiota rachodes is, with *M. procera*, very often depicted, but good descriptions of this species, in the sense used here, excluding dark variants recognized as *M. olivieri*, are hard to find. For instance, the description of *M. rachodes* by Candusso & Lanzoni, Lepiota: 530-534. 1990 (as var. *rachodes*) includes *M. olivieri*.

Macrolepiota olivieri differs from *M. rachodes* in that velar patches and background hyphae are both dark coloured, and that the spores are slightly smaller. Claimed differences in habitat, exclusively in *Picea*-plantations for *M. olivieri* versus a wide range of habitats, including *Picea*-plantations for *M. rachodes* (De Kok in Coolia 34: 99. 1991), can no longer be used to separate them, as grey variants of *M. olivieri* have been found in deciduous woods in southern Limburg.

Macrolepiota bohemica is often recognized as a separate taxon (either as a species, more often as a variety of *M. rachodes*). As was shown by De Kok & Vellinga (in Persoonia 17: 70-71. 1998), all the characters used to distinguish the two species form a continuum, and vary independently. Preliminary molecular studies have failed to separate the two taxa. For a discussion on the name 'hortensis', also used for this taxon, see again De Kok & Vellinga (in Persoonia 17: 70-71. 1998).

Macrolepiota venenata is quite similar to *M. rachodes*, but differs mainly in the absence of clamp-connections, a simple ring, and the more radially oriented velar arrangement on the pileus. Filippi & Barbini (in Riv. Micol. 32: 266-271. 1989) proposed that the two species could be identical.

Macrolepiota abruptibulba (R. Heim) Heinem., a species described from tropical Africa, was found in a greenhouse in England (Pegler et al. in Bot. J. Scotl. 50: 191-197. 1998). This species also belongs to sect. *Laevistipedes*, because of the smooth stipe, and the shape of the spores. The most striking characters of this species are the strongly bulbous base, the dark purplish brown pileus covering, and the pale pinkish brown pileus surface in between the squames, and the purplish brown discolouration of the stipe when bruised.

Clamp-connections are often present, at least at the base of the basidia in *M. rachodes*, but sometimes are reported to be absent (Kasparek in Mittbl. Arbeitsgem. Pilzk. Niederrhein 10: 84-85. 1992).

Macrolepiota rachodes is considered a good edible species, but specimens growing in the vicinity of roads, in areas where chemicals are sprayed, near heavy metal smelters etc. should be avoided. The species accumulates the heavy metals lead and to a lesser extent mercury (Kalac & Svoboda in Food Chem. 69: 273-281. 2000).

Sagara (in Trans. mycol. Soc. Japan 33: 487-496. 1992) reported on the occurrence of *M. rachodes* on old wood-ant nests in England. However, there is no evidence that the ants cultivate this mushroom species.

7. Macrolepiota olivieri (Barla) Wasser, Fl. Fung. R.S.S. Ucrainicae, Agaricaceae: 298. 1980. – Fig. 49.

Lepiota olivieri Barla in Bull. Soc. mycol. Fr. 2: 113. 1886; *Lepiota rachodes* var. *olivieri* (Barla) Barla, Fl. mycol. ill.: 27. 1889; *Macrolepiota rachodes* f. *olivieri* (Barla) R. de Kok in Kok & Vellinga in Persoonia 17: 74. 1998.

EXCL. – *Macrolepiota olivieri* sensu Wasser, Fl. Fung. R.S.S. Ucrainicae, Agaricaceae: 298. 1980; sensu Wasser in Libri bot. 9: 87. 1993 (= in both cases *M. rachodes*).

SEL. ICON. – Barla, Fl. mycol. ill.: pl. 9bis. figs. 6-10. 1889; Bellù in Boll. Gruppo micol. G. Bres. 25: 113 upper photo. 1982 (as *M. rhacodes* var. *rhacodes*); Candusso & Lanzoni, Lepiota: pl. 67. 1990 (as *M. rachodes* var. *rachodes*); J. Lange, Fl. agar. dan. 1: pl. 9C. 1935 (as *Lepiota rhacodes*); R. Phillips, Paddest. Schimm.: 25. 1981 (as *M. rachodes* var. *rachodes*); Pil. & Usák, Nase Houby 1: pl. 110. 1980 (as *Lepiota rhacodes*).

SEL. DESCR. & FIGS. – Kok & Vellinga in Persoonia 17: 74. 1998 (as *M. rachodes* f. *olivieri*).

VERN. NAME – Sombere knolparasolzwam.

Pileus 46-130 mm, when mature plano-convex, applanate, sometimes (sub)umbonate; central velar patch star-shaped to circular, with indistinct border, 21-38 mm wide, with concentrical zones of applanate or upwards curving squamulose patches, dark brown to reddish brown at centre to paler brown at margin (7.5 YR 5/6, 4-3/4, 3/2, 5 YR 4-3/4, 10 YR 6-5/4-6, 7/3); background yellowish brown to light brown or greyish brown (10 YR 5-6/3-5, 7/3, 7.5 YR 6/4, 3/2), not or hardly paler than patches, smooth to radially fibrillose-ragged. Lamellae, L = c. 80-100, l = 1-3, moderately crowded, free, 1-7 mm remote from stipe, 8.5-15 mm wide, whitish, later cream-beige, or yellowish discoloured, when touched light red (2.5 YR 6/8) to yellowish red, with dark brown eroded edge. Stipe (45-)80-190 × 7-13 mm, bulbous to subbulbous, with 21-32 mm wide bulb, hollow, white to cream coloured, when scratched yellowish brown, saffron-orange to darker reddish brown (10 YR 4/4, 10 YR 5/4-6, 5 YR 3/4, 7.5 R 3/4), lengthwise marmorate-striate, white-tomentose on bulb. Annulus mobile with age, with double crown, 25-30 mm in diameter, 1-5 mm thick, very light brown (10 YR 7/4) at upper side, sometimes adhered, lower side coloured as pileus centre. Context white, 7-17 mm thick in pileus, when cut turning reddish yellow or orange (7.5 YR 6-7/8, 5 YR 6/8), later red (10 R 4-6/6-8 or 2.5 YR 5/6). Smell none, earth-like or fungoid. Taste unpleasant. Spore print colour unknown.

Spores (7.5-)8.0-11.0 × 5.5-7.0 µm, on average 8.7-10.0 × 5.8-6.6 µm, Q = 1.3-1.65, Qav = 1.45-1.55, in side-view ellipsoid-amygdaliform, slightly ovoid in frontal view, with rounded to slightly truncate apex with small germ pore, thick-walled, dextrinoid, congophilous, cyanophilous, metachromatic in Cresyl Blue. Basidia 29-40 × 8.0-11 µm, 4-spored, sometimes intermixed with 2- and 3-spored basidia, with clamp-connection. Lamella edge sterile with a broad band of cystidia. Cheilocystidia 16-45 × 35-45 µm, clavate to ovoid, not rostrate, many with clouded brown intracellular pigment. Pleurocystidia not observed. Pileus covering at centre of pileus an intricate trichoderm with narrowly clavate terminal elements, 25-50 × 6.0-11 µm, with brown intracellular pigment; pileitrama hyphae also pigmented. Stipitipellis a cutis of 3.0-5.0 µm wide cylindrical hyphae, with brown, often refractive pigment. Clamp-connections present, at least at base of basidia.

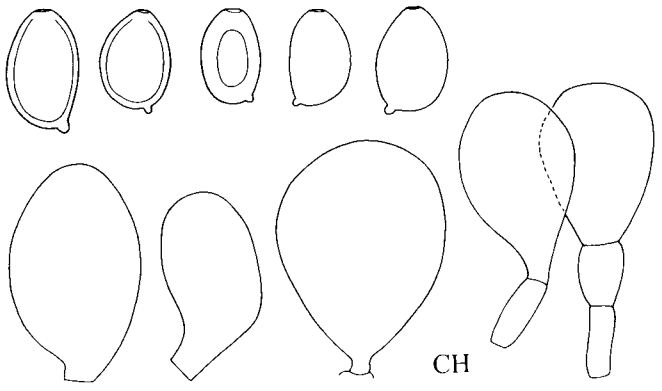

Fig. 49. *Macrolepiota olivieri*.

HABITAT & DISTR. – Solitary or gregarious, saprotrophic and terrestrial on loamy soils, in woods and plantations with coniferous trees (in the Netherlands *Picea*), in southern Limburg also in deciduous or mixed woods. Rather rare and scattered, Sept.-Nov. Widespread in Europe, and probably quite common.

Macrolepiota olivieri differs from *M. rachodes* in the slightly smaller spores, and the fact that the velar squames and the fibrillose background are of the same colour.

8. Macrolepiota venenata M. Bon in M. Bon et al. in Doc. mycol. 9 (35): 13. 1979.

SEL. ICON. – Bellù in Boll. Gruppo micol. G. Bres. 24: 103, 105, 106. 1982; Bon et al. in Doc. mycol. 9 (35): pl. 1-3. 1979.

SEL. DESCR. & FIGS. – Bellù in Boll. Gruppo micol. G. Bres. 24: 104, 107. 1982; Bon et al. in Doc. mycol. 9 (35): 13-16, fig. 1. 1979; Lavorato in Riv. Micol. 32: 277-280, fig. 3. 1989.

CHARACTERISTICS – Pileus 120-170 cm, convex, without umbo, with central light brown calotte up to 70 mm in diam., and with light brown appressed squames, with towards margin a radial-fibrillose aspect, on pale cream background; lamellae crowded, free, white to cream, discolouring reddish brown with age; stipe 100-160 × 10-15 mm, with bulbous base, glabrous, pale; annulus simple, descending; context white, when cut discolouring pink-brown; smell indistinct, fungoid; spore print white.

Spores 9.5-11.5 × 6.5-8.0 µm, on average 10.4 × 7.4 µm, Q = 1.3-1.5, Qav = 1.4, ellipsoid-amygdaliform, with truncate apex, in which germ pore is situated, thick-walled; basidia 28-37 × 11-15 µm, 4-spored; cheilocystidia 26-35 × 13-15 µm, clavate; velum on pileus a trichoderm, with clavate terminal elements; pigment brown and intracellular in cylindrical hyphae; stipitipellis a cutis; clamp-connections not observed.

HABITAT & DISTR. – Gregarious, saprotrophic and terrestrial in nitrogen-rich grasslands. Known from northern France and Italy.

Macrolepiota venenata is very closely related to *M. rachodes*, from which it differs in the absence of clamp-connections, the simple annulus, and the radially fibrillose pileus surface.

The macroscopic characteristics given above, are based on the description by Bon et al. (in Doc. mycol. 9 (35): 14-15. 1979); the microscopy is based on observations on the type material.

Ingestion of *M. venenata* has been the cause of gastrointestinal problems (Bon et al. in Doc. mycol. 9 (35): 13-21. 1979; Mazzolai in Riv. Micol. 32: 264-265. 1989).

4. **Chlorophyllum** Mass.

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Chlorophyllum Mass. in Kew Bull. 1898: 136. 1898, non *Chlorophyllum* Murrill, 1910; *Macrolepiota* sect. *Chlorophyllum* (Mass.) Moreno et al. in Mycotaxon 55: 469. 1995 (not valid).

SELECTED LITERATURE – Heinem. in Bull. Jard. bot. natn. Belg. 38: 195-206. 1968; Reid & Eicker in Bot. Bull. Acad. sinica 32: 317-333. 1991.

Basidiocarp pluteoid; pileus with coarse squames; lamellae free and remote from stipe; stipe with bulbous base; annulus present, made up of partial veil and universal veil; spore print pale green to grey green.

Spores thick-walled, when young dextrinoid, congophilous, cyanophilous, metachromatic in Cresyl Blue, but when mature not visibly so, with germ pore, glabrous; cheilocystidia present; pleurocystidia absent; hymenophoral trama trabecular; velum universale on pileus trichodermal; clamp-connections in most species present, but very rare and difficult to find. Development probably bivelangiocarpic, possibly hemiangiocarpic, and pileocarpic. – Holotype species *Chlorophyllum esculentum* Mass.

HABITAT & DISTRIBUTION – Saprotrophic, terrestrial, gregarious, in fairy rings, probably in woods in the Tropics, but outside the Tropics in irrigated lawns and fields, in temperate areas only indoors. Widespread in the Tropics.

The genus *Chlorophyllum* is closely related to *Macrolepiota* sect. *Laevistipedes* (Pázmány) M. Bon, and can be distinguished by the green spores.

Chlorophyllum molybdites (G. Meyer: Fr.) Mass. in Kew Bull. 1898: 136. 1898.

Agaricus molybdites G. Meyer, Pr. Fl. essequ.: 300. 1818; *Agaricus molybdites* G. Meyer: Fr., Syst. mycol. 1: 308. 1821; *Mastocephalus molybdites* (G. Meyer: Fr.) O. Kuntze, Rev. Gen. Pl. 2: 860. 1891; *Leucocoprinus molybdites* (G. Meyer: Fr.) Pat. in Bull. trimest. Soc. mycol. Fr. 29: 215. 1913; *Macrolepiota molybdites* (G. Meyer: Fr.) Moreno et al. in Mycotaxon 55: 467. 1995. – *Agaricus morganii* Peck in Bot. Gaz. 4: 137. 1879; *Lepiota morganii* (Peck) Sacc., Syll. Fung. 5: 30. 1887; *Mastocephalus morganii* (Peck) O. Kuntze, Rev. Gen. Pl. 2: 860. 1891; *Chlorophyllum morganii* (Peck) Mass. in Kew Bull. 1898: 136. 1898. – *Lepiota ochrospora* Cooke & Mass. in Grevillea 21: 73. 1893. – *Chlorophyllum esculentum* Mass. in Kew Bull. 1898: 136. 1898; *Lepiota esculenta* (Mass.) Sacc. & Syd. in Sacc., Syll. Fung. 16: 2. 1901. – *Agaricus guadelupensis* Pat. in Bull. Soc. mycol. Fr. 15: 197. 1899. – *Annularia camporum* Speg. in An. Mus. nac. Hist. nat. B. Aires 6: 117. 1899; *Lepiota camporum* (Speg.) Speg. in Boln Acad. nac. Cienc. Córdoba 29: 114. 1926. – *Agaricus congolensis* Beeli in Bull. Soc. roy. bot. Belg. 61: 92. 1928; *Chlorophyllum molybdites* var. *congolense* (Beeli) Heinem. in Fl. icon. Champ. Congo 16: 323. 1967. – *Chlorophyllum molybdites* var. *luteolosperma* Sing. in Papers Mich. Acad. Sci., Arts Letters 32: 139. 1946. – *Lepiota molybdites* var. *marginata* A.H. Smith, Mushr. nat. Hab.: 429. 1949.

SEL. ICON. – Imaz. et al., Fungi Japan: 181. 1988; Lincoff, Field Guide N. Amer. Mushr.: pl. 169, 170. 1981; Migl. in Boll. Gruppo micol. G. Bres., n.S. 39: 109. 1996; Serafin in Riv. Micol. 39 (3): front & back cover. 1996; Watling in Mycologist 5: 23. 1991.

SEL. DESCR. & FIGS. – Cherubini in Boll. Ass. micol. ecol. Romana 45: 20-22. 1998; Moreno et al. in Mycotaxon 55: 468, fig. 1. 1995 (as *Macrolepiota molybdites*); Reid & Eicker in Bot. Bull. Acad. sinica 32: 318-320, figs. 1 & 2. 1991; Sundb. in Madroño 21: 15-20, fig. 1. 1971; Vellinga in Coolia 33: 78-79, figs. 1 & 2. 1990; Watling in Mycologist 5: 23. 1991.

VERN. NAME – Groenspoorknolparasolzwam.

CHARACTERISTICS – Pileus c. 90 mm, plano-convex with very low, broad umbo; velum closed on umbo, dark chocolate brown (Mu. 10 YR 3/4), pallescent towards margin and slightly cracking into small velutinuous patches around centre, with some scattered 4-5-sided dark brown patches on cream coloured, radially fibrillose background, with at margin also some dark brown patches; lamellae crowded, free, brownish with greenish sheen; lamella edge eroded and dark brown in places; stipe 84 × 11 mm, widening downwards to 22 mm wide truncate base, ascending into pileus, hollow, pale creamy buff, with white bloom, darkening on touch, with ascending annulus; context pale buff in pileus, brownish in stipe and reddish in base of stipe; smell of cut basidiocarps like carrots; taste not reported; spore print 'pale green to grey green' when fresh (see Sundberg in Madroño 21: 18. 1971).

Spores 8.7-11.2 × 6.7-8.3 µm, on average 9.9 × 7.6 µm, Q = 1.2-1.45, Qav = 1.35-1.4, broadly ellipsoid to ellipsoid, slightly amygdaliform in side view, with conspicuous hilar appendix, green- and thick-walled, with broad truncate apex and germ pore; mature spores not reacting in Congo Red, Melzer's Reagent, nor in Cresyl Blue; immature spores, of which the wall is not yet green, do colour in the reagents mentioned; basidia 29-40 × 9.0-11.5 µm, 4-spored, without clamp-connection; lamella edge sterile; cheilocystidia 32-65 × 13-22 µm, clavate, narrowly clavate, thick-walled, many with brown contents; pileus covering (velar patches) made up of erect brown-coloured hyphae, densely

packed; terminal elements 4.0-10 µm wide; clamp-connections not observed, but rare in pileitrama (Sundberg in Madroño 21:18. 1971).

HABITAT & DISTR. – Gregarious, in fairy rings, saprotrophic, terrestrial. In the Netherlands only recorded once, growing indoors, in the solarium of a tropical swimming pool, with imported plants. Also reported from Scotland, growing in a similar habitat. A pantropical species, with a wide distribution, also in artificially irrigated lawns etc. in subtropical areas (e.g. Israel, Canary Islands, North America).

A very extensive literature survey of this species is given by Reid & Eicker (in Bot. Bull. Acad. sinica 32: 317-333. 1991); both the morphological and the toxic characteristics of the species are broadly discussed. Because of its wide distribution, and its toxic effects, *Chlorophyllum molybdites* is the species of the lepiotaceous fungi most often mentioned in literature.

Chlorophyllum molybdites is variable in its appearance; the Dutch specimen, on which the macroscopic description given here is based, is characterized by a dark extensive velar patch on the pileus; specimens with smaller, and loose-lying patches, and a very fibrillose covering are often depicted (e.g. Imazeki et al., Fungi Japan: 181. 1988; Lincoff, Field Guide N. Amer. Mushr.: pl. 169, 170. 1981).

There are many reports in literature on the toxicity of this species (for an overview see Reid & Eicker in Bot. Bull. Acad. sinica 32: 317-333. 1991). It causes gastrointestinal problems, especially when eaten raw. The effect on children is in general more severe than on adults. One report mentioned the presence of amatoxins (Feinfeld et al. in J. Toxicol. Clin. Toxicol. 32: 715-721. 1994).

5. **Leucocoprinus** Pat.

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Leucocoprinus Pat. in J. Bot., Paris 2: 16. 1888. – *Mastocephalus* Batt. ex O. Kuntze, Rev. Gen. Pl. 2: 857. 1891. – *Lepiota* subgen. *Leucobolbitius* J. Lange, Fl. agar. dan. 1: 23. 1935 (not valid). – *Lepiota* sect. *Striatae* Murrill in N. Amer. Fl. 10 (1): 42. 1914.

SELECTED LITERATURE – Candusso & Lanzoni, Lepiota: 458-504. 1990; Migl. in Boll. Gruppo micol. G. Bres., n.S., 39: 14-16; 73-82. 1996.

Basidiocarp pluteoid. Pileus with striate-sulcate marginal zone, thin-fleshed; lamellae free, not changing colour with ammonia vapour; stipe often bulbous-clavate; annulus present; spore print white to pale pink, pale lilacinous, or cream.

Spores smooth, thick-walled, binucleate, dextrinoid, congophilous, with metachromatic inner wall and tract (if present) in Cresyl Blue, cyanophilous, with or without germ pore, with walls swelling in $NH_{3(aq)}$ (ammonia) and $CH_3COOH_{(aq)}$ (acetic acid); in most species basidia starting short and squat, growing out to be long and slender, always surrounded by pseudoparaphyses; cheilocystidia present; pleurocystidia absent; lamellar trama trabecular; clamp-connections absent. Development bivelangiocarpic, and pileostipitocarpic. – Type species *Lepiota cepaestipes* (Sow.: Fr.) Kumm.

HABITAT & DISTRIBUTION – Solitary to gregarious, sometimes in clumps, saprotrophic and terrestrial, on compost heaps, more rarely on rotten wood or woodchips, mainly tropical, a few species outside in temperate regions, but also some species introduced in greenhouses, and appearing indoors with potted plants.

Only the most commonly encountered greenhouse and indoor species are treated here, viz. *L. birnbaumii*, *L. cepaestipes*, *L. cretaceus*, *L. ianthinus*, and *L. straminellus*. Some of these occasionally fruit outside on compost heaps, piles of leaves or sawdust and woodchips etc. in warm and humid summers. Additional species might be encountered in hothouses. The selected literature is restricted to European references only.

As the systematics of this genus is under study, a formal infrageneric classification would be premature. There are, however, two morphologically distinct groups of species, one with big, thick-walled spores with a germ pore, and a second group with relatively small, thinner walled spores without a germ pore. The sulcate pileus margin, and the presence of pseudoparaphyses distinguish the second group from species in *Cystolepiota* and *Leucoagaricus* with which they could be confused.

The neutral term 'pileus covering' is used for all the covering layers of the pileus, not taking into account their origin.

In the Neotropics several species belonging to the genera *Leucocoprinus* and *Leucoagaricus* are cultivated by attine ants; for more information on this interesting topic, see e.g. Chapela et al. (in Science 266: 1691-1694. 1994); and Mueller et al. (in Science 281: 2034-2039. 1998).

KEY TO THE SPECIES

1. Elements of pileus covering globose; clamp-connections present ..... **Cystolepiota**
1. Elements of pileus covering globose, inflated, irregular, cylindrical, lageniform; clamp-connections absent
   2. Pileus and stipe turning red on bruising; lamellae green or red with ammonia vapour
      see **Leucoagaricus Key one**
   2. Pileus and stipe not turning red on bruising; lamellae not changing colour with ammonia vapour
      3. Basidiocarp yellow, sulphur-yellow, or pale yellow
         4. Elements on pileus elongate, not globose; spores 8.0-12 × 5.0-9.0 µm, with germ pore **3. L. birnbaumii**
         4. Elements on pileus surface globose; spores 5.0-8.5 × 4.0-7.0 µm, without germ pore **7. L. straminellus**
      3. Basidiocarp white, cream, with or without coloured (brown, lilac, black) squamules and/or fibrils on pileus or with brown pileus

5. Pileus brown, especially at centre, or cream with lilac tinges
   6. Pileus with lilac centre; stipe lilac in lower part ..... **4. L. ianthinus**
   6. Pileus with brown or buff tinges
      7. Pileus with brownish centre and uplifted squamules; terminal elements of pileus squamules narrowly lageniform with long, often flexuous neck ..... **1. L. cepaestipes** sensu J. Lange
      7. Pileus white, at centre cream, and with age with cream buff tips of cottony flocculose warts or squames; elements of pileus covering cylindrical, often branched and H-shaped or T-shaped, and bone-like in appearance ..... **2. L. cretaceus**
5. Pileus totally white, or white with grey to blackish squamules or fibrils
   8. Pileus with black or dark grey, rarely grey, tinges
      9. Pileus with dark calotte, contrasting with white surface (set with squamules), rarely with faded, pale grey, calotte; spores 8.5-13 × 5.0-8.0 µm, with germ pore; growing outdoors; basidiocarps medium-sized (pileus 15-40(-80) mm) ..... **5. L. brebissonii**
      9. Pileus with gradual transition between centre and rest, with dark fibrils and small squamules; spores 5.5-9.0(-9.5) × 3.0-4.5(-5.0) µm, without germ pore; growing either in greenhouses or outdoors; basidiocarps small (pileus 7-20 mm)
         10. Spores 6.0-9.0(-9.5) × 3.0-4.5(-5.0) µm, Qav = 1.8-1.85; pileus sulcate in marginal zone; growing in greenhouses ..... **8. L. heinemannii**
         10. Spores 5.5-7.0 × 3.5-4.5(-5.0) µm, Qav = 1.55-1.65; pileus not sulcate; growing outdoors
             Leucoagaricus melanotrichus var. **melanotrichus**
   8. Basidiocarps totally white8
      11. Basidiocarps big (pileus 35-90 mm; stipe 28-110 × 2-13 mm), and warty-floccose on pileus, floccose on stipe; spores 8.0-12 × 5.5-7.5 µm, with germ pore ..... **2. L. cretaceus**
      11. Basidiocarps small (pileus 10-35 mm; stipe 9-50 × 1-3 mm), fine-granular-floccose all over or only on pileus centre; spores 5.0-8.5 × 3.5-7.0 µm, without germ pore
         12. Pileus covering rather smooth, made up of radially oriented hyphae, with occasional round elements; spores ellipsoid-amygdaliform in side-view; growing in natural habitats, most often on rotten wood ..... **6. L. cygneus**
         12. Pileus powdery of globose elements; spores subglobose to broadly ellipsoid; growing in greenhouses, rarely outside and then on compost heaps etc.
             L. straminellus var. **albus** (see notes under 7. *L. straminellus*)

1. Leucocoprinus cepaestipes (Sow.: Fr.) Pat. sensu J. Lange, Fl. agar. dan. 1: pl. 14F. 1935. – Fig. 50.

Leucocoprinus cepaestipes f. *macrosporus* Migl. in Boll. Ass. micol. ecol. Romana 6-7: 18. 1986.

EXCL. – *Leucocoprinus cepaestipes* sensu Dennis in Kew Bull. 7: 462-488. 1952; sensu Horak, Syn. Gen. Agar.: 346-348. 1968; sensu Pegl., Prel. Agaric Fl. East Africa: 318. 1977; sensu Chiusa in Riv. Micol. 41: 514-157. 1998; sensu Pegl., Agaric Fl. Lesser Antilles: 417. 1983; sensu Pegl., Agaric Fl. Sri Lanka: 324-325. 1986; sensu Pegl. & Calonge in Bol. Soc. micol. Madrid 22: 49-50, fig. 2. 1997 (= in all cases *L. cretaceus*).

SEL. ICON. – Breitenb. & Kränzl., Pilze Schweiz 4: pl. 246. 1995; J. Lange, Fl. agar. dan. 1: pl. 14F. 1935.

SEL. DESCR. & FIGS. – Candusso & Lanzoni, Lepiota: 472-474, fig. 104. 1990 (as *L. cepistipes*); Haller in Schweiz. Z. Pilzk. 29: 33-35. 1951 (as *Lepiota cepaestipes*); Migl. in Boll. Ass. micol. ecol. Romana 6-7: 10-14. 1986 (as *L. cepaestipes* f. *macrosporus*).

VERN. NAME – Dikvoetplooiparasol.

Pileus when expanded 30-65 mm, when very young paraboloid, expanding to campanulate, and finally plano-convex with flattened centre, to applanate, when young totally granular plush-like, brown-coloured, later at centre plush-like, velvety (lens), dark brown to pale beige-brown (Mu. 10 YR 4/4 - 7/4), around centre with radially arranged, uplifted, small beige-brown or ochraceous brown (10 YR 6-7/6) squamules, discolouring yellow when touched; those squamules are further apart near margin than near centre, on creamy background; sulcate in marginal, 5-7 mm wide, zone. Lamellae, L = c. 80, l = 0-1, rather crowded to crowded, free and remote from stipe, segmentiform to ventricose, up to 4 mm wide, cream, pale brownish cream, discolouring brown with age, with whitish, fimbriate to flocculose (lens) edge. Stipe 30-130 × 2.5-5 mm, slightly broadening downwards and tapering upwards, hollow, when young white, later cream to pale brownish cream, densely fine-pubescent all over, below annulus with some small squamules, when young turning yellow when bruised, later yellow-brown to brown when damaged, when fresh and young exuding drops. Annulus ascending, white when young, with yellow exudation drops, with at the margin some thickened squamules, concolorous with those on pileus, evanescent. Context in young specimen white in pileus and stipe, later cream. Smell of cut basidiocarp slightly like the smell of *Lepiota cristata*, or fruity with some soapy component. Taste like rubber. Spore print probably white.

Spores 7.5-13 × 6.0-8.0 µm, on average 8.5-11.1 × 6.6-7.5 µm, Q = 1.1-1.7, Qav = 1.25-1.55, in side-view ellipsoid, oblong, slightly amygdaliform, in frontal view ellipsoid to oblong, thick-walled, with germ pore, congophilous, dextrinoid, cyanophilous, with pink inner wall and tract in Cresyl Blue. Basidia 16-37 × 8.0-12 µm, 4-spored, rarely 2-spored, surrounded by 4-6 pseudoparaphyses. Lamella edge sterile; cheilocystidia 25-60 × 8-15 µm, clavate, without (in young specimens) or with (in mature specimens) apical excrescence, up to 20 × 2.0-3.0 µm, lageniform, colourless. Pleurocystidia absent. Pileus covering with squamules, made up of short squat elements; terminal

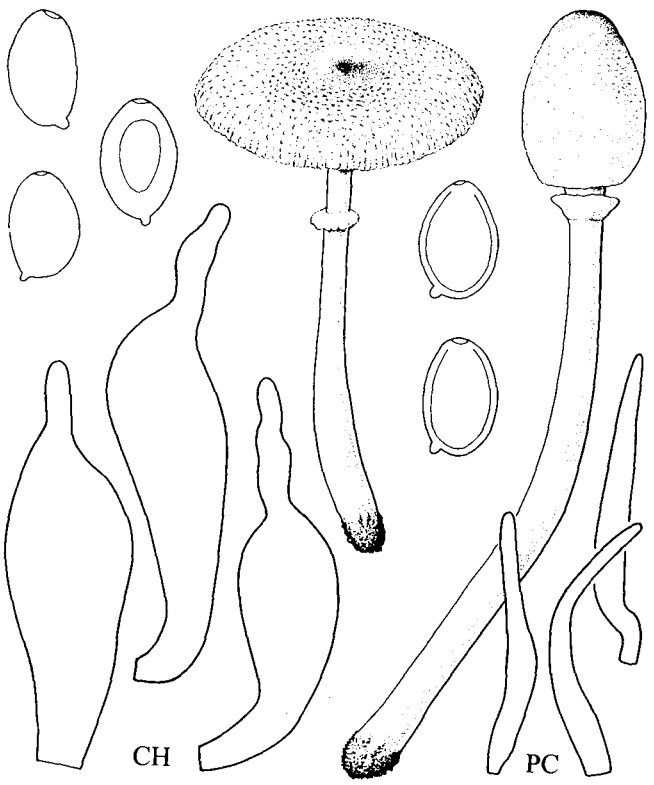

Fig. 50. *Leucocoprinus cepaestipes*.

elements 31-110 × 5-9 µm, 3.0-5.0 µm at apex, cylindrical, lageniform with long flexuous neck, with yellowish intracellular pigment. Stipitipellis a cutis of narrowly cylindrical hyphae, 2.0-4.0 µm wide, with colourless cystidioid elements in tufts, as terminal elements of pileus squamules: 45-90 × 6.5-9.0 µm, 3.0-4.0 µm at apex, narrowly lageniform with long tapering neck. Clamp-connections absent.

HABITAT & DISTR. – In small clumps and groups, saprotrophic and terrestrial, on soil in greenhouses, and on wood chips and compost heaps outside. In the Netherlands rather rare, and recently repeatedly recorded from the outside (Wassenaar, Apeldoorn). End of July-beginning of Sept. (both inside and outside). Widespread in Europe, mainly in greenhouses etc., of tropical origin.

Leucocoprinus cepaestipes in the present sense has the following microscopical characters: cheilocystidia clavate with in full-grown specimens abrupt apical, cylindrical excrescence; narrowly lageniform to cylindrical elements on pileus and stipe surfaces. The spores are, as in many species of the genus, variable in size and shape, depending on age and growing conditions of the basidiocarps. For this reason Migliozzi's forma *macrosporus* (described in in Boll. Ass. micol. ecol. Romana 6-7: 10-14. 1986) is not recognized here.

Leucocoprinus cepaestipes var. *rorulentus* (Panizzi) Babos is a white variant, in which the lamellae turn pink with age (Panizzi in Comm. Soc. critt. ital. 1: 172. 1861).

Variants with lilac-grey to greyish brown tinges in the pileus have been found, both indoors in heated and non-heated glasshouses, and on a pile of leaves outside (in a botanical garden). The cheilocystidia are different from the typical *L. cepaestipes*, but caulocystidia and pileus covering elements are similar. These collections have been excluded from the above description.

English authors, e.g. Pegler (Agaric Fl. Sri Lanka: 324-325. 1986), have used the name *L. cepaestipes* for a white tropical species, for which *L. cretaceus* is the correct name (see excluded names). However, the present species, which must be widespread in the tropics and is clearly separated from *L. cretaceus*, is not represented by its own description in Pegler's work. Sowerby (Col. Figs. engl. Fungi 1: pl. 2. 1796) introduced *Agaricus cepaestipes* to accommodate both *Agaricus cretaceus* Bull. and *A. luteus* Bolt. which he considered colour variants of the same species.

2. Leucocoprinus cretaceus (Bull.: Fr.) Locq. in Bull. mens. Soc. linn. Lyon 14: 93. 1945. – Fig. 51.

Agaricus cretaceus Bull., Herb. France: pl. 374. 1788; *Agaricus cretaceus* Bull.: Fr., Syst. mycol., Ind. gen.: 14. 1832, non *Agaricus cretaceus* Pers., 1801, nec *Agaricus cretaceus* Pers.: Fr., 1821; *Lepiota cretacea* (Bull.: Fr.) Quél., Fl. mycol. France: 298. 1881. – *Lepiota cretata* Locq. in Haller in Mitt. aargau. naturf. Ges. 23: 82. 1950 (not valid); *Leucocoprinus cretatus* (Locq.) Mos., Blätter-, Bauchpilze, 1. Aufl.: 116. 1953 (not valid); *Leucocoprinus cretatus* Locq. ex Lanzoni in Atti XIX Com. scient. naz. Serina (Bergamo): 30-31. 1986.

EXCL. – *Leucoagaricus cretaceus* sensu Mos., Röhrlinge Blätterpilze, 3. Aufl.: 185. 1967; sensu Knudsen in Hansen & Knudsen, Nordic Macromyc. 2: 223. 1992 (= in both cases *Leucoagaricus leucothites*). – *Lepiota cretacea* sensu Mal. & Bert., Fl. Champ. sup. Maroc 1: 120-121, fig. 16. 1970 (= unknown species).

MISAPPL. – *Leucocoprinus cepaestipes* sensu Chiusa in Riv. Micol. 41: 514-157. 1998; sensu Pegl., Prel. Agaric Fl. East Africa: 318. 1977; sensu Pegl., Agaric Fl. Lesser Antilles: 417. 1983; sensu Pegl., Agaric Fl. Sri Lanka: 324-325. 1986; sensu Pegl. & Calonge in Bol. Soc. micol. Madrid 22: 49-50, fig. 2. 1997. – *Lepiota cepaestipes* sensu Lincoff, Field Guide N. Amer. Mushr.: 515, pl. 179. 1981

SEL. ICON. – Candusso & Lanzoni, Lepiota: pl. 60. 1990 (as *L. cretatus*); Lincoff, Field Guide N. Amer. Mushr.: pl. 179. 1981 (as *Lepiota cepaestipes*); Migl. in Boll. Gruppo micol. G. Bres. 39: 4, 6. 1996 (as *L. cretatus*); Pegl. & Calonge in Bol. Soc. micol. Madrid 22: fig. 2. 1997 (as *L. cepaestipes*).

SEL. DESCR. & FIGS. – Candusso & Lanzoni, Lepiota: 477-478, fig. 105. 1990 (as *L. cretatus*); Migl. in Boll. Gruppo micol. G. Bres. 39: 5-8, figs. 1-3. 1996 (as *L. cretatus*); Reid & Eicker in S. Afr. J. Bot. 59: 92-95, figs. 16-19. 1993.

VERN. NAME – Krijtwitte plooiparasol.

Pileus 38-90 mm, at first hemispherical to obtusely conical or conico-convex or convex, with margin inflexed at first, later expanding to plano-concave with or without a vague low umbo, when fully mature with sulcate marginal 2-3 mm wide zone, thin-fleshed (1-2.5 mm above middle of lamellae), white with cream-buff tinges at centre, at first completely covered with conical, about 2 mm in diam. and up to 2.5 mm high soft conical warts to merely irregularly floccose-squamulose and these warts white to cream-buff tinged, usually at centre with pale brownish tips; pileus surface dry between warts, radially woolly-fibrillose (lens); margin hung with fringes and so exceeding lamellae. Lamellae, L = 85-100, l = 0-3, rather crowded, free and distant from stipe, very thin, (sub)ventricose, up to 7 mm broad, white to very pale sordid-creamy whitish, with entire, concolorous edge. Stipe 28-110 × 2-13 mm, attenuate upwards, with strongly enlarged bulbous or clavate to fusiform base (7-19 mm wide) and somewhat rooting, solid, but later stuffed, white at first but taking very slight ochraceous buff tinge, particularly in upper part, minutely felted-flocculose above annulus, with rather thick fine-warted covering to finely flocculose-squamulose in transverse rows below annulus, with stipe surface under covering discolouring yellowish when bruised, with white mycelium. Annulus c. halfway up stipe, first flaring, but then pending, 5-10 mm wide, thin, felted-submembranaceous, smooth at upper surface,

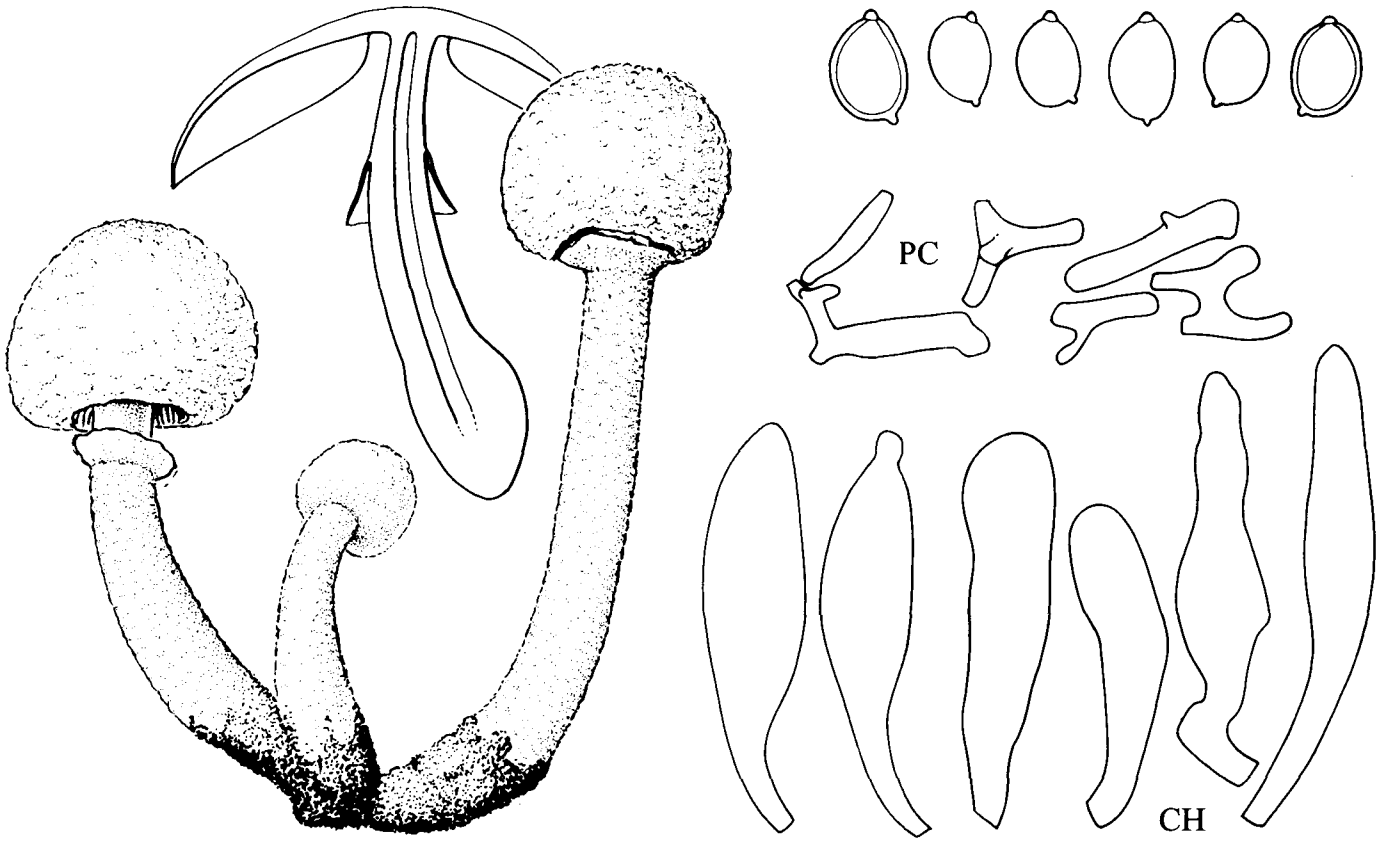

Fig. 51. *Leucocoprinus cretaceus*.

minutely flocculose at lower surface, with broken thicker rim at inside of margin. Context whitish to pale buff, with age somewhat sordid, rather soft and pliable except in cortex of stipe. Smell variable, recorded as weak, typically lepiotoid and later like the smell of *Inocybe bongardii*, or as rather strong, unpleasant, rather nauseating (also in young specimens); when crushed different, more herbaceous, suggestive of *Pelargonium*. Taste strong, unpleasant, astringent (lepiotoid), not bitter. Spore print off-white to pale cream (Romagnesi 1b-2a).

Spores 8.0-12 × 5.5-7.5 µm, on average 8.7-10.5 × 5.9-6.8 µm, Q = 1.3-1.95, Qav = 1.4-1.65, in side-view ellipsoid to oblong, slightly amygdaliform, sometimes with shallow suprahilar depression, in frontal view ellipsoid to oblong, or slightly ovoid, thick-walled, with germ pore, often with bulging hyaline cap over germ pore, dextrinoid, congophilous, cyanophilous, with pink inner wall and tract in Cresyl Blue. Basidia 18-28 × 8.5-12 µm, 4-spored, surrounded by 4-6 pseudoparaphyses. Lamella edge sterile; cheilocystidia (30-)40-100 × 7-14(-21) µm, narrowly clavate to fusiform, narrowly lageniform, cylindrical, sometimes with short apical excrescence, slightly moniliform, rarely clavate, colourless, and rather thin-walled to slightly thick-walled, sometimes with amorphous matter at apex. Pleurocystidia absent. Pileus covering with warts and floccules, made up of elongate colourless elements, cylindrical, branched, with excrescences, H-shaped or T-shaped, with straight and often widened ends, often a bit bone-like in appearance, 5.0-10 µm wide. Stipitipellis a cutis of narrow, colourless, cylindrical hyphae, 2.0-4.0 µm wide, with floccules made up of elements similar to those of squamules on pileus. Clamp-connections absent.

HABITAT & DISTR. – In bundles, in groups, saprotrophic and terrestrial, often on sawdust or woodchips, compost heaps etc., in greenhouses, or outdoors. In the Netherlands known from heated and non-heated glasshouses, but in recent years also outside (Apeldoorn, Leusden), but rare. Outside (Aug.) Sept., inside the whole year through. Scattered in Europe, mostly recorded from greenhouses, widespread in the tropics.

Leucocoprinus cretaceus is taken here in the original sense of Bulliard (Herb. France: pl. 374. 1788). Bulliard's description under the plate clearly stated that the pileus covering was cottony or plush-like and chalk-white. Some authors (e.g. Haller in Mitt. aargau. naturf. Ges. 23: 82-85. 1950) have argued that Bulliard's somewhat stylized plate depicts a species with a smooth pileus surface, now commonly known as *Leucoagaricus leucothites* (Vitt.) Wasser, and consequently have used a different name for the present species. Knudsen (in Hansen & Knudsen, Nordic Macromyc. 2: 223. 1992) still used *Leucoagaricus cretaceus* for the species called *L. leucothites* in the present work.

The name *Agaricus cretaceus* Bull. was sanctioned by Fries in the Index to the Systema mycologicum (1832: 14), and so has priority over *Agaricus cretaceus* Pers. (Syn. meth. Fung.: 349. 1801), which was also sanctioned by Fries (Syst. mycol. 1: 95. 1821).

Locquin (in Haller in Mitt. aargau. naturf. Ges. 23: 82. 1950) proposed the name *Lepiota cretata* for the present species. This has been widely followed, overlooking the many older synonyms, based on tropical collections, which are available (see Pegler, Agaric Fl. Sri Lanka: 323-324. 1986 for an extensive list, under *L. cepaestipes*).

Pegler (e.g. Agaric Fl. Sri Lanka: 323-324. 1986), and other English authors, have used the name *L. cepaestipes* (Sow.: Fr.) Pat. for this white species. The name *Leucocoprinus cepaestipes* is nowadays most commonly used for a species with brown squamules (e.g. Candusso & Lanzoni, Lepiota: 472-474. 1990), following Lange's interpretation (Fl. agar. dan. 1: pl. 14F. 1935).

Cystolepiota pulverulenta is also a clampless, white, floccose-warty species, but the basidiocarps discolour on bruising, the spores are small (viz. (3.5-)4.0-5.5(-6.0) × (2.0-)2.5-3.5 µm) and they lack a germ pore. This species occasionally grows in pots of houseplants and in greenhouses.

3. Leucocoprinus birnbaumii (Corda) Sing. in Sydowia 15: 67 ('1961') 1962. – Fig. 52.

Agaricus birnbaumii Corda, Icon. Fung. 3: 48. 1839. – *Agaricus flos-sulphuris* Schnizl. in Sturm, Deutschl. Fl. 3, Abt. 31. 32. Heft: 2. 1851; *Lepiota flos-sulphuris* (Schnizl.) Mattirolo in Atti Accad. naz. Lincei Memorie, Ser. V, 12 (11): (566) 34. 1918; *Leucocoprinus flos-sulphuris* (Schnizl.) Cejp in Ceská Mykol. 2: 78. 1948; *Lepiota cepaestipes* var. *flos-sulphuris* (Schnizl.) J. Rick in Iheringia, Bot. 8: 314. 1961 (not valid). – *Agaricus luteus* Bolt., Hist. Fung. Halifax 2: pl. 50. 1788, non *Agaricus luteus* Huds., 1778, nec *Agaricus luteus* Huds.: Fr., 1821; *Lepiota lutea* (Bolt. ∅) Godfrin in Bull. Soc. mycol. Fr. 13: 33. 1897; *Leucocoprinus luteus* (Bolt. ∅ Godfrin) Locq. in Bull. mens. Soc. linn. Lyon 14: 93. 1945. – *Lepiota aurea* Mass. in Kew Bull. 1912: 189. 1912, non *Lepiota aurea* (Mattuschka: Fr.) S.F. Gray, 1821. – *Lepiota pseudolicmophora* Rea, Brit. Basidiomyc.: 74. 1922. – *Lepiota coprinoides* Beeli in Fl. icon. Champ. Congo 2: 42. 1936.

SEL. ICON. – Breitenb. & Kränzl., Pilze Schweiz 4: pl. 244. 1995; Dähncke & Dähncke, 700 Pilze: 318. 1979; Imaz. et al., Fungi Japan: 185. 1988; J. Lange, Fl. agar. dan. 1: pl. 14G. 1935 (as *Lepiota lutea*); Migl. et al. in Riv. Micol. 32: 24. 1989; Rocabruna in Bolets Catalunya 3: pl. 130. 1984.

SEL. DESCR. & FIGS. – Candusso & Lanzoni, Lepiota: 465-466, fig. 102. 1990; Kelderman, Parasolzw. Zuid-Limburg: 174-175. 1994); Migl. et al. in Riv. Micol. 32: 24-26. 1989.

VERN. NAME – Goudgele plooiparasol.

Pileus when expanded 20-60 mm, when very young paraboloid, then hemispherical, and expanding to applanate, or plano-convex, with or without umbo, bright sulphur yellow when young, with easily removable floccules, pallescent to pale yellow-brown when old, with yellow-brown squamules, forming a patch at centre, in old specimens with distinctly radially grooved marginal zone, when young with yellow fringes at margin. Lamellae, L = 50-70, l = 1, rather crowded to crowded, free and remote from stipe, segmentiform to ventricose, up to 4 mm wide, pale-yellow, with strongly eroded, more intense yellow to brownish edge. Stipe 30-80 × 2-5 mm, at base distinctly clavate-bulbous, up to 7 mm wide, hollow, first lemon-yellow to sulphur-yellow, later brownish, over total length fine-squamulose, except for just above base and there distinctly yellow. Annulus membranaceous, yellow on upper side, whitish on underside, evanescent. Context thin and soft, dull and whitish in pileus, shiny whitish in stipe. Smell indistinct. Taste indistinct. Spore print white.

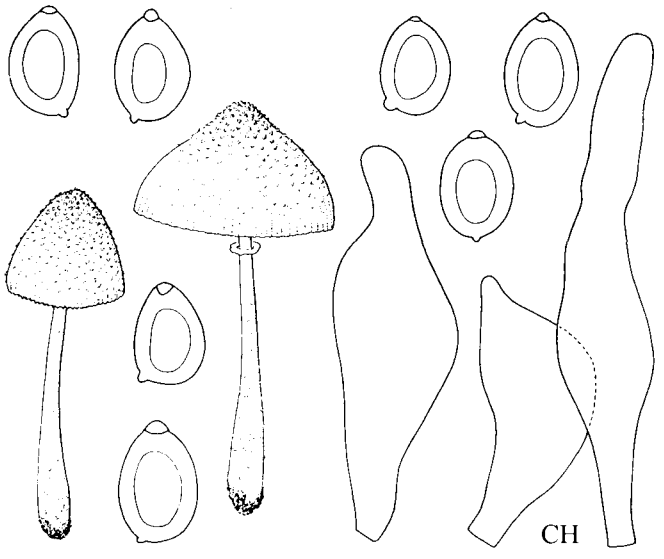

Fig. 52. *Leucocoprinus birnbaumii*.

Spores 8.0-12 × 5.0-9.0 µm, on average 8.9-9.9 × 6.3-7.2 µm, Q = 1.25-1.6, Qav = 1.35-1.45, in side-view amygdaliform-ellipsoid, ellipsoid, in frontal view ellipsoid or ovoid, thick-walled, with germ pore and hyalinous cap over germ pore, dextrinoid, congophilous, cyanophilous, with pink inner wall and tract in Cresyl Blue. Basidia 16-40 × 7.5-10 µm, 4-spored, surrounded by 4-6 pseudoparaphyses. Lamella edge sterile; cheilocystidia 25-70 × 11-17 µm, variable in shape and size, lageniform with 3.0-6.0 µm wide neck, utriform, narrowly clavate, thin-walled and colourless. Pleurocystidia absent. Pileus covering with squamules made up of elongate, inflated, sometimes branched elements, 5.0-15 µm wide, and some scattered ellipsoid and clavate elements, up to 35 × 23 µm. Pigment yellowish-brownish, granular and diffuse, intracellular. Stipitipellis a cutis of narrow cylindrical, yellowish, hyphae, 2.0-5.0 µm, with tufts of irregular tangled hyphae, with rather short elements, cylindrical, almost cylindrical, often branched, around 5.0 µm in diam., with yellowish intracellular pigment. Clamp-connections absent.

HABITAT & DISTR. – Solitary and in clumps of a few specimens, saprotrophic and terrestrial in houseplant pots indoors, and in greenhouses. Common, throughout the year, widespread in Europe, of tropical origin.

Annotations with Dutch material stated that the spore print is white; surprisingly Breitenbach & Kränzlin (Pilze Schweiz 4: pl. 244. 1995) said that the spore print is pale pink.

4. Leucocoprinus ianthinus (Cooke ∅ Sacc.) Locq. in Bull. mens. Soc. linn. Lyon 14: 94. 1945. – Fig. 53.

Agaricus ianthinus Cooke in Grevillea 16: 101. 1888, non *Agaricus janthinus* Fr.: Fr., 1821; *Lepiota ianthina* (Cooke ∅) Sacc., Syll. Fung. 9: 10. 1891; *Leucocoprinus ianthinus* (Cooke ∅ Sacc.) Mohr in Boletus 18: 48. 1992 (superfluous). – *Lepiota lilacinogranulosa* P. Henn. in Verh. bot. ver. Prov. Brandenb. 40: 145. 1898; *Leucocoprinus lilacinogranulosus* (P. Henn.) Locq. in Bull. mens. Soc. linn. Lyon 12: 94. 1943; *Leucocoprinus lilacinogranulosus* (P. Henn.) M. Bon et al. in Doc. mycol. 19 (75): 53. 1989 (superfluous); *Hiatula cepaestipes* var. *lilacinogranulosa* (P. Henn.) Heim & Romagn. in Bull. trimest. Soc. mycol. Fr. 50: 184. 1934.

SEL. ICON. – Heim & Romagn. in Bull. trimest. Soc. mycol. Fr. 50: pl. 11, fig. 1. 1934 (as *Hiatula cepaestipes* var. *lilacinogranulosa*); Migl. et al. in Riv. Micol. 32: 21. 1989 (as *L. lilacinogranulosus*);

SEL. DESCR. & FIGS. – Babos in Agarica 6 (12): 212-213, fig. 14. 1985 (as *L. lilacinogranulosus*); Candusso & Lanzoni, Lepiota: 484-486, fig. 107. 1990 (as *L. lilacinogranulosus*); G. Fischer in Ulmer Pilzfl. 1: 136. 1986; Heim & Romagn. in Bull. trimest. Soc. mycol. Fr. 50: 184-185, fig. 12. 1934 (as *Hiatula cepaestipes* var. *lilacinogranulosa*); Migl. et al. in Riv. Micol. 32: 20-23. 1989 (as *L. lilacinogranulosus*); D. Reid in Mycol. Res. 93: 418. 1989 (as *L. ianthinus* and *L. lilacinogranulosus* resp.).

VERN. NAME – Lilakorrelige plooiparasol.

Pileus in expanded specimens 17-62 mm, when young closed and paraboloid with flattened apex to ovoid, expanding to broadly campanulate, conical-campanulate and finally plano-convex with big, truncate umbo, and uplifted margin, at centre finely fibrillose-squamulose felted, purplish, reddish brown (K. & W. 8E6, 9D6, 7E5), around cen-

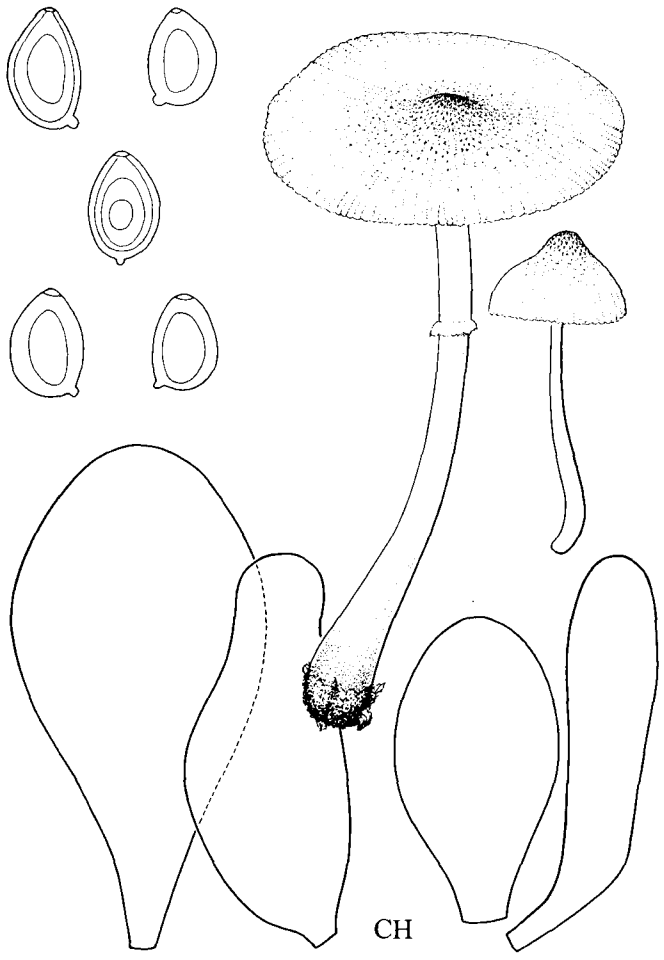

Fig. 53. *Leucocoprinus ianthinus*.

tre with small purplish fibrils, especially on the ridges, but mostly white or cream especially in outer half, and there without purplish fibrils, costate-plicate up to 2/3 of radius or up to umbo, at utmost margin yellowing with age, easily radially splitting, very thin-fleshed. Lamellae, L = 35-55, l = (0-)1(-2), moderately distant to moderately crowded, free and remote from stipe, segmentiform-linear to ventricose, narrow, up to 3 mm wide, sometimes anastomosing-furcate, white with vague lilacinous sheen on some places when older, with finely flocculose white edge. Stipe 35-70(-150) × 2-5 mm, broadening downwards and there bulbous-clavate, hollow, in apical part yellowish white, shiny, lengthwise fibrillose, below annulus white, or pale yellowish white with age, in lower half and at at bulb with purplish-violaceous fibrils to complete lilac covering (e.g. 11C4), with white tomentum at bulb itself, discolouring yellow when bruised. Annulus ascending, and slightly flaring, white, with purplish margin, evanescent. Context very thin and soft in pileus, white, concolorous with surface in stipe (but not lilac-tinged). Smell of cut basidiocarp fungoid, strong, slightly astringent. Taste fungoid. Spore print probably pale lilacinous to white.

Spores 8.0-12 × 5.5-7.5 µm, on average 9.4-10.4 × 6.5-6.7 µm, Q = 1.25-1.7, Qav = 1.4-1.55, in side-view ellipsoid-amygdaliform, some with apical papilla, in frontal view ellipsoid to slightly ovoid, thick-walled, with germ pore and hyaline cap over pore, dextrinoid, congophilous, cyanophilous, with pink inner wall and tract in Cresyl Blue. Basidia 17-42 × 8.0-11 µm, 4-spored, rarely 2-spored, surrounded by 4-6 pseudoparaphyses. Lamella edge sterile; cheilocystidia 27-80 × 9.0-35 µm, varying from cylindrical, utriform to broadly clavate, thin-walled, colourless. Pleurocystidia absent. Pileus covering made up of irregular chains of cylindrical to ellipsoid to globose elements, with adnate to ascending elements, ranging from 15-35 × 5.0-9.0 µm to 25 µm in diam.; pigment intracellular and lilac-brown to greyish lilac. Stipitipellis a cutis of cylindrical colourless hyphae, 4.0-13 µm in diam., with at base of stipe similar elements as on pileus surface. Clamp-connections absent.

HABITAT & DISTR. – In small groups, saprotrophic and terrestrial in pots of plants, in greenhouses. Rather rare in the Netherlands, found throughout the year, widespread in Europe, probably of tropical origin.

The name *L. ianthinus* is used for the species, more commonly known as *L. lilacinogranulosus*, following Bon (Fl. mycol. Eur. 3, Lépiotes: 112. 1993); Reid (in Mycol. Res. 93: 418. 1989) gave arguments for and against this synonymy, but he did not reach a conclusion.

Reid (in Mycol. Res. 93: 420. 1989) distinguished *L. lilacinogranulosus* var. *subglobisporus* with smaller, subglobose spores; this variety has not yet been recorded from the Netherlands. Zuccherelli & Migliozzi (in Boll. Gruppo micol. G. Bres., n.S., 41: 197-203. 1998) reported on its occurrence in Italy.

Specimens with grey-lilac to lilac-brown tinges and narrowly lageniform to cylindrical elements on pileus and stipe are described under *L. cepaestipes*.

5. Leucocoprinus brebissonii (Godey) Locq. in Bull. mens. Soc. linn. Lyon 12: 41. 1943. – Fig. 54.

Lepiota brebissonii Godey in Gillet, Hyménomycètes: 64. 1874. – *Leucocoprinus otsuensis* Hongo in J. Jap. Bot. 28: 70. 1953.

MISAPPL. – *Agaricus clypeolarius* sensu Sow., Col. Ill. Engl. Fungi 2: pl. 171. 1798.

SEL. ICON. – Arnolds & Veerkamp, Gids Paddest. Meetnet: 76. 1999; Krieglst. in Z. Mykol. 48: opp. p. 64. 1982; J. Lange, Fl. agar. dan. 1: pl. 14H. 1935; R. Phillips, Paddest. Schimm.: 30. 1981.

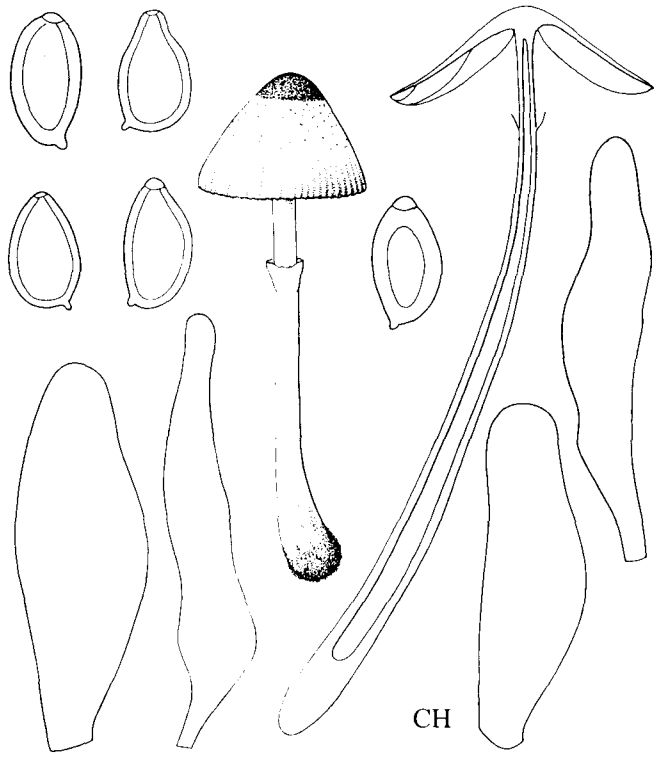

Fig. 54. *Leucocoprinus brebissonii*.

SEL. DESCR. & FIGS. – Babos in Agarica 6 (12): 208, 210. 1985; Candusso & Lanzoni, Lepiota: 469-470, fig. 103. 1990; Hotz in Schweiz. Z. Pilzk. 61: 89. 1983; Krieglst. in Z. Mykol. 48: 54-55. 1982; Kelderman, Parasolzw. Zuid-Limburg: 176-177. 1994; Kühner in Bull. trimest. Soc. mycol. Fr. 52: 237-238. 1936.

VERN. NAME – Spikkelplooiparasol.

Pileus when expanded 20-60(-80) mm, when very young paraboloid, then conical, with rounded apex and expanding via campanulate or convex to plano-convex and applanate with low umbo, or without any umbo, very dark grey-brown, grey-brown, dark brown to almost black (Mu. 10 YR - 2/5 Y 3/2), and velvety or finely squamulose-granular at centre; centre well-limited; around centre with small concentrical dark grey-brown to blackish squamules and more towards margin with fine dark brown-grey to blackish fibrils on cream-coloured or whitish background, rarely with faded colours on centre and squamules, slightly yellowing when damaged, when young scarcely sulcate at margin later more distinctly so, up to 1/4 of radius. Lamellae, L = 35-60, l = 0-3, moderately crowded, free, some furcate-anastomosing, segmentiform to slightly ventricose, up to 3.5 mm broad, white, pale cream-coloured or slightly yellowish, with white, eroded to flocculose edge. Stipe 35-80 × 2-5 mm, gradually widening towards clavate, up to 8 mm wide base, hollow, white and pinkish-brownish in lower part, finely flocculose-pruinose to dark fibrillose-flocculose, especially in lower part, white tomentose on base. Annulus ascending, white, tomentose, evanescent. Context white in pileus, in stipe white in upper part and brownish in lower part. Smell indistinct, either fungoid, or reminiscent of the smell of *Lepiota cristata*. Taste not unpleasant to indistinct. Spore print pale cream-coloured.

Spores 8.5-13 × 5.0-8.0 µm, on average 9.3-11.5 × 5.6-7.0 µm, Q = 1.35-2.1, Qav = 1.6-1.8, in side-view ellipsoid-amygdaliform to cylindrical-amygdaliform, with or without elongated papilla-like apex, in frontal view ellipsoid-ovoid to cylindrical-ovoid, thick-walled, with germ pore, dextrinoid, congophilous, cyanophilous, with pink inner wall and tract in Cresyl Blue. Basidia 20-43 × 8.0-11 µm, 4-spored, rarely 2-spored, surrounded by 4-6 pseudoparaphyses. Lamella edge sterile; cheilocystidia in tufts, 34-80 × 8.0-18.5 µm, cylindrical to narrowly clavate, or subutriform, or sublageniform, thin-walled to slightly thick-walled, especially in apical part, some with some small crystals at apex, colourless. Pleurocystidia absent. Pileus covering made up of cylindrical and short to ellipsoid-clavate to globose elements, in chains or disorderly arrangements; elements up to 15-50(-70) × 8.0-30 µm; towards margin ascending, narrowly clavate elements are predominant; pigment dark grey-brown and intracellular. Stipitipellis a cutis of colourless, cylindrical to slightly inflated hyphae, 6.0-18 µm wide, with scattered clavate and narrowly clavate cystidioid elements, c. 16-20 µm wide, with brown-grey intracellular pigment. Clamp-connections absent.

HABITAT & DISTR. – Gregarious in small groups, saprotrophic and terrestrial, in woods on various soil types, from sand to clay, probably always relatively nutrient-rich. Not uncommon in the Netherlands, scattered, Aug.-Oct.; widespread in Europe.

Leucocoprinus brebissonii is very easy to recognize in the field, because of its contrasting dark centre on the mostly white pileus. It is possibly one of those species whose numbers are increasing in the Netherlands, because of ongoing nitrogen enrichment of the environment.

6. Leucocoprinus cygneus (J. Lange) M. Bon in Doc. mycol. 8 (30-31): 70. 1978. – Fig. 55.

Lepiota cygnea J. Lange, Fl. agar. dan. 1: 35. 1935 (not valid); *Lepiota cygnea* J. Lange, Fl. agar. dan. 5: V. 1940; *Pseudobaeospora*

Fig. 55. *Leucocoprinus cygneus* (habit del. P. Kelderman).

cygnea (J. Lange) Locq. in Bull. trimest. Soc. mycol. Fr. 68: 169. 1952; *Sericeomyces cygneus* (J. Lange) Heinem. in Bull. Jard. bot. natn. Belg. 48: 405. 1978; *Cystolepiota cygnea* (J. Lange) Mos., Röhrlinge Blätterpilze, 4. Aufl.: 236. 1978.

SEL. ICON. – Boisselet & Migl. in Bull. Féd. mycol. Dauphiné-Savoie 138: 9. 1995; J. Lange, Fl. agar. dan. 1: pl. 13A. 1935 (as *Lepiota cygnea*); Migl. et al. in Riv. Micol. 32: 18. 1989.

SEL. DESCR. & FIGS. – Boisselet & Migl. in Bull. Féd. mycol. Dauphiné-Savoie 138: 4-5. figs. 1 & 2. 1995; Candusso & Lanzoni, Lepiota: 482, fig. 106. 1990; Huijsman in Meded. Ned. mycol. Vereen. 28: 51-53. 1943; Kelderman, Parasolzw. Zuid-Limburg: 178-179. 1994; Migl. et al. in Riv. Micol. 32: 18-20. 1989; Romagn. in Kühner & Romagn. in Bull. Soc. nat. Oyonnax 10-11: 92-94. 1957 (Compl. Fl. anal. 7).

VERN. NAME – Gladde plooiparasol.

Pileus 4-15 mm, when young spherical, expanding via plano-convex with umbo and uplifted margin to applanate, white, slightly ochraceous with age, when young with scattered greyish granulose flocks, later only slightly granulose-farinose at centre, and towards margin radially fibrillose, sulcate in outer half of radius. Lamellae, L = c. 40, l = 0-1, rather crowded to very crowded, free, ventricose, white with concolorous flocculose edge. Stipe 9-28 × 0.5-2 mm, cylindrical with widened clavate base, hollow, white, pruinose in upper part, slightly hairy-pubescent below annulus. Annulus ascending, membranaceous, white. Context white and very thin in pileus, white in stipe. Smell indistinct. Taste not known. Spore print probably white.

Spores (5.5-)6.0-7.0(-7.5) × 3.5-4.5 µm, on average 6.5 × 4.0, Q = 1.4-1.8(-1.9), Qav = 1.6, ellipsoid-amygdaliform in side-view, ellipsoid to ovoid in frontal view, dextrinoid, congophilous, with pink inner wall in Cresyl Blue; in ammonia germ pore not visible, after treatment with acetic acid in some spores faintly visible. Basidia 15-20 × 6.5-8.0 µm, 4-spored. Lamella edge sterile; cheilocystidia 24-65(-100) × 6-15(-18) µm, lageniform with long neck (up to 50 × 3.0-7.0 µm) and with subcapitate apex, rarely clavate, or with short excrescence, not-coloured. Pleurocystidia absent. Pileus covering with radial cylindrical hyphae, 3.0-10 µm wide, with colourless encrusting pigment, and with chains of ellipsoid to globose elements, 15-35 × 15-25 µm, with intracellular greyish pigment in floccules, and at centre of pileus. Clamp-connections absent.

HABITAT & DISTR. – Solitary or in small groups, saprotrophic and terrestrial or on rotting wood of stumps; in the Netherlands very rare, recorded from the dunes on Walcheren (on a stump) and from southern Limburg (in a deciduous wood), beginning of Sept. Rarely recorded in the rest of Europe; mentioned from a greenhouse in Italy.

The description is based on the selected descriptions, as cited.

Leucocoprinus cygneus is aberrant from the other European *Leucocoprinus* taxa in the shape of the spores and the peculiar architecture of the pileus covering.

7. Leucocoprinus straminellus (Bagl.) Narducci & Caroti in Memorie Soc. tosc. Sci. nat., Ser. B, 102: 49. ('1995') 1996. – Fig. 56.

Agaricus straminellus Bagl. in Comm. Soc. critt. ital. 2 (2): 263. 1865; *Lepiota straminella* (Bagl.) Sacc., Syll. Fung. 5: 44. 1887; *Lepiota cepaestipes* var. *straminella* (Bagl.) Konr. & M., Ic. sel. Fung. 6: 41. 1924. – *Agaricus denudatus* Rab. in Hedwigia 6: 45. 1867; *Lepiota denudata* (Rab.) Sacc., Syll. Fung. 5: 52. 1887; *Leucocoprinus denudatus* (Rab.) Sing. in Lilloa 22: 424. ('1949') 1951. – *Lepiota boudieri* Guéguen in Bull. trimest. Soc. mycol. Fr. 24: 131. ('1908') 1909, non *Lepiota boudieri* Bres., 1884; *Lepiota gueguenii* Sacc. & Trott. in Sacc., Syll. Fung. 21: 21. 1912.

SEL. ICON. – Migl. et al. in Riv. Micol. 32: 9-11. 1989; Vellinga & Huijser in Coolia 40: pl. 7. 1997 (both as *L. denudatus*).

SEL. DESCR. & FIGS. – Candusso & Lanzoni, Lepiota: 493, fig. 109. 1990 (as *L. denudatus*); Guéguen in Bull. trimest. Soc. mycol. Fr. 24: 131. ('1908') 1909 (as *Lepiota boudieri*); Herink in Ceská Mykol. 13: 110-115. 1959 (as *L. denudatus*); Kelderman, Parasolzw. Zuid-Limburg: 180-181. 1994 (as *L. denudatus*); Migl. et al. in Riv. Micol. 32: 10. 1989 (as *L. denudatus*).

VERN. NAME – Zwavelgele plooiparasol.

Pileus, when expanded 15-33 mm, when young paraboloid-cylindrical, expanding to plano-convex with deflexed margin to applanate with small umbo in shallow central depression, with or without uplifted margin, pale lemon-yellow (K. & W. 1A4 at centre, 1A3 in rest of pileus), sometimes cream-coloured at margin, with floccose granules to fine-granulose (lens) all over, or even making a smooth impression, outer half to 3/4 of radius radially sulcate. Lamellae, L = c. 55, l = 0-1, moderately crowded, free and remote from stipe, subventricose, up to 2 mm wide, white with slightly sulphur tinge to pale lemon-yellow, with concolorous, eroded to finely fimbriate edge. Stipe 17-50 × 1-3 mm, cylindrical, slightly widened in basal part, hollow, pale lemon-yellow, concolorous with pileus surface, totally pruinose to covered with loose floccules of granules. Annulus midway on stipe, small, ascending, pale lemon-yellow. Context thin and concolorous with surfaces. Smell fungoid, unpleasant. Taste not known. Spore print white.

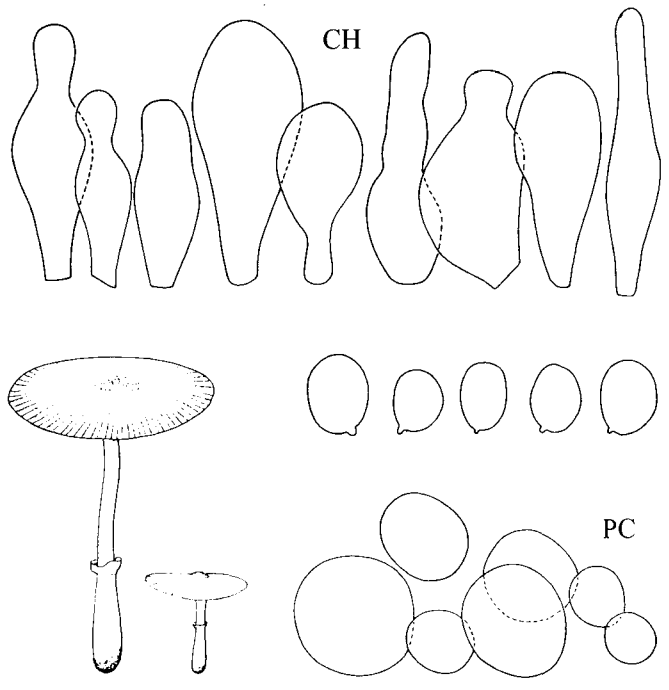

Fig. 56. *Leucocoprinus straminellus*.

Spores 5.0-8.5 × 4.0-7.0 µm, on average 5.4-7.1 × 4.2-5.3 µm, Q = 1.1-1.6, Qav = 1.25-1.35, broadly ellipsoid to ellipsoid in side-view and in frontal view, without germ pore, dextrinoid, congophilous, cyanophilous, with pink inner wall in Cresyl Blue. Basidia 15-31 × 6.0-8.0 µm, 4-spored, surrounded by 4-6 pseudoparaphyses. Lamella edge sterile or almost entirely so; cheilocystidia 13-48 × 6.0-15 µm, extremely variable, rather irregular, lageniform with 3.0-6.5 µm wide neck, clavate-cylindrical, cylindrical, with or without pedicel, colourless, but in fresh material full of yellow granules. Pleurocystidia absent. Pileus covering squamules made up of globose elements, 15-45 µm in diam., some ellipsoid, some with broad connecting excrescence(s) to cylindrical elements, 3.0-5.0 µm wide; the bigger elements slightly thick-walled; pigment pale yellow in drops and granules situated in the cylindrical elements. Stipitipellis a cutis of narrow cylindrical elements, 2.0-5.0 µm wide, with scattered squamules made up of rounded and ellipsoid elements, as on pileus surface. Clamp-connections absent.

HABITAT & DISTR. – In clumps and groups, rarely solitary, saprotrophic and terrestrial, in pots of plants in greenhouses or on compost heaps and woodchips outdoors. In the Netherlands rather rare, in recent years recorded from several places outside (Eindhoven, Eerbeek). Aug.-Sept. in the wild, and the whole year through inside. Widespread and recorded from all over Europe, probably of tropical origin.

Narducci & Caroti (in Memorie Soc. tosc. Sci. nat., Ser. B, 102: 49. ('1995') 1996) showed that *Agaricus straminellus* Bagl. is identical with *A. denudatus* Rab. The former name was the first published, so the well-known name *L. denudatus* has to be replaced by the virtually unknown name *L. straminellus*.

From France and Italy a white variety of this species is known, viz. *L. straminellus* var. *albus* (Joss.) Migl. & Rava (in Micol. Veget. medit. 14 (1): 25. 1999); this has not yet been found in the Netherlands.

8. Leucocoprinus heinemannii Migl. in Micol. ital. 16 (2): 8. 1987.

SEL. ICON. – Migl. et al. in Riv. Micol. 32: 13. 1989; Migl. & Zecchin in Belg. J. Bot. 131: 172. ('1998') 1999.

SEL. DESCR. & FIGS. – Fourré in Doc. mycol. 24 (93): 63. 1994; Migl. in Micol. ital. 16 (2): 8-13. 1987; Migl. et al. in Riv. Micol. 32: 12. 1989; Mohr in Mykol. Mittbl. 35: 87-89. 1992.

CHARACTERISTICS – Pileus 15-20 mm, plano-convex to plano-concave with age, with flattened centre, at centre dark grey to almost black, with small fibrils, around centre with irregular dark grey to black, plush-like fibrils on pale, whitish to yellowish background, sulcate in outer 3-10 mm of radius, sometimes with remnants of annulus at margin; lamellae, L = 35-40, l = 0-1, moderately to rather crowded, free, subventricose, whitish to cream, with even and concolorous edge; stipe 15-35 × 1.5-2 mm, gradually widening downwards to 3 mm at base, hollow, shiny white-cream to very pale pinkish-lilacinous with white fibrils; annulus fugacious, white; context white in pileus and stipe; smell fungoid or none.

Spores 6.0-9.0(-9.5) × 3.0-4.5(-5.0) µm, on average 6.5-7.7 × 3.6-4.2 µm, Q = 1.55-2.0, Qav = 1.8-1.85, in side-view oblong-amygdaliform, in frontal view oblong, without germ pore; basidia 14-21 × 6.5-8.5 µm, 4-spored, surrounded by pseudoparaphyses; lamella edge sterile; cheilocystidia 13-33 × 7.0-11 µm, narrowly clavate to narrowly utriform, variable, sometimes slightly capitate; pileus covering made up of loosely attached irregular hyphae with short and long elements, up to 11 µm wide, with grey-brown or greenish brown intracellular pigment; clamp-connections absent.

HABITAT & DISTR. – In small groups, saprotrophic and terrestrial, in pots of plants, in greenhouses. In the Netherlands a few times record-

ed (Leiden, botanical garden; 's-Graveland, Boekesteyn), Sept.-Jan. Reported from several European countries (Italy, France, Germany), probably of tropical origin.

Leucocoprinus heinemannii macroscopically resembles *Leucoagaricus melanotrichus* (Mal. & Bert.) Trimbach var. *melanotrichus*. Because of this resemblance the characteristics of this greenhouse species are given here.

It differs from *L. melanotrichus* in microscopical characters (see Migliozzi & Zecchin in Belg. J. Bot. 131: 174. ('1998') 1999. for a tabular overview). The easiest character to tell the two taxa apart is the spore shape, as expressed by the average length width ratio: 1.8-1.85 in *L. heinemannii* versus 1.55-1.65 in *L. melanotrichus*. *Leucocoprinus heinemannii* shows a sulcate pileus margin, whereas the pileus is not grooved in *L. melanotrichus*.

6. **Leucoagaricus** (Locq. ex) Sing.

ELSE C. VELLINGA

Leucocoprinus subgen. *Leucoagaricus* Locq. in Bull. mens. Soc. linn. Lyon 12: 92. 1943 (not valid); *Leucoagaricus* (Locq. ex) Sing. in Sydowia 2: 35. 1948. – *Sericeomyces* Heinem. in Bull. Jard. bot. natn. Belg. 48: 401. 1978.

SELECTED LITERATURE – M. Bon in Doc. mycol. 11 (43): 50-65. 1981; M. Bon, Fl. mycol. Eur. 3, Lépiotes: 85-110. 1993 (as *Sericeomyces* and *Leucoagaricus* resp.); Candusso & Lanzoni, Lepiota: 329-457. 1990; Kelderman, Parasolzw. Zuid-Limburg: 141-171. 1994.

Basidiocarps pluteoid, varying from fragile and slender to sturdy and fleshy; pileus not or rarely sulcate; lamellae free; annulus present, though often fugacious, made up of partial, more rarely also universal veil; spore print white, whitish. Some species discolouring with ammonia vapour, and some changing colour on drying.

Spores smooth or minutely roughened, binucleate, with or without germ pore, dextrinoid though slowly and vaguely in some species, and metachromatic in Cresyl Blue, in some species with metachromatic tract, congophilous, cyanophilous, with walls swelling in ammonia ($NH_{3(aq)}$) and acetic acid ($CH_3COOH_{(aq)}$; basidia 4-spored, rarely 2-spored, not surrounded by pseudoparaphyses; cheilocystidia present; pleurocystidia rarely present; hymenophoral trama trabecular or regular; pileus covering very variable, from a cutis to a complicated trichoderm; clamp-connections absent. Development bivelangiocarpic and stipitocarpic. – Type species *Leucoagaricus macrorhizus* Locq. ex Horak.

HABITAT & DISTRIBUTION – Saprotrophic and terrestrial, on wood chips and sawdust, in woods, grasslands and on road verges, and in dune vegetation. Widespread, and world-wide, but represented by more species in the subtropical than in cool-temperate regions, absent from arctic and alpine habitats.

The genus *Leucoagaricus* was split off from *Leucocoprinus* Pat. which thereby became more homogeneous. *Leucoagaricus*, however, accommodates species which differ widely in macroscopical and microscopical characters. The position of some species has been disputed. The group of species which turn green or red in ammonia vapours has been placed both in *Leucocoprinus* and in *Leucoagaricus*. The latter approach is followed here. The species, characterized by a white sericeous pileus covering, have been placed in a separate genus, *Sericeomyces* Heinem., but that is not recognized here. There are strong indications that most species of *Sericeomyces* form a monophyletic group together with species like *L. rubrotinctus* (Peck) Sing., *L. sublittoralis*, and *L. purpureolilacinus*. *Macrolepiota nympharum* (Kalchbr.) Wasser is included in *Leucoagaricus*, on account of its molecular and morphological characteristics.

The existing infrageneric classifications of the genus are very inconsistent, as closely related species are placed in different sections (e.g. *L. americanus* (as *L. bresadolae*) in sect. *Annulati* and *L. meleagris* in sect. *Piloselli*; *L. barssii* (as *L. pinguipes* and *L. macrorhizus*) in sect. *Leucoagaricus* and *L. leucothites* in sect. *Annulati*) (see e.g. Bon, Fl. mycol. Eur. 3, Lépiotes: 90-110. 1993). Furthermore, widely different species, like *L. barssii* and *L. melanotrichus*, were placed in the same section. As more research on species from all over the world, especially on the molecular level, is needed to establish a well-founded and sound infrageneric classification, none is given here.

A thorough monographic approach to this group is badly needed. Many species are known from a single or a few reports in literature, without a critical character evaluation.

The genus is represented by a relatively small number of species in the northern parts of Europe, whereas southern Europe harbours a much greater diversity. This suggests even greater diversity in the tropics, but the actual species numbers are unknown.

Note that species not (yet) recorded from the Netherlands are not included in the keys, although some are treated in notes under the species which most resemble them.

The neutral term 'pileus covering' is used for all the covering layers of the pileus, not taking into account their origin.

Several species are cultivated by attine ants in the Neotropics (see e.g. Chapela et al. (in Science 266: 1691-1694. 1994), and Mueller et al. (in Science 281: 2034-2039. 1998)). These fungi are mostly known from a vegetative stage, as basidiocarp formation is inhibited by chemicals exuded by the ants.

KEYS TO THE SPECIES

1. Pileus and stipe turning red on bruising; lamellae green or red with ammonia vapour ..... **Key one**
1. Pileus and stipe not changing colour when bruised, or some yellow or brown with age; lamellae not discolouring with ammonia vapour
   2. Basidiocarps big, fleshy, predominantly white (some greyish, or brown-squamulose); spores with or without germ pore, with rounded apex ..... **Key two**
   2. Basidiocarps thin-fleshed, fragile; pileus white, white with brown or black, grey or pinkish fibrils or squamules or totally coloured; spores without germ pore; spores amygdaliform with rather acute apex, or ellipsoid to oblong, with rounded apex
      3. Basidiocarps when fresh predominantly white, with sometimes some ochre or brown at pileus centre **Key three**
      3. Basidiocarps with coloured pileus (lilac, pink, purple, brown, grey or black) ..... **Key four**

KEY ONE

Species which turn green or red in ammonia vapour, and/or bruise red

1. Basidiocarps turning brick-red in ammonia vapour and on bruising, staying this colour, not changing to black **8. L. croceovelutinus**
1. Basidiocarps turning green in ammonia vapour or not showing any reaction at all in ammonia; turning red or brownish when damaged
   2. Basidiocarps when cut first turning yellow, saffron-yellow, then red; spores 7.0-12 × 5.5-8.0 µm, Qav = 1.25-1.45, (broadly) ellipsoid, relatively thick-walled, with distinct or indistinct germ pore
      3. Pileus (70-)100-135(-230) mm; germ pore distinct; elements on pileus gradually tapering towards apex **4. L. americanus**
      3. Pileus 13-45(-80) mm; germ pore indistinct or absent; elements on pileus with more or less abrupt appendix **5. L. meleagris**
   2. Basidiocarps directly turning red on bruising and cutting, no yellow discoloration happening; spores (5.5-)6.0-10.0 × 3.5-5.0(-6.0) µm, Qav = 1.5-1.9, often amygdaliform, without germ pore
      4. Basidiocarps whitish with lilacinous tinges, hardly staining or only browning at stipe, when bruised; pileus covering made up of more or less adnate hyphae ..... **10. L. marriagei**
      4. Basidiocarps whitish when young, changing rapidly to red or black when touched, or brownish when young and remaining so; pileus covering with erect cystidioid elements
         5. Cheilocystidia clavate, without apical excrescence ..... **9. L. pilatianus**
         5. Cheilocystidia clavate, narrowly clavate to narrowly fusiform, with short to long apical excrescence, though mixed with clavate elements
            6. Basidiocarps medium-sized to robust (pileus 25-65 mm; stipe 35-105 mm long) ..... **6. L. badhamii**
            6. Basidiocarps slender, small (pileus not exceeding 20 mm; stipe not longer than 35 mm) **7. L. georginae**

KEY TWO

Species with white or grey, big, and fleshy basidiocarps; spores with rounded apex, with or without germ pore

1. Pileus covering made up of adnate cylindrical hyphae; spores without a germ pore
   2. Cheilocystidia smooth-walled, without crystals; basidiocarps grey-fibrillose to pale brown-squamulose **1. L. barssii**
   2. Cheilocystidia with crystals at apex; basidiocarps predominantly white ..... see notes under 21. *L. menieri*
1. Pileus covering made up of erect elements; spores with a germ pore
   3. Ring complex, double; pileus surface coarsely squamose ..... **3. L. nympharum**
   3. Ring simple, though variable; pileus surface smooth or granular, without or with star-shaped pale pattern
      4. Spores 7.5-10(-11.5) × 5.0-7.0(-7.5) µm; clamp-connections absent; pileus without star-shaped pattern, varying in colour from white to grey or grey-brown, often discolouring yellow when touched **2. L. leucothites**
      4. Spores 11-16 × (6.5-)7.5-10.5 µm; basidia often with clamp-connection; pileus often with star-shaped pattern, brown at centre, cream around centre, not discolouring when bruised or turning red in stipe with damage **Macrolepiota excoriata**

KEY THREE

Species with predominantly white, sericeous, radially innate fibrillose pileus

1. Cheilocystidia clavate, rather thin-walled, with long pedicel, without crystals ..... **19. L. serenus**
1. Cheilocystidia lageniform, narrowly lageniform, narrowly clavate to cylindrical, with optionally some clavate cystidia present, in most cases with crystals at apex
   2. Pileus covering made up of adnate to ascending cylindrical hyphae, with ellipsoid to globose elements at centre of pileus and in squamules ..... **Leucocoprinus cygneus**
   2. Pileus covering made up of adnate to ascending cylindrical hyphae only
      3. Cheilocystidia distinctly lageniform, without crystals or occasionally with some crystals; basidia 4- or 2-spored; basidiocarps turning brown on drying ..... **18. L. sericifer**
      3. Cheilocystidia narrowly clavate, cylindrical, narrowly lageniform, with crystals at apex; basidia 4-spored; basidiocarps retaining cream colours on drying
         4. Basidiocarp relatively thin-fleshed; cheilocystidia narrowly clavate, cylindrical to lageniform, often with coarse crystals at apex ..... **20. L. crystallifer**
         4. Basidiocarp relatively thick-fleshed, with abrupt bulbous base; cheilocystidia irregularly shaped, lageniform, with crystals at apex ..... **21. L. menieri**

KEY FOUR

Species which are thin-fleshed, with coloured sericeous or fibrillose-squamulose covering

1. Pileus rather smooth, with radially innate fibrils
   2. Pileus with a white velar patch at centre; stipe with abrupt bulb at base; cheilocystidia narrow, 4.0-11.5 µm wide, with pale grey contents, sometimes with some small crystals ..... **15. L. wichanskyi**
   2. Pileus without velar patch at centre; stipe not abruptly bulbous, sometimes rooting in sand; cheilocystidia narrow to wide, 6.0-15 µm µm wide, with or without crystals at apex
      3. Cheilocystidia rarely with some small crystals at apex, mostly inside cystidia; pileus pinkish brown at centre **14. L. sublittoralis**
      3. Cheilocystidia with crystals at apex; pileus purplish brown, dark purplish red-brown, dark vinaceous brown at centre ..... **16. L. purpureolilacinus**
1. Pileus distinctly fibrillose to squamose
   4. Pileus with pink, lilac, or purple colours (often fading to brown with age)
      5. Spores amygdaliform with acute apex and often with apical papilla
         6. Pileus squamules made up of erect elements, 20-130 × 6.0-14 µm, situated on short elements, 5.0-10 µm wide ..... **17. L. gauguei**
         6. Pileus squamules made up of elongate, ascending elements, 60-130 × 14-24 µm see notes under 14. *L. sublittoralis*
      5. Spores ellipsoid to oblong, not distinctly amygdaliform
         7. Pileus pink, discolouring brownish with age; pileus covering made up of adnate cylindrical elements, with terminal elements 40-145 × 10-17 µm ..... **10. L. marriagei**
         7. Pileus purple-tinged (dark purple, violaceous purple); pileus covering with long, tapering elements, 110-300 × 8.0-12 µm ..... **11. L. ionidicolor**
   4. Pileus brown, black, or dark grey
      8. Pileus with black or dark grey fibrils (with or without green or purplish hue)
         9. Spores 5.5-7.0 × 3.5-4.5(-5.0) µm, Qav = 1.55-1.65; pileus not sulcate; growing outdoors **12a. L. melanotrichus** var. **melanotrichus**
         9. Spores 6.0-9.0(-9.5) × 3.0-4.5(-5.0) µm, Qav = 1.8-1.85; pileus sulcate in marginal zone; growing in greenhouses ..... **Leucocoprinus heinemannii**
      8. Pileus brown-fibrillose
         10. Pileus dull brown; fresh basidiocarps not exuding drops **12b. L. melanotrichus** var. **fuligineobrunneus**
         10. Pileus orange-red-brown, red-brown, or dark cinnamon-brown; fresh basidiocarps exuding drops, on stipe and pileus ..... **13. L. tener**

1. Leucoagaricus barssii (Zeller) Vellinga in Mycotaxon 76: 431. 2000. – Fig. 57.

Lepiota barssii Zeller in Mycologia 26: 211. 1934. – *Lepiota pinguipes* A. Pears. in Trans. Br. mycol. Soc. 35: 97. 1952; *Leucoagaricus pinguipes* (A. Pears.) M. Bon in Doc. mycol. 11 (43): 54. 1981; *Leucoagaricus macrorhizus* var. *pinguipes* (A. Pears.) Alessio in Micol. ital. 17(2): 8. 1988 (not valid). – *Leucocoprinus macrorhizus* Locq. in Bull. mens. Soc. linn. Lyon 12: 80. 1943 (not valid); *Leucoagaricus macrorhizus* (Locq.) Sing. in Sydowia 2: 35. 1948 (not valid); *Lepiota macrorhiza* (Locq.) Kühner & Romagn., Fl. anal. Champ. sup.: 406. 1953 (not valid); *Leucoagaricus macrorhizus* (Locq. ex) Horak, Syn. Gen. Agar.: 344. 1968; *Leucocoprinus macrorhizus* (Locq. ex Horak) D. Reid in Mycol. Res. 93: 421. 1989. – *Leucoagaricus macrorhizus* var. *pseudocinerascens* M. Bon in Doc. mycol. 20 (78): 58. 1990; *Leucoagaricus pseudocinerascens* (M. Bon) M. Bon in Doc. mycol. 23 (89): 61. 1993.

SEL. ICON. – Courtec. & Duhem, Guide Champ. France Europe: fig. 697. 1994 (as *L. macrorhizus*); Tabarés in Bolets Catalunya 2: pl. 80. 1983 (as *L. macrorhizus*); Wilhelm in Schweiz. Z. Pilzk. 72: 259. 1994 (as *L. macrorhizus* var. *pinguipes* and var. *macrorhizus* resp.); Zalin & Migl. in Micol. veneta 7 (3): 20. 1991 (as *L. macrorhizus* var. *pseudocinerascens*).

SEL. DESCR. & FIGS. – Horak, Syn. Gen. Agar.: 344-346. 1968 (as *L. macrorhizus*); Migl. & Clericuzio in Micol. Veget. medit. 4 (1): 29-33 (as *L. macrorhizus* var. *pinguipes*); A. Pears. in Trans. Br. mycol. Soc. 35: 97. 1952 (as *L. pinguipes*); D. Reid in Mycotaxon 69: 124-126, figs. 1-6. 1998 (as *L. pinguipes*).

VERN. NAME – Wortelende champignonparasol.

Pileus 35-80 mm, when young hemispherical-convex, truncate-conical, expanding to campanulate to plano-convex, with low and flattened umbo, and slightly deflexed margin, when young completely hairy-fibrillose-squamulose, slightly brownish grey, sordid pale grey-brown (Mu. 10 YR 7/2) at centre, grey to grey-brown (10 YR 7/2, 6-5/3) around it, later more fibrillose-squamose to squamose, and then sordid dark brown at centre to sordid pale brown at margin, coarse white-fibrillose at margin, when young with white teeth at margin and underneath the fibrillose covering a white fringed margin (connected to annulus), exceeding lamellae. Lamellae, L = c. 95, l = (0-)1, crowded, free and remote from stipe, ventricose, up to 8 mm wide, white-cream, with distinctly white rather even edge. Stipe 60-165 × 8-15 mm in the middle, tapering upwards and with fusiform base, buried with lower part (up to 2/3 of total length) in the soil, compressed, hollow, white at superterranean part, discolouring brownish on handling, brownish lower down, hirsute-hairy in upper part or shiny-fibrillose, and fibrillose in lower part. Annulus, easily removable from stipe, and clinging to pileus margin, with white upper side, and fringed, thickened margin, brownish-fibrillose underneath, in appearance reminiscent of the annulus of a *Macrolepiota* species. Context very thick in pileus, white, slightly cream-beige, in stipe brownish, tough and slightly shiny. Smell strongly fungoid-lepiotoid. Taste pleasant-fungoid, like cultivated *Agaricus bisporus*. Spore print 'pale cream'.

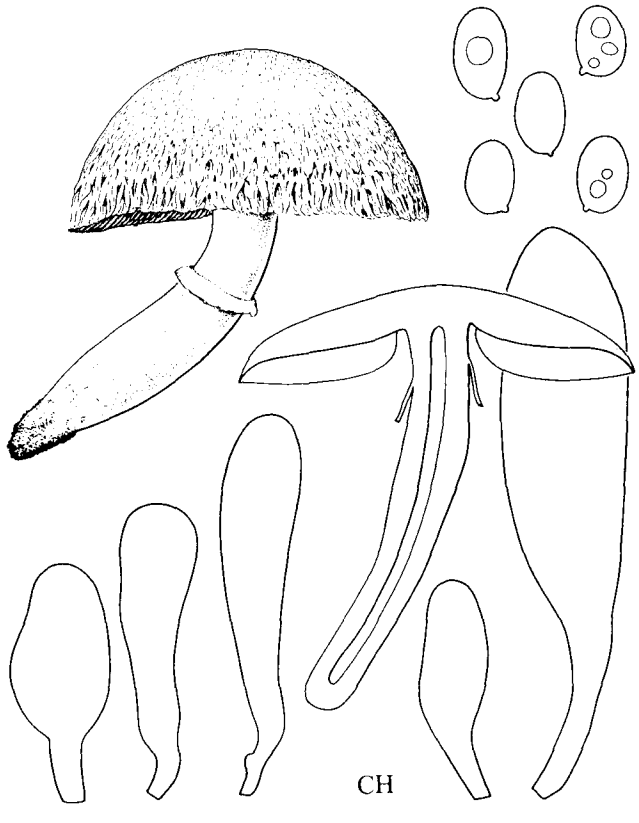

Fig. 57. *Leucoagaricus barssii*.

Spores 6.5-9.5 × 4.0-5.5 µm, on average 7.4-8.3 × 4.7-5.1 µm, Q = 1.4-1.85, Qav = 1.5-1.65, ellipsoid to oblong in side-view (reminiscent of *Pluteus*-spores), without germ pore, dextrinoid, congophilous, cyanophilous, with pink inner wall in Cresyl Blue, thick-walled. Basidia 18-42 × 6.5-10 µm, 4-spored, intermixed with 2-spored basidia, sometimes thick-walled and cystidioid. Lamella edge heterogeneous. Cheilocystidia 20-85 × 6.0-25 µm, varied in shape and size, clavate, cylindrical, broadly utriform, often with thickened colourless wall. Pleurocystidia present near lamella edge, similar to cheilocystidia. Pileus covering made up of repent hyphae, up to 15 µm wide, with an occasional short element; terminal elements 10-16 µm wide, tapering towards acute apex; in older material difficult to study, because of bacteria and gelatinization. Pigment either brown and diffuse, or grey and granular, intracellular; some elements with internally thickened walls. Stipitipellis a cutis of colourless cylindrical hyphae, 5-15 µm wide, with loosely arranged colourless, cylindrical flexuous hyphae in tufts. Clamp-connections absent.

HABITAT & DISTR. – Solitary or in small groups, saprotrophic and terrestrial in open mossy dune vegetation, in open sand close to shrubs, or in road verge, also in deciduous wood on loamy soil, mostly in the dune area (from Texel southwards), once found in southern Limburg, end of Sept.-Oct. Reported from various countries in Europe (e.g. Great Britain, Italy, Spain, Switzerland, Hungary), also found in North America.

Lepiota barssii, described from the western part of the U.S.A., has been demonstrated to be synonymous with *L. pinguipes* (Vellinga in Mycotaxon 76: 431-433. 2000).

Reid (in Mycotaxon 69: 117-128. 1998) gave an elaborate overview of the literature on *L. pinguipes* and *L. macrorhizus*, covering the nomenclatorial issues involved, and the differences between the two taxa. His conclusion, that differentiation between the two taxa on species level is not possible, is supported by observations on the Dutch material.

Dutch specimens with the appearance of *L. macrorhizus* are old. These specimens are big with a squamose, brownish, pileus covering, and relatively long spores. Young and fresh specimens fit the descriptions of *L. pinguipes* very well. Therefore, the distinction of varieties within *L. barssii* is superfluous.

A germ pore was not observed, neither under the light microscope, nor with the Scanning Electron Microscope, though some spores show a slight thinning at the apex.

Pleurocystidia are often present close to the lamella edge, and some basidia near the edge become very big and thick-walled.

2. Leucoagaricus leucothites (Vitt.) Wasser in Ukr. bot. Zh. 34: 308. 1977 (as *L. leucothitus*). – Fig. 58.

Agaricus leucothites Vitt., Descr. Funghi mang. Italia: 310. 1835; *Lepiota leucothites* (Vitt.) P.D. Orton in Trans. Br. mycol. Soc. 43: 177. 1960; *Leucoagaricus carneifolius* var. *leucothites* (Vitt.) M. Bon in Doc. mycol. 7 (27-28): 21. 1977 (not valid). – *Agaricus holosericeus* Fr., Epicrisis: 16. 1838; *Leucocoprinus holosericeus* (Fr.) Locq. in Bull. mens. Soc. linn. Lyon 12: 95. 1943; *Leucoagaricus holosericeus* (Fr.) Mos., Blätter-, Bauchpilze, 1. Aufl.: 115. 1953 (not valid); *Leucoagaricus holosericeus* (Fr.) Mos., Röhrlinge, Blätterpilze, 3. Aufl.: 185. 1967. – *Agaricus naucinus* Fr., Epicrisis: 16. 1838; *Lepiota naucina* (Fr.) Kumm., Führ. Pilzk.: 136. 1871; *Leucoagaricus naucinus* (Fr.) Sing. in Lilloa 22: 423. ('1949') 1951. – *Lepiota densifolia* Gillet, Champ. France: 68. 1874; *Leucoagaricus densifolius* (Gillet) Babos in Szujko-Lacza, Fl. Hortobágy natn. Park: 82. 1982. –*Lepiota carneifolia* Gillet, Hyménomycètes: 65. 1874; *Leucocoprinus carneifolius* (Gillet) Locq. in Bull. mens. Soc. linn. Lyon 14: 93. 1945; *Leucoagaricus carneifolius* (Gillet) Mos., Blätter-, Bauchpilze, 1. Aufl.: 115. 1953 (not valid); *Leucoagaricus carneifolius* (Gillet) M. Bon in Doc. mycol. 7 (27-28): 21. 1977; *Leucoagaricus carneifolius* (Gillet) Wasser in Ukr. bot. Zh. 34: 307. 1977. – *Lepiota olgae* Velen., Ceské Houby: 210. 1920; *Leucocoprinus olgae* (Velen.) Locq. in Bull. mens. Soc. linn. Lyon 14: 92. 1945; *Leucoagaricus olgae* (Velen.) Mos., Blätter-, Bauchpilze, 1. Aufl.: 115. 1953 (not valid). – *Leucoagaricus subcretaceus* M. Bon in Doc. mycol. 7 (27-28): 17. 1977 (not valid); *Leucoagaricus subcretaceus* M. Bon in Doc. mycol. 11 (43): 64. 1981 (not valid); *Leucoagaricus subcretaceus* M. Bon in Bon & Haluwijn in Doc. mycol. 13 (49): 49. 1983.

MISAPPL. – *Leucoagaricus cretaceus* sensu Mos., Blätter-, Bauchpilze, 1. Aufl.: 115. 1953; sensu Mos., Röhrlinge Blätterpilze, 3. Aufl.: 185. 1967; sensu Knudsen in Hansen & Knudsen, Nordic Macromyc. 2: 223. 1992.

EXCL. – *Lepiota naucina* sensu Mos., Röhrlinge, Blätter-Bauchpilze, 2. Aufl.: 135. 1955 (= *Lepiota subalba*).

KEY TO THE VARIETIES

1. Pileus white to cream, not grey, yellow discolouring or not; elements of pileus covering elongate (20-145 × 6.0-15 µm), without, sometimes with pale intracellular pigment ..... 2a. var. **leucothites**
1. Pileus grey, grey-brown, brownish, especially when young, and at centre when full-grown; elements of pileus covering often ellipsoid, 11-70(-125) × 8.0-15 µm, with intracellular pigment 2b. var. **carneifolia**

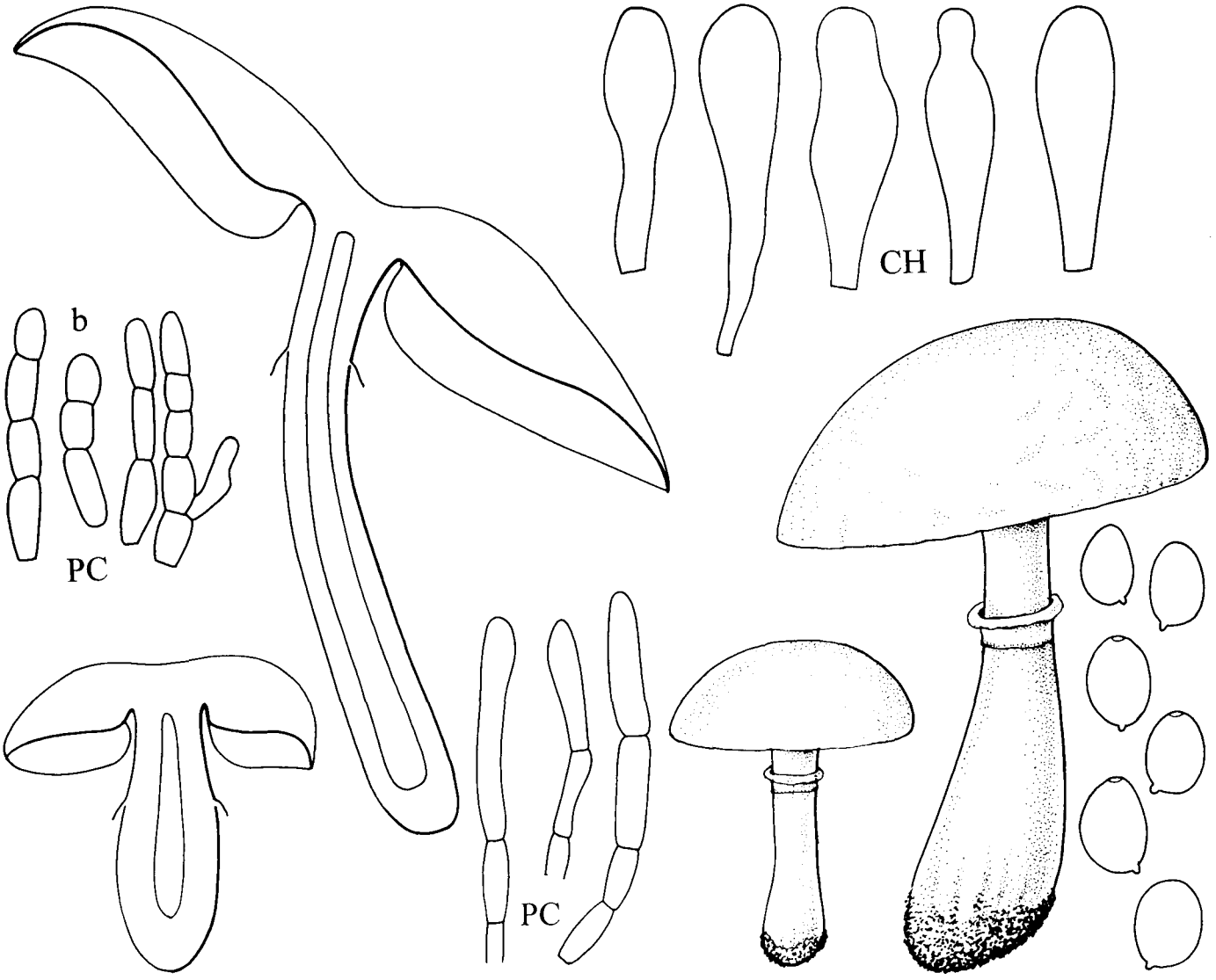

Fig. 58. *Leucoagaricus leucothites* (b: pc of var. *carneifolius*).

2a. var. **leucothites**

SEL. ICON. – Breitenb. & Kränzl., Pilze Schweiz 4: pl. 240, pl. 243. 1995 (as *L. leucothites* and *L. subcretaceus* resp.); Candusso & Lanzoni, Lepiota: pl. 52-54. 1990 (as *L. leucothites* and *L. subcretaceus* resp.); Courtec. & Duhem, Guide Champ. France Europe: pl. 704. 1994; J. Lange, Fl. agar. dan. 1: pl. 9A. 1935 (as *Lepiota naucina*).

SEL. DESCR. & FIGS. – Kelderman, Parasolzw. Zuid-Limburg: 170-171. 1994.

VERN. NAME – Blanke champignonparasol.

Pileus 35-200 mm, at first hemispherical with straight deflexed margin or wide-truncate-conical with inflexed margin, later expanding to plano-convex with flattened or depressed centre, plano-convex, or more truncate-conical, finally with uplifted margin, white at first, cream, isabella cream to cream at margin (overall impression e.g. Mu. 10 YR 7/2), with some pale greyish tinges, e.g. finely grey-punctate, often, but not always, irregularly breaking up into small to big patches, with radial fissures, tomentose (lens) or granulose-fibrillose and more radially fibrillose at margin; often yellowing (paler than 5-2.5 Y 8/4) at margin and in spots when touched; when young margin fringed, exceeding lamellae. Lamellae, L = c. 50-100, l = 1-5, crowded, rather crowded, rarely moderately distant, free and remote from stipe, often anastomosing, segmentiform, subventricose to ventricose, 5-14 mm broad, white, pale creamy, greyish white, often with pinkish sheen, sometimes reddening when bruised, with white, brown with age in some specimens, finely flocculose edge (lens). Stipe 45-125 × 6-15(-40) mm, cylindrical, in some specimens broadened into bulb (up to 25 mm wide), hollow, when young white all over, later only white at apex, in older specimens below this white zone greyish-brownish, and below annulus short-striate or lengthwise creamy with some greyish fibrils in lower part, at bulb pinkish or yellowish when touched. Annulus white or cream, sometimes with greyish underside, variable, ascending with tomentose-membranous cuff and thickened margin, descending with flaring limb, only a cuff around stipe with a small flaring part halfway, or without any cuff, but just an evanescent flaring part. Context very thick in pileus, white and dull, with glassy line above lamellae, turning yellow in some specimens, in stipe shiny and white, sometimes yellowing when cut, and pinkish or brownish in bulb, and stipe sometimes protruding into pileus. Smell strong and fungoid (a bit aniseed-like, like *Agaricus bisporus*), a bit astringent, musty to musty fungoid, indistinct. Taste fungoid, indistinct. Spore print white to very pale pink.

Spores 7.5-11 × 5.0-7.0 µm, on average 8.0-9.2 × 5.3-6.4 µm, Q = 1.25-1.9, Qav = 1.35-1.6, ellipsoid-amygdaliform, oblong-amygdaliform, with rounded or with slightly acute apex, thick-walled, with germ pore, dextrinoid, congophilous, cyanophilous, with inner wall and plug in germ pore pink in Cresyl Blue. Basidia 17-39 × 8.0-13 µm, 4-spored, rarely 2-spored. Lamella edge sterile. Cheilocystidia 22-70 × 7.0-15 µm, cylindrical, narrowly clavate, often irregular, with excrescence at apex or acuminate apex, or subcapitate apex, not-coloured, and slightly thick-walled. Pleurocystidia absent. Pileus covering made up of erect to ascending (close to margin) cylindrical hyphae, often arranged into tufts, with terminal elements 20-145 × 6.0-15 µm, often wider than penultimate elements, without or with pale greyish or brownish intracellular pigment. Stipitipellis a cutis of cylindrical colourless hyphae, 4.0-7.0 µm in diam. Clamp-connections not observed.

HABITAT & DISTR. – Gregarious, solitary, saprotrophic and terrestrial, mainly in lawns, grasslands, road verges, dune grasslands etc. Aug.-Nov. Widespread and common in the Netherlands. Widespread throughout the Northern Hemisphere, also in the Southern Hemisphere (e.g. southern Australia).

In older European literature, this species is often known under the name *L. pudicus* (e.g. Moser, Röhrlinge Blätterpilze, 3. Aufl.: 185. 1967). However, Bulliard (Herb. France: pl. 579. 1791) described and depicted two totally different species under that name, one with white lamellae, a striped annulus, and a stuffed stipe, not fitting the present concept of *L. leucothites* at all; the other with brown lamellae, white patches on the pileus, and also with a striped annulus, resembling a species of the genus *Rhozites*.

Leucoagaricus leucothites is taken here in a wide sense, including all the white variants, varying from small to big. Specimens which turn yellow on aging or bruising are also included, as no characters were found to discriminate between the variants. Grey variants come very close, and are recognized here as a variety of *L. leucothites* (viz. var. *carneifolius*). This taxon differs from *L. leucothites* in the predominantly grey or grey-brown pileus, the more pink lamellae, and the in general shorter elements in the pileus covering. All those characters show a certain amount of variation; there are slightly grey variants of *L. leucothites*; pigment is not totally absent from whitish basidiocarps, and the length of the elements in the pileus covering varies greatly (see e.g. Candusso & Lanzoni, Lepiota: fig. 95. 1990).

The yellowing reaction of the basidiocarps on bruising is not considered of any taxonomical importance. It should be borne in mind, that in all the original diagnoses of the species in this group this character is not mentioned. This is a pervasive problem in this species complex, as modern authors (e.g. Bon, Fl. mycol. Eur. 3, Lépiotes: 108-110. 1993) have interpreted the species in a different manner than the original authors, and have distinguished species using characters, which are not mentioned by the older authors. Of course, in almost all cases, type material is lacking. *Leucoagaricus densifolius* exemplifies this. Gillet (Champ. France: 68. 1874) described it as a white fungus: white pileus, white lamellae, and a white stipe, but in modern concepts it has pink lamellae, and discolours quickly via yellow to brown. And Candusso & Lanzoni (Lepiota: pl. 51. 1990) even depicted it as a species with a brown-squamulose pileus.

Leucoagaricus cinerascens (Quél.) Bon & Boiffard is a distinct and different species, with a peculiar pileus covering, made up of wide, globose elements, on which narrow cylindrical hyphae are set (see Candusso & Lanzoni, Lepiota: fig. 93. 1990 for a stylized picture). This is probably a rare species, with a mediterranean distribution.

Leucoagaricus moseri (Wasser) Wasser, described from the Ukraine, is probably also separate from *L. leucothites* on account of the absence of cheilocystidia (see description by Wasser in Libri bot. 9: 72-73. 1993).

Both varieties of *Leucoagaricus leucothites* are very widespread and cosmopolitan. It is not known whether the distribution is natural or anthropogenic. The species grows especially in man-made habitats like grasslands, lawns, meadows, and road verges.

2b. var. **carneifolius** (Gillet) Vellinga in prep.

MISAPPL. – *Leucoagaricus cinerascens* sensu Migl. & Coccia in Boll. Ass. micol. ecol. romana 28: 7-14. 1993; sensu Wasser in Libri bot. 9: 76. 1993; sensu Knudsen in Hansen & Knudsen, Nordic Macromyc. 2: 223. 1992.

SEL. ICON. – Breitenb. & Kränzl., Pilze Schweiz 4: pl. 239. 1995 (as *L. cinerascens*); Migl. & Coccia in Boll. Ass. micol. ecol. Romana 28: 12. 1993 (as *L. cinerascens*).

SEL. DESCR. & FIGS. – Migl. & Coccia in Boll. Ass. micol. ecol. Romana 28: 7-10. 1993 (as *L. cinerascens*).

VERN. NAME – Grijze champignonparasol.

CHARACTERISTICS – Pileus grey, grey-brown, especially when young; lamellae pink with age, with white flocculose edge; stipe discolouring yellow when touched.

Spores 8.0-11.5 × 5.0-7.0(-7.3) µm, on average 9.0-9.5 × 5.7-6.5 µm, Q = 1.3-1.8, Qav = 1.45-1.6, ellipsoid-amygdaliform with rounded apex, thick-walled, with germ pore, dextrinoid, congophilous, with pink inner wall and tract in Cresyl Blue, cyanophilous; pileus covering trichodermal, made up of relatively short elements, 11-70(-125) × 8.0-15 µm, with greyish or brownish intracellular pigment.

HABITAT & DISTR. – As the typical variety, but rare in the Netherlands. Sept.-Nov. Widespread in the Northern Hemisphere, but rarer than the typical, white variety.

Leucoagaricus cinerascens is an often used name for this grey to brown variety, but the concept of Bon (Fl. mycol. Eur. 3, Lépiotes: 110. 1993) and Candusso & Lanzoni (Lepiota: 422-424. 1990) is followed here. This taxon is characterized by the interesting and unique structure of its pileus covering, in which globose to wide-cylindrical elements give rise to slender cylindrical elements. Furthermore, the cheilocystidia have a distinct apical excrescence. This is probably a species with a mediterranean distribution; it has not been found yet in the Netherlands.

Leucoagaricus cinereolilacinus (Barbier) Bon & Boiffard may be a synonym of *L. leucothites* var. *carneifolius*, but it is not quite clear what its characters are, as different authors reported different spore sizes; Migliozzi & Coccia (in Boll. Ass. micol. ecol. romana 28: 12. 1993) gave a good overview.

3. Leucoagaricus nympharum (Kalchbr.) M. Bon in Doc. mycol. 7 (27-28): 19. 1977. – Fig. 59.

Agaricus nympharum Kalchbr., Ic. sel. Hymenomyc. Hungariae: 10, pl. 2, fig. 2. 1873; *Lepiota nympharum* (Kalchbr.) Kalchbr. in Magy tudom. Akad. Értek. természettud. Köreb. 1878: 7. 1878; *Macrolepiota nympharum* (Kalchbr.) Wasser, Agar. Griby S.S.S.R.: 114. 1985. – *Lepiota densesquamosa* Velen., Ceské Houby: 206. 1920. – *Agaricus rachodes* var. *puellaris* Fr., Monogr. Hymenomyc. Suec. 2: 285. 1863; *Lepiota rachodes* var. *puellaris* (Fr.) Sacc., Syll. Fung. 5: 29. 1887; *Lepiota procera* var. *puellaris* (Fr.) Mass., Brit. Fung. Fl. 3: 235. 1893; *Lepiota puellaris* (Fr.) Rea, Brit. Basidiomyc.: 65. 1922; *Lepiotophyllum rachodes* var. *puellaris* (Fr.) Locq. in Bull. mens. Soc. linn. Lyon 11: 40. 1942; *Leucocoprinus puellaris* (Fr.) Locq. in Bull. mens. Soc. linn. Lyon 14: 91. 1945; *Macrolepiota puellaris* (Fr.) Mos., Blätter-, Bauchpilze, 1. Aufl.: 114. 1953 (not valid); *Macrolepiota puellaris* (Fr.) Mos., Röhrlinge Blätterpilze, 3. Aufl.: 184. 1967.

MISAPPL. – *Lepiota cepaestipes* sensu Michael, Führ. Pilzfr., Ausg. B, 2: pl. 194. 1918.

EXCL. – *Leucoagaricus nympharum* sensu M. Bon in Doc. myc. 7 (27-28): 19. 1977 (= unknown species); *Lepiota puellaris* sensu Rea, Brit. Basidiomyc.: 65. 1922 (= unknown species); *Macrolepiota puellaris* sensu M. Bon in Doc. myc. 7 (27-28): 19. 1977 (= *Macrolepiota rachodes*).

SEL. ICON. – Bellù in Boll. Gruppo micol. G. Bres. 25: 112. 1982 (as *Macrolepiota puellaris*); Breitenb. & Kränzl., Pilze Schweiz 4: pl. 255. 1995 (as *Macrolepiota puellaris*); Candusso & Lanzoni, Lepiota: pl. 66. 1990 (as *Macrolepiota puellaris*); Cetto, Funghi Vero, Ed. 5, 1: pl. 23. 1975 (as *L. puellaris*); J. Lange, Fl. agar. dan. 1: pl. 9B. 1935 (as *L. rhacodes* var. *puellaris*); Kalchbr., Ic. sel. Hymenomyc. Hungariae: pl. 2, fig. 2. 1873; Korhonen in Sieni Lehti 41 (3): cover. 1989 (as *Macrolepiota puellaris*); Migl. & Bizio in Funghi Amb. 66: 14. 1994 (as *M. puellaris*); Pegl. & Legon in Mycologist 6: 187. 1992 (as *Macrolepiota puellaris*).

SEL. DESCR. & FIGS. – J. Favre, Cat. descr. Champ. sup. Zone subalp.: 556-557. 1960 (as *Lepiota puellaris*); Migl. & Bizio in Funghi Amb. 66: 10-11. 1994 (as *Macrolepiota puellaris*); Pegl. & Legon in Mycologist 6: 187. 1992 (as *Macrolepiota puellaris*).

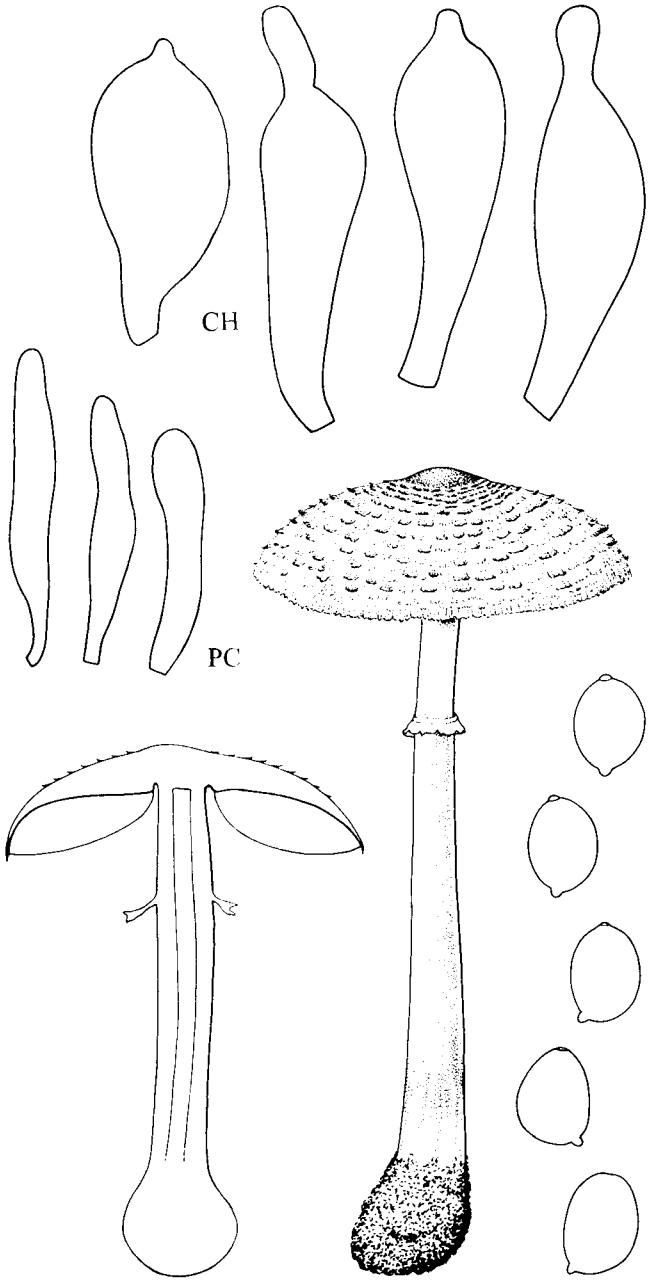

Fig. 59. *Leucoagaricus nympharum*.

VERN. NAME – Witschubbige parasolzwam.

Pileus 38-90 mm, conico-convex, convex or slightly truncate broadly conical to plano-convex, without umbo or papilla, without depressed centre, with margin inflexed when young, later with deflexed margin exceeding lamellae, white to very pale buff to very pale brown (Mu. 10 YR 8/3), dry and radially fibrillose-squamose; squames concentrically arranged with uplifted tips; with 13-31 mm wide, pale to moderately dark grey-brown calotte (7.5 YR 6/6 - 10 YR 5/4-7/3), surrounded by small patches of velum lying on top of the often recurved squames. Lamellae, L = c. 70-80, l = 1, moderately crowded, free and 1-1.5 mm remote from stipe, ventricose, 5-10 mm wide,

white, creamy white with pale pink sheen, with entire to subfloccose whitish edge. Stipe 50-115 × 5-9 mm, tapering towards apex, with subbulbous to bulbous base, 16-42 mm in diameter, fistulose with some fibrils inside, whitish, but soon sordid pinkish brown to very pale brown to brownish yellow (10 YR 7/4 - 6/8), glabrous and dry, with white tomentum at bulb and base. Annulus at 2/3 from base, first immobile, becoming mobile, c. 13 mm in diameter, whitish to very pale pinkish-greyish-brownish, slightly darker at edge, with smooth upper and lower side, and with double, rarely single, crown, with side as pileus surface. Context compact, 7.5-9 mm thick in pileus centre, white in pileus and stipe, pale brown after being cut (10 YR 8/4). Smell faint and indistinct. Taste indistinct to slightly fungoid. Spore print pale cream (Romagnesi 2A).

Spores 8.0-12.5 × (5.5-)6.0-8.0 µm, in average 8.5-9.7 × 6.3-6.4 µm, Q = 1.3-1.65, Qav = 1.35-1.55, broadly ellipsoid to oblong, thick-walled (up to 0.8 µm thick), with central germ pore and rounded apex, with hyaline cap over germ pore, dextrinoid, congophilous, cyanophilous, metachromatic in Cresyl Blue. Basidia 21-40 × 8.5-12 µm, 4-spored, without clamp-connection. Lamella edge sterile. Cheilocystidia 34-65 × 10-19 µm, subglobose to obovoid or lageniform, pedicellate, often rostrate, with 3.0-22 × 3.0-6.0 cylindrical to slightly moniliform excrescence, thin-walled, colourless, some with pale brown contents. Pileus covering a cutis; velum with ascending hyphae, with terminal elements 25-45 × 8.0-10 µm, (irregularly) cylindrical; pigment brown, predominantly intracellular, situated in ultimate and optionally penultimate elements. Stipitipellis a cutis of 5.0-10 µm wide cylindrical colourless hyphae. Clamp connections not observed; according to Migliozzi & Bizio (in Funghi Amb. 66: 11. 1994) very rare, mostly in the hymenium.

HABITAT & DISTR. – Gregarious, saprotrophic and terrestrial in *Picea*-forests, also reported for other types of coniferous forests, rarely in deciduous woods. Recorded once from a deciduous wood on nutrient-poor, dry soil in southeastern Limburg, but no material conserved. For more information on distribution and ecology see Nauta & Vellinga (Atl. Nederl. Paddest.: 204. 1995). Sept.-Oct. Rare and widespread in Europe.

The above description is based on material from Germany and Switzerland, as no material of the Dutch collection was conserved.

Leucoagaricus nympharum strongly resembles members of *Macrolepiota* sect. *Laevistipedes*. Migliozzi & Bizio (in Funghi Amb. 66: 9-16. 1994) suggested that this species is an intermediate between the genus *Leucoagaricus* and *Macrolepiota*, because of the relatively small spores, and the lageniform or appendiculate cheilocystidia. Other morphological characters, like the absence of clamp-connections, and the structure of the pileus covering, as well as molecular evidence, point to a close relationship to *Leucoagaricus leucothites*, rather than to the *M. rachodes*-group.

In most European literature this species is known as *Macrolepiota puellaris*, but De Kok & Vellinga (in Persoonia 17: 77-78. 1998) pointed out that the epithet 'nympharum' has priority on species level.

Macrolepiota citrinascens Vasas (in Annls hist.-nat. Mus. natn. hung. 81: 46. 1990), described from *Picea*-plantations in Hungary, differs from *L. nympharum* in staining yellow, when damaged, but is identical in all other respects.

Leucoagaricus nympharum may cause gastrointestinal problems (Kühnl in Südwestd. Pilzrundschau 29: 21. 1993).

4. Leucoagaricus americanus (Peck) Vellinga in Mycotaxon 76: 433. 2000. – Fig. 60.

Agaricus americanus Peck in Rep. N.Y. St. Mus. nat. Hist. 23: 71. ('1870') 1872; *Lepiota americana* (Peck) Sacc., Syll. Fung. 5: 43. 1887; *Leucocoprinus americanus* (Peck) Redhead in Groves, Edible pois. Mushr. Canada, Ed. 2: 323. 1979. – *Agaricus cupreus* S. Schulz. in Verh. zool.-bot. Ges. Wien 27: 112. 1877, non *Agaricus cupreus* (Krombh.) Krombh., 1846; *Lepiota bresadolae* S. Schulz. in

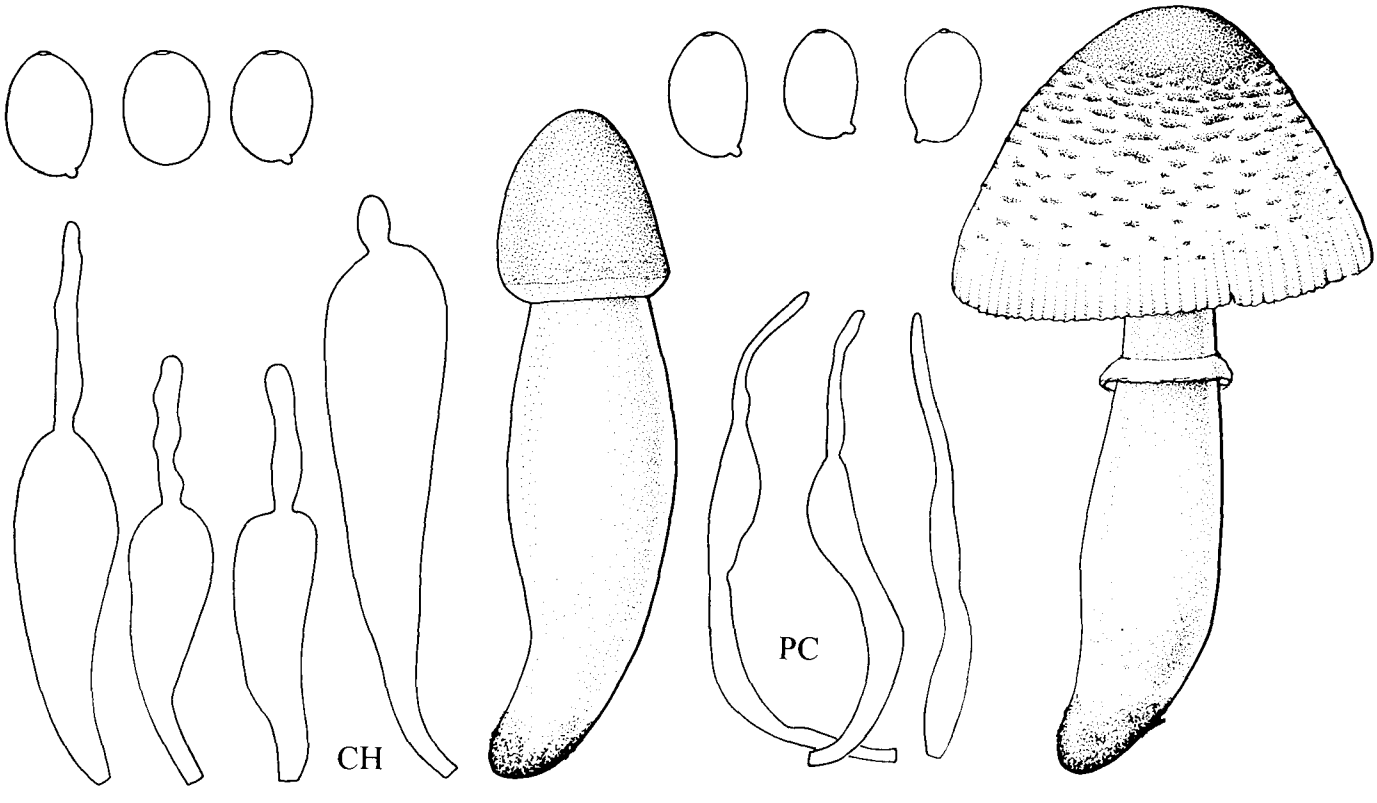

Fig. 60. *Leucoagaricus americanus*

Hedwigia 24: 132. 1885, non *Lepiota bresadolae* P. Henn., 1890; *Leucoagaricus bresadolae* (S. Schulz.) M. Bon in Doc. mycol. 7 (27-28): 15. 1977; *Leucocoprinus bresadolae* (S. Schulz.) Wasser in Nov. Sist. vyssh. nizsh. Rast. 1977: 221. ('1977') 1978; *Leucocoprinus bresadolae* (S. Schulz.) Mos., Röhrlinge Blätterpilze, 4. Aufl.: 248. 1978 (superfluous).

EXCL. – *Lepiota americana* sensu Johnson & Vilgalys in Mycologia 90: 971-979. 1998 (= *Leucoagaricus* spec.). – *Leucocoprinus bresadolae* sensu Imaz. et al., Fungi Japan: 184. 1988 (= *L. meleagris*).

MISAPPL. – *Lepiota badhamii* sensu Huijsman in Meded. Ned. mycol. Vereen. 28: 6-8. 1943; sensu Melzer in Ceská Mykol. 13: 117-119; *Leucoagaricus badhamii* sensu Rocabruna in Bolets Catalunya 8: pl. 378. 1989; *Leucocoprinus badhamii* sensu Cetto, Gr. Pilzf., 6. Aufl., 1: pl. 22. 1980; sensu Schwöbel in Z. Pilzk. 32: 1-2. 1966; sensu Wichansky in Mykol. Sb., Praha 41: 12, pl. 17. 1964.

SEL. ICON. – Breitenb. & Kränzl., Pilze Schweiz 4: pl. 238. 1995 (as *L. bresadolae*); Brunelli in Schweiz. Z. Pilzk. 63: opp. p. 174. 1985 (as *Leucocoprinus bresadolae*); Gerhardt, Gr. Pilzf.: 36. 1997 (as *L. bresadolae*); Imler in Icones mycol. 1985: pl. 102. 1985 (as *Leucocoprinus bresadolae*); Massart, Champignons: 31. 1996 (as *L. bresadolae*); Rocabruna in Bolets Catalunya 8: pl. 378. 1989 (as *L. badhamii*).

SEL. DESCR. & FIGS. – D. Reid in Mycol. Res. 94: 649-650, figs. 31-36. 1990 (as *Leucocoprinus bresadolae*); Schwöbel in Z. Pilzk. 32: 1-2, fig. 1. 1966 (as *Lepiota badhami*); Weholt in Agarica 13: 39, fig. 2. 1986 (as *Leucocoprinus bresadolae*).

VERN. NAME – Gebundelde champignonparasol.

Pileus (70-)100-135(-230) mm, at first cylindrical, subcylindrical with slightly convex sides with truncate apex, then broadly conical with rounded to almost flat centre, flattening to plano-convex to applanate, with very slight central depression or with low umbo, first with uniform covering layer, later with covering layer minutely granulose-squamulose at centre, around centre breaking into small or bigger, concentric to scattered patches, sometimes with small fibrillose pointed scales at margin, and this covering at centre brownish to dark purplish brown (Mu. 5 YR 4/3, 10 YR 7/5), or paler brown, and around centre purple-brown, vinaceous brown to much paler ochraceous, (as pale as 10 YR 7/6), turning pale vinaceous pink where bruised and with age, excoriate at margin and thus leaving there whitish, radially fibrillose, sulcate margin bare, in some specimens with pieces of annulus adhering to margin. Lamellae, L = c. 100, l = 0-7, crowded, fairly crowded, free and remote from stipe, moderately broad, up to 18 mm, creamy whitish, later pale sordid yellowish (paler than 2.5 Y 8/4), with yellow reflection when looked into from below, with a minutely flocculose concolorous to whitish edge, but locally dark vinaceous brown-red (probably after damage). Stipe 95-180 × 12-20 mm, widening downwards, but with tapering foot, hollow, white above to pinkish brown, or purplish brown (5 YR 8/3 to 5 YR 4/5) (from handling) below, somewhat flocculose at apex, almost glabrous downwards to coarsely lengthwise fibrillose, whitish to pinkish brown, white-subtomentose at base. Annulus ascending, with cuff-like part, and flaring 3-11 mm wide part, whitish then dark vinaceous or purplish brown on both sides. Context white or whitish, after cutting immediately or rather rapidly turning in spots, or all over, bright yellow, or sulphur yellow (c. 5 Y 8/6), then after one minute, or more slowly changing to bright brick-red to brownish orange (c. 2.5 YR 6/8), and then to vinaceous red to sordid purplish brown. Smell weak, pleasant, more or less chocolate-like. Taste indistinct, or slightly astringent. Spore print colour not known.

Ammonia solution on context of pileus and on lamellae blue-green, changing to very dark blue. Exsiccate vinaceous pink, fading after some years of storage.

Spores (7.0-)8.0-11.5 × (5.5-)6.0-8.0 µm, on average (7.7-)9.1-9.7 × (6.0-)6.4-7.0 µm, Q = 1.2-1.6, Qav = (1.25-)1.35-1.45, broadly ellipsoid, ellipsoid, thick-walled, with germ pore, dextrinoid, but not strongly so, congophilous, cyanophilous, with pink inner wall and pink plug in germ pore in Cresyl Blue. Basidia 28-39 × 9.5-11 µm, predominantly 4-spored, but often intermixed with 2-spored basidia. Lamella edge sterile. Cheilocystidia abundant, 30-74 × 9.0-18 µm, narrowly clavate, or gradually widening upwards, without or with abrupt, slightly moniliform appendix, 2.0-32 × 3.0-6.0 µm, sometimes with wider capitulum, with green-brown contents and sometimes dark red granules in ammonia. Pleurocystidia not observed. Pileus set with squamules made up of erect elements, 100-160 × 8.0-12 µm, sinuous, with abrupt or gradual apical appendix, flexuous, sometimes capitulate, or slightly moniliform, thick-walled, green-brown in ammonia, also with brown walls in lower part of elements; pigment in connecting hyphae sometimes encrusting. Stipitipellis a cutis of cylindrical hyphae, 2.0-4.0 µm in diam., set (over total length, above and below annulus) with cystidioid elements: 65-180 (including appendix) × 9.0-13 µm, tapering into or more abrupt ending in flexuous appendix; pigment, also in connecting hyphae, green-brown in ammonia. Clamp-connections not observed.

HABITAT & DISTR. – Clustered and in groups, saprotrophic on sawdust, piles of wood chips etc. In the Netherlands known from a find near Putten in Aug. 1895, and a second locality near Amsterdam where the species was found in 1999, probably on old wood, in a meadow. Aug.-Sept. Recorded from all over Europe, except the boreal, montane and alpine zones, but not common, possibly of tropical origin.

The macroscopic description is partly based on notes accompanying extra-limital material and on descriptions from literature (as cited).

There seem to be two variants of this species, one with small patches on pileus surface, as depicted by Brunelli (in Schweiz. Z. Pilzk. 63: opp. p. 174. 1985), the other variant with a pileus surface more reminiscent of a *Macrolepiota* species (as depicted by Gerhardt, Gr. Pilzf.: 36. 1997).

The range of spore sizes is quite large, due to the presence of a variable number of 2-spored basidia.

The elements on the pileus are shorter than reported by Reid (in Mycol. Res. 94: 650. 1990), who specified elements up to 260 µm long.

Leucoagaricus americanus from North America and *L. bresadolae* from Europe proved to be identical (Vellinga in Mycotaxon 76:433-436. 2000), though Smith and Weber (in Contr. Univ. Mich. Herb. 16: 219. 1987) stated that they were different. In fact, there are no morphological characters to distinguish the two, and molecular research has confirmed the occurrence of identical species on both sides of the Atlantic Ocean.

In older literature the names of *L. badhamii* and *L. bresadolae* are often confused (see the misapplied names). For a full discussion of this confusion see Demoulin (in Lejeunia, n. S. 39: 1-15. 1966) or Krieglsteiner (in Beitr. Kenntn. Pilze Mitteleur. 7: 39-60. 1991).

Leucoagaricus meleagris differs from *L. americanus* in the smaller size of the basidiocarps, the different aspect of the pileus surface, and the shape of the pilear and stipital elements. Furthermore, the germ pore is indistinct.

Dried specimens of *L. americanus* turn vinaceous pink, a feature considered to be specific for *L. biornatus* sensu Cooke by Babos (in *L. americanus* the exsiccates should turn 'wine reddish brown') (Babos in Beih. Sydowia 8: 34. 1979).

Reid (in Mycol. Res. 90: 1994) described two other closely related species, viz. *Leucocoprinus caldariorum* D. Reid (not valid) and *L. holospilotus* (B. & Br.) D. Reid (including *Lepiota biornata* (B. & Br.)

Sacc.). Both species are said to have smaller basidiocarps (pileus up to 9 cm); *L. caldariorum* does not stain yellow, but immediately red, and has relatively short, squat hairs on the pileus. The context of *Leucocoprinus holospilotus* does not stain red at all, though the stem discolours red-brown on handling, and the spores are 7.0-8.5 × 5.0-6.0 µm.

All these species seem very closely related, and more research is definitely needed to clarify the relationships and similarities between those taxa. The fact that they occur in temperate regions only in greenhouses and on compost heaps and piles of discarded wood and sawdust near saw mills etc., suggests a (sub)tropical origin.

Leucoagaricus americanus is the type species of sect. *Annulati* and its subsect. *Rubescentes*, but the closely related *L. meleagris*, has been placed in sect. *Piloselli* with other red-staining species, like *L. badhamii* (Bon, Fl. mycol. Eur. 3, Lépiotes: 104. 1993). Section *Annulati* harbours the non-staining *L. leucothites* as well.

Some European authors (e.g. Breitenbach & Kränzlin, Pilze Schweiz 4: 209. 1995; Massart, Champignons: 31. 1996; as *L. bresadolae*) consider *L. americanus* a toxic species. American authors, on the other hand, regard it as a good edible (e.g. Arora, Mushr. demyst.: 301 1986).

5. Leucoagaricus meleagris (Sow.) Sing. in Lilloa 22: 422. ('1949') 1951. – Fig. 61

Agaricus meleagris Sow., Col. Fig. Engl. Fungi 2: pl. 171. 1799; *Gymnopus meleagris* (Sow.) S.F. Gray, Nat. Arr. Br. Pl. 1: 609. 1821; *Lepiota meleagris* (Sow.) Quél. in Mém. Soc. Émul. Montbéliard, Sér. II, 5: 338. 1873 (Champ. Jura Vosges 2); *Hiatula meleagris* (Sow.) Sing. in Annls mycol. 34: 431. 1936; *Leucocoprinus meleagris* (Sow.) Locq. in Bull. mens. Soc. linn. Lyon 14: 93. 1943; *Leucocoprinus meleagris* (Sow.) Zschieschang in Mykol. Mittbl. 31: 5. 1988 (superfluous); *Leucocoprinus meleagris* (Sow.) Raithelhuber in Metrodiana 16: 16. 1988 (superfluous); *Leucoagaricus meleagris* (Sow.) M. Bon in Doc. mycol. 7 (27-28): 19. 1977 (superfluous); *Leucoagaricus meleagris* (Sow.) M. Bon in Doc. mycol. 9 (35): 44. 1979 (superfluous).

MISAPPL. – *Leucocoprinus bresadolae* sensu Imaz. et al., Fungi Japan: 184. 1988.

SEL. ICON. – Vellinga & Huijser in Coolia 40: pl. 6. 1997; Imaz. et al., Fungi Japan: 184. 1988 (as *Leucocoprinus bresadolae*).

SEL. DESCR. & FIGS. – Babos in Annls hist.-nat. Mus. natn. hung. 72: 84-87, figs. 3 & 4. 1980; Bender in Mittbl. Arbeitsgem. Pilzk. Niederrhein 13: 137-139. 1995; A. v.d. Berg & Vellinga in Coolia 41: 35-38, fig. 1. 1998; Migl. & Coccia in Micol. ital. 21 (2): 47-49, fig. 24. 1992; Zschieschang in Mykol. Mittbl. 31: 5-8. 1988 (as *Leucocoprinus meleagris*).

VERN. NAME – Compostchampignonparasol.

Pileus 13-45(-80) mm, when young ellipsoid with truncate apex, expanding via campanulate to plano-convex, when very young with closed covering, soon with plush-like to fibrillose squamules, in undamaged state pure white with dark red-brown fibrillose squamules, especially at centre, more dispersed towards margin, on fibrillose-silky background, becoming red, later wine-red (Mu. 7.5-10 YR 3/4); old specimens completely dark purple, with darker squamules; marginal zone up to 8 mm wide, radially sulcate, in some specimens yellow at margin. Lamellae, L = 50-60, l = 0-3, crowded, free, segmentiform or subventricose, up to 4 mm wide, white-cream at first, later lemon-yellow (c. 5 Y 8/3), reddish or reddish-vinaceous when damaged, with finely flocculose edge, which turns red easily on damaging. Stipe 20-65 × 3-7(-12) mm, narrower at apex and at base, slightly eccentrically fusiform with widest part 1/4 of length above base, sometimes cylindrical, white-cream, completely set with fine, cobwebby fibrils, slightly squamulose,

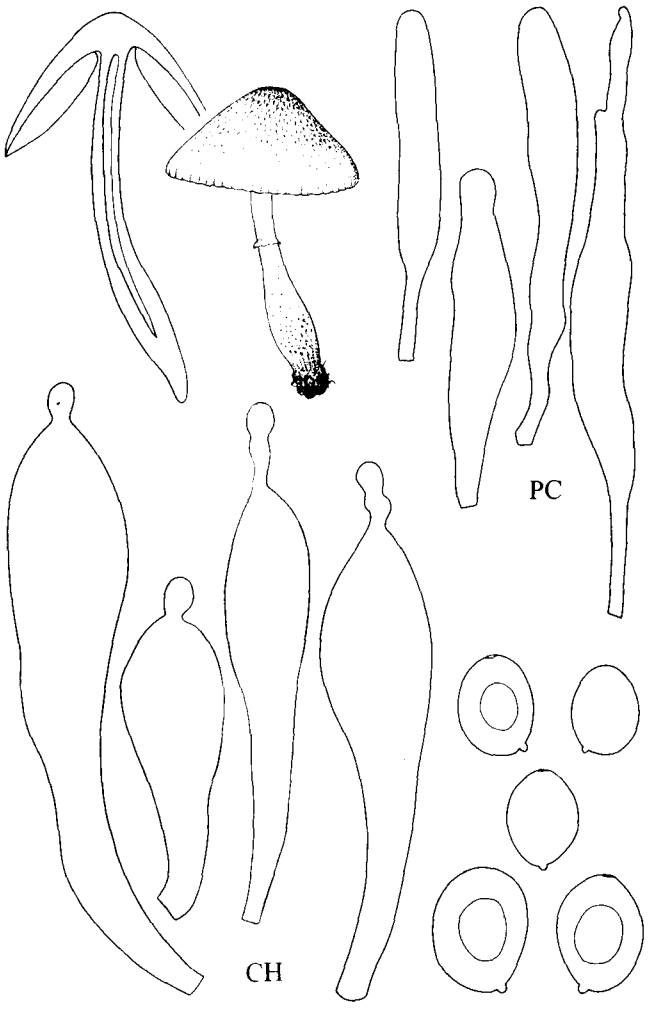

Fig. 61. *Leucoagaricus meleagris*.

dark purple to dark wine-red in old specimens, sometimes pale pinkish, discolouring brown when touched, with white mycelial cords at base. Annulus present, mostly incomplete, sometimes only at pileus margin, ascending, white on upper side, with dark brown underside. Context in pileus and stipe whitish, discolouring at first bright yellow (fading after 5 minutes), then reddish to vinaceous red, but disappearing, slightly shiny in stipe. Smell unpleasant, sweetish-fungoid. Taste unpleasant, bitterish, or fungoid. Spore print probably cream.

Ammonia vapour and solution on pileus, lamellae and stipe, and context green (K. & W. 28EF4-5). Exsiccate vinaceous pink, fading after a year of storage.

Spores 7.5-11.5 × 5.5-8.0 µm, on average 8.6-9.7 × 6.3-7.5 µm, Q = 1.2-1.6, Qav = 1.35-1.4, broadly ellipsoid, ellipsoid, with inconspicuous germ pore, dextrinoid, congophilous, cyanophilous, with pink inner wall and plug in germ pore in Cresyl Blue. Basidia 20-39 × 9.0-12 µm, predominantly 4-spored, but 2-spored basidia may be present in some places on a lamella. Lamella edge sterile, set with cheilocystidia, 20-65 × 8.0-17 µm, narrowly clavate, clavate, narrowly fusiform, without, but mostly with apical excrescence(s) 2-25 µm long, sometimes branched and/or moniliform, with (in ammonia) green-brown intracellular pigment and some red granulose structures. Pleurocystidia absent. Pileus squamules made up of cystidioid, slightly thick-walled elements, 35-170 × 10-20 µm, clavate short elements intermixed with narrowly clavate to more cylindrical (depending on age of basidiocarp) cystidioid elements, slightly truncate at apex, with or rarely without

apical excrescences, with same kinds of pigment as cheilocystidia; connecting hyphae with encrusting pigments. Stipitipellis a cutis of cylindrical hyphae, 3.0-5.0 µm in diam., over total length of stipe set with caulocystidia, 33-150 × 8.0-17 µm, narrowly clavate to narrowly fusiform, when young without, later with narrow long, sometimes branched, appendices (included in length), with the same kind of pigments as cheilocystidia. Clamp-connections not observed.

HABITAT & DISTR. – Fasciculate and often gregarious, saprotrophic and terrestrial on compost and leaf heaps, on paths with wood chips etc., July-Oct., in the Netherlands not common, scattered. Known in Europe from hothouses, and similar substrates as in the Netherlands, very rarely recorded; also known from Japan, eastern U.S.A. and western Canada.

Leucoagaricus meleagris differs from *L. americanus* in size of the basidiocarps and the structure of the squamules on the pileus; microscopically the cystidioid elements are shorter and often more truncate at the apex than in *L. americanus*, and the germ pore in the spores is not as distinctly visible as in *L. americanus*.

Krieglsteiner (in Beitr. Kenntn. Pilze Mitteleur. 7: 48. 1991) suggested that *L. meleagris* is merely a stunted and nutrient-deprived variant of *L. americanus* (which he called *L. bresadolae*), but the differences, both morphological and molecular, warrant the recognition of two species. Differences in spore size, as proposed by several authors, do not exist between the two species. Both show a wide variation in spore size, partly due to a variable proportion of 2-spored basidia. Weather conditions prior to collecting, and refrigerated storage before examining the specimens, also strongly influence spore size (and shape).

Lepiota sanguiflua Murrill (see modern description by Smith & Weber in Contr. Univ. Mich. Herb. 16: 213-214. 1987) appears to be very close or identical with *L. meleagris*, on account of its general shape, discoloration (first yellow, then red), and shape and size of cystidia and spores, which are provided with an inconspicuous germ pore.

6. Leucoagaricus badhamii (B. & Br.) Sing. in Lilloa 22: 419. ('1949') 1951. – Fig. 62

Agaricus badhamii B. & Br. in Ann. Mag. nat. Hist., Ser. II, 13: 397. 1854 (Notic. Br. Fungi 664); *Lepiota badhamii* (B. & Br.) Quél. in Mém. Soc. Émul. Montbéliard, Sér. II, 5: 231. 1872 (Champ. Jura Vosges 1); *Lepiotophyllum badhamii* (B. & Br.) Locq. in Bull. mens. Soc. linn. Lyon 11: 40. 1942; *Leucocoprinus badhamii* (B. & Br.) Locq. in Bull. mens. Soc. linn. Lyon 12: 15. 1943; *Leucocoprinus badhamii* (B. & Br.) Wasser in Nov. Sist. vyssh. nizsh. Rast. 1977: 217. ('1977') 1978 (superfluous); *Leucoagaricus badhamii* (B. & Br.) Herink in Mykol. Sb., Praha 21: 11. ('1985') 1986 (superfluous). – *Lepiota rufovelutina* Velen., Ceské Houby: 217. 1920. – *Lepiota meleagroides* Huijsman in Meded. Nederl. mycol. Vereen. 28: 11. 1943 (not valid). – *Lepiota rufovelutina* var. *sanguinescens* Pilát in Acta Mus. nat. Prag. 11B (2): 16. 1955.

EXCL. – *Lepiota badhamii* sensu Huijsman in Meded. Ned. mycol. Vereen. 28: 6-8. 1943; sensu Melzer in Ceská Mykol. 13: 117-119; *Leucoagaricus badhamii* sensu Rocabruna in Bolets Catalunya 8: pl. 378. 1989; *Leucocoprinus badhamii* sensu Cetto, Gr. Pilzf., 6. Aufl. 1: pl. 22. 1980; sensu Schwöbel in Z. Pilzk. 32: 1-2. 1966; sensu Wichansky in Mykol. Sb., Praha 41: 12, pl. 17. 1964 (in all cases *L. americanus*); *Lepiota badhamii* sensu Michael & Hennig, Handb. Pilzfr., 3. Aufl., 3: 139, pl. 16. 1964 (= *Macrolepiota olivieri*).

SEL. ICON. – Breitenb. & Kränzl., Pilze Schweiz 4: pl. 237. 1995; Enderle in Boll. Gr. micol. G. Bres. 42: 176. 1999; Enderle & Laux in Mittbl. Arbeitsgem. Pilzk. Niederrhein 11 (without page number). 1993.

SEL. DESCR. & FIGS. – Babos in Sydowia Beih. 8: 45-48, fig. 5. 1979; Enderle in Boll. Gr. micol. G. Bres. 42: 175-177. 1999; Heilmann-Clausen in Svampe 26: 18. 1992 (as *Leucocoprinus badhamii*); Joss. in Bull. mens. Soc. linn. Lyon 43: 210-213, fig. 4. 1974; Kelderman, Parasolzw. Zuid-Limburg: 162-163. 1994; D. Reid in Mycol. Res. 94: 643-647. 1990.

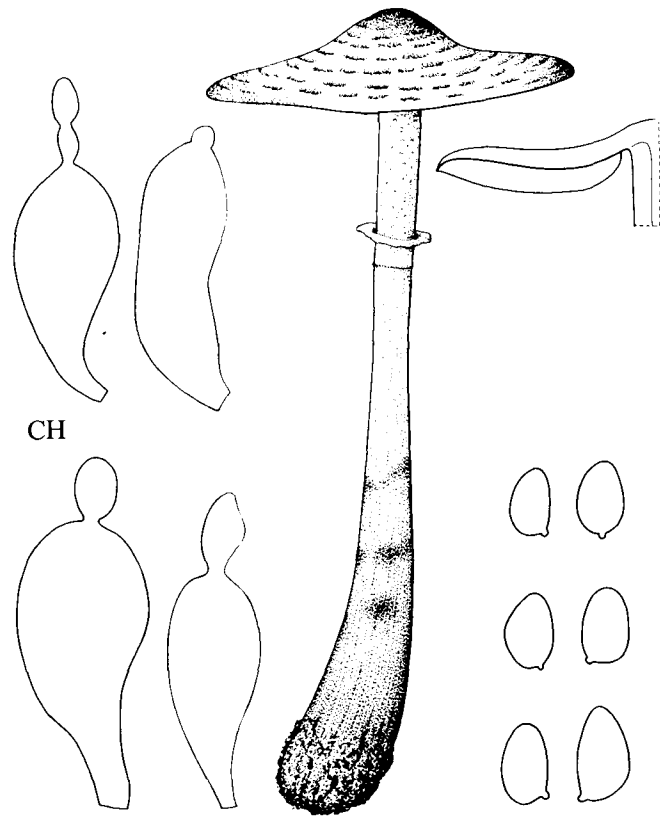

Fig. 62. *Leucoagaricus badhamii*.

VERN. NAME – Bloedende champignonparasol.

Pileus 25-65 mm, at first conico-convex or hemispherical to convex with dentate-fringed margin, expanding to plano-convex, applanate, with broad, flattened or low umbo, with straight, non-sulcate margin, either totally set with small plush-like squamules or with distinct calotte and around centre with radial fibrillose squames, white when fresh and untouched, as soon as touched red, turning dark brown, blackish in some minutes, often greyish spotted. Lamellae, L = c. 70-100, l = (0)1, moderately crowded to crowded, free, remote from stipe, hardly ventricose to ventricose, up to 5.5 mm wide, cream, with reddish sheen, with flocculose edge, which becomes dark. Stipe 35-105 × 3-7 mm, widening gradually towards bulbous base, up to 17 mm wide, hollow, at utmost apex smooth, rest of stipe with flocculose fibrils, at first white, turning red and then dark brown. Annulus ascending, rather thin, and with 2 mm wide rim, white on upper side, discolouring dark on lower side, disappearing with age. Context in pileus and stipe whitish, shiny and brittle in stipe, immediately red when basidiocarp cut; this discoloration vanishes after 0.5 minutes. Smell none, fungoid-lepiotoid or unpleasant, rancid. Taste none or unpleasant. Spore print 'pale cream'.

Ammonia vapour on lamellae, pileus surface and context (olive) green, slowly changing into grey-red. Exsiccate blackish.

Spores 6.0-9.5(-10.0) × 3.5-6.0 µm, on average 6.4-8.8 × 4.0-5.1, Q = 1.25-2.0, Qav = 1.5-1.85, distinctly amygdaliform in side-view, some with an indistinct apical papilla, and amygdaliform in frontal view, without germ pore, dextrinoid, congophilous, cyanophilous, metachromatic in Cresyl Blue; wall strongly swelling in ammonia and

acetic acid. Basidia 15-29 × 6.0-9.0 µm, predominantly 4-spored. Lamella edge sterile. Cheilocystidia abundant, 23-50 × 9.0-18 µm, clavate, without but mostly with abrupt apical excrescence, 2.0-25 × 3.0-5.5 µm, cylindrical and flexuous, sometimes capitate; green-brown in ammonia, often with red-brown concrete granules (these disappearing after a while) and with small colourless crystals. Pleurocystidia not observed. Pileus completely set with pileocystidia, 90-350 × 8.0-22 µm, with some shorter elements present as well, cylindrical with rounded apex, with green-brown pigment in ammonia. Stipitipellis a cutis of cylindrical elements, 3.0-5.0 µm in diam., some with green-brown pigment in ammonia, some with refractive walls, set with patent to adnate caulocystidia (over whole length of stipe), varying from clavate to cylindrical, 74-260 × 9-30 µm, with green-brown contents in ammonia. Clamp-connections not observed.

HABITAT & DISTR. – Solitary or in small groups, saprotrophic and terrestrial in nutrient-rich habitats, deciduous woods, copses, scattered throughout the country, from the outer dune ridge to the province of Drenthe, rather rare, Sept.-mid Nov. Widespread in Europe, but not common, and preferring temperate to subtropical regions.

There is an extremely wide range of spore sizes in this species, though two-spored basidia are not as common as in *L. americanus* or *L. meleagris*.

In European literature of the first two thirds of the 20th century this species is often known as *L. bresadolae* (for a full discussion see Demoulin in Lejeunia, n. S. 39: 1-15. 1966; or Krieglsteiner in Beitr. Kenntn. Pilze Mitteleur. 7: 39-60. 1991).

Reid (in Mycol. Res. 94: 647. 1990) considered *L. badhamii* var. *erubescens* (Babos) M. Bon a not-blackening variant of *L. badhamii* s.str.

7. Leucoagaricus georginae (W.G. Sm.) Candusso in Riv. Micol. 33: 10. 1990. – Fig. 63

Agaricus georginae W.G. Sm. in Seem. J. Bot. 9: 1. 1871; *Lepiota georginae* (W.G. Sm.) Sacc., Syll. Fung. 5: 71. 1887; *Leucocoprinus georginae* (W.G. Sm.) Mos., Röhrlinge, Blätter-, Bauchpilze, 2. Aufl.: 132. 1955 (not valid); *Leucocoprinus georginae* (W.G. Sm.) Bon & Boiffard in Bull. trimest. Soc. mycol. Fr. 86: 28. 1972 (not valid); *Leucocoprinus georginae* (W.G. Sm.) Wasser, Agar. Griby S.S.S.R.: 108. 1985.

SEL. ICON. – Charbonnel in Doc. mycol. 28 (109-110): pl. 1B. 1998.

SEL. DESCR. & FIGS. – Candusso & Lanzoni, Lepiota: 401-402, fig. 87. 1990; Kelderman, Parasolzw. Zuid-Limburg: 166-167. 1994; D. Reid in Beitr. Kenntn. Pilze Mitteleur. 3: 205-206, figs. 1 & 2. 1987.

VERN. NAME – Glinsterende champignonparasol.

Pileus 11-30 mm, truncately conical to hemispherical when young, expanding via plano-convex without or with low umbo to undulating-applanate with flattened centre, set with glittering hairs (lens), making a granulose-fibrillose impression, white at first, easily turning red to red-brown and consequently dark brown with age, when young with fringed, overhanging margin, exceeding lamellae. Lamellae, L = 25-35, l = 1-3, moderately distant to rather crowded, free, segmentiform to hardly ventricose, whitish or cream, sometimes with faint pinkish tinge, with eroded or floccose concolorous edge, which easily discolours red. Stipe 13-35 × 0.7-2 mm, slightly broadened at base, cylindrical and flexuous, hollow, white in untouched places, when touched orange-red or red, soon turning dark brown to black, over total length densely set with minute, glittering hairs. Annulus small and membranous and evanescent or persistent with age, as a narrow band around stipe, sometimes with flaring rim, concolorous with stipe surface, not set with hairs. Context white in pileus, cream and shiny in stipe, discolouring red in both pileus and stipe. Smell a bit fruity-acrid, faintly reminiscent of the smell of *Lepiota cristata*, but without the rubber component. Taste not known. Spore print colour not known.

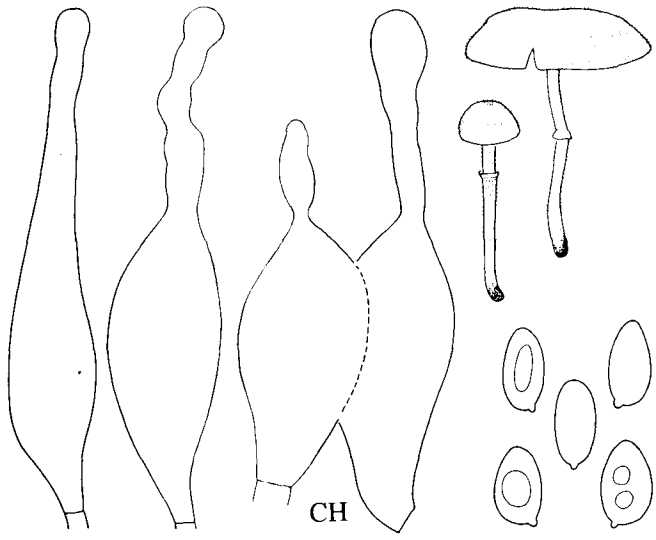

Fig. 63. *Leucoagaricus georginae*.

Ammonia vapour on pileus, lamellae, stipe and context (glaucous) green. Exsiccate blackish.

Spores (5.5-)6.0-8.5 × 3.5-5.0 µm, on average 6.7-7.7 × 3.9-4.3 µm, Q = 1.45-2.25, Qav = 1.7-1.85, ellipsoid to subcylindrical, slightly fusiform to amygdaliform in side-view, without germ pore, though some with an indistinct pore, dextrinoid, congophilous, cyanophilous, many not or hardly colouring in Cresyl Blue, some spores with pink inner wall; wall swelling, but not strongly so, in ammonia and acetic acid. Basidia 15-25.5 × 6.0-8.0 µm, 4-spored. Lamella edge sterile. Cheilocystidia (13-)17-53 × (8.0-)9.0-18 µm, ellipsoid, rarely slightly utriform; appendix absent, most often present, rather abrupt, and then 3.0-25 × 2.5-6.0 µm, slightly moniliform or cylindrical, often with capitulum, up to 8.5 µm wide; first with reddish pigment in ammonia, turning green-brown with some red concrete granules. Pleurocystidia not observed. Pileus covering with clusters of cystidioid elements, 45-240 × 10-20 µm, narrowly ellipsoid, often with long abrupt or tapering into long appendix, intermixed with clavate elements c. 30-40 × 10-14 µm, in some basidiocarps with predominantly clavate elements, in others with a relatively high number of cystidioid elements; pigment parietal and dark brown, especially in lower part of cystidioid elements, encrusting in connecting hyphae, but also green-brown contents and red granules (as observed in ammonia) present, also in connecting repent hyphae. Stipitipellis a cutis of cylindrical elements, 3.0-8.0 µm wide, over whole length set with clusters of patent caulocystidia, 50-270 × 11-22 µm, narrowly ellipsoid to cylindrical with flexuous, slightly moniliform apex; some clavate elements, as on pileus, present as well; pigmentation as in pileus elements. Clamp-connections absent.

HABITAT & DISTR. – Gregarious in small groups, saprotrophic and terrestrial in several vegetation types, such as deciduous woods on clay or loamy soils, *Picea* plantations, and dune copses; in the Netherlands uncommon, scattered throughout the country, Oct. Due to its small size and inconspicuous colours not recorded often, but apparently widespread, not known from the nordic countries.

Good photographs or paintings of *Leucoagaricus georginae* hardly exist, because of the small size and the immediate discoloration of the basidiocarps on the slightest touch.

8. Leucoagaricus croceovelutinus (Bon & Boiffard) Bon & Boiffard in Doc. mycol. 6 (24): 45. 1976. – Fig. 64

Leucocoprinus croceovelutinus Bon & Boiffard in Bull. trimest. Soc. mycol. Fr. 88: 26. 1972. – *Leucocoprinus croceovelutinus* var. *diversisporus* D. Reid in Mycol. Res. 94: 658. 1990 (not valid).

SEL. ICON. – Chiusa in Riv. Micol. 42: 47. 1999; Heilmann-Clausen in Svampe 26: 19. 1992 (as *Leucocoprinus croceovelutinus*); Mos. & Jül., Farbatl. Basidiomyc. 15: III Leucocoprinus 3. 1997.

SEL. DESCR. & FIGS. – Babos in Sydowia Beih. 8: 42-45, fig. 4. 1979; Bon & Boiffard in Bull. trimest. Soc. mycol. Fr. 88: 23-26, fig. 3. 1972 (as *Leucocoprinus croceovelutinus*); Heilmann-Clausen in Svampe 26: 20-21. 1992 (as *Leucocoprinus croceovelutinus*); Kelderman, Parasolzw. Zuid-Limburg: 164-165. 1994; D. Reid in Mycol. Res. 94: 655-658, figs. 46-51. 1990 (as *Leucocoprinus croceovelutinus*); Schreurs in Coolia 25: 33-38. 1982.

VERN. NAME – Verkleurende champignonparasol.

Pileus 30-50 mm, plano-convex to applanate with deflexed margin and low umbo, when very young completely whitish-pinkish velvety, later with purple-brown, tomentose-velvety calotte of the pileus covering, around calotte with concentrical zones of radially arranged triangular adnate fibrillose squamules, closer to margin with more fibrillose squamules; centre and squamules dark red-brown (Mu. 5 YR 3/3), paler at margin on cream background; both squamules and background discolouring orange-red (2.5 R 5/8); margin exceeding lamellae. Lamellae, L = c. 80, l = 1-3, crowded, free, segmentiform, up to 4 mm wide, pale cream to pink with white edge, discolouring orange-red (K. & W. 8AB7 to 9E8) with age, and on bruising. Stipe 50-85 × 3-6 mm, tapering upwards, with up to 15 mm wide basal bulb, hollow and fragile, white, pinkish cream fibrillose, strongly discolouring vinaceous red (10 R 4/4) when touched. Annulus membranous and evanescent (not always present), and a second ascending annulus with red rim below the membranous one. Context white, greyish white, shiny in stipe, immediately discolouring orange when cut, then pink-red to dark purple-brown, temporarily yellow with ammonia vapour. Smell none. Taste none to slightly bitter. Spore print colour not known.

Ammonia vapour (not the solution) on lamellae orange-red. Exsiccate dark red-brown.

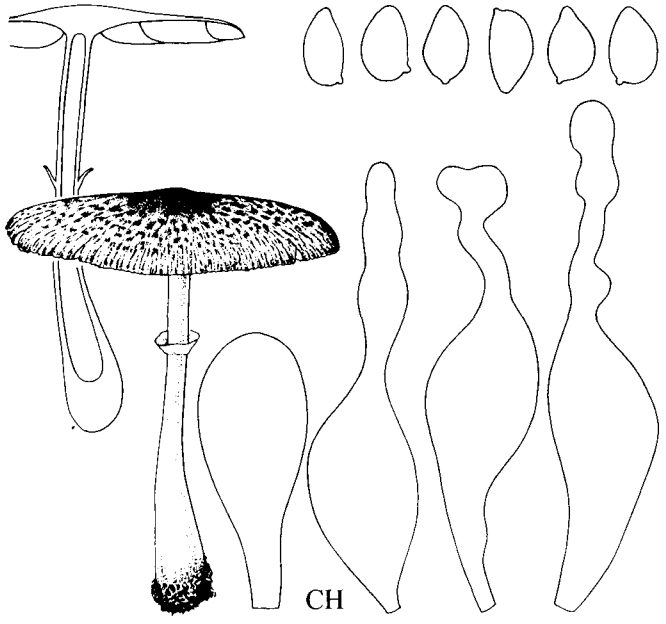

Fig. 64. *Leucoagaricus croceovelutinus*.

Spores 6.0-9.0 × 3.5-5.0 µm, on average 7.0-7.7 × 4.2-4.5 µm, Q = 1.5-2.0, Qav = 1.6-1.75, oblong-amygdaliform, some with apical papilla, as seen in side-view, dextrinoid, congophilous, cyanophilous, metachromatic in Cresyl Blue, without germ pore, or with indistinct germ pore (especially as seen in ammonia and acetic acid), some with brown contents. Basidia 15-22 × 6.0-8.0 µm, 4-spored. Lamella edge sterile. Cheilocystidia 26-50 × 8.5-22 µm, ellipsoid, clavate, narrowing into appendix, or with abrupt appendix 4.0-40 × 3.0-5.0 µm, rarely without appendix; appendix often moniliform, with up to 8.0 µm wide, sometimes branched, capitulum; cystidia with red contents in ammonia. Pleurocystidia not observed. Pileus covering with globose, ellipsoid to clavate elements, 25-55 × 18-33 µm, in clusters; on top of this layer squamules with terminal, slightly inflated elements, 130-260 × 16-33 µm, and cylindrical connecting hyphae; pigment in the terminal elements red-brown in plates along the inner walls, and fine-encrusting in connecting hyphae. Stipitipellis a cutis of cylindrical elements, 3.0-5.0 µm wide, with over whole length of stipe 10-15 µm wide, flexuous hyphae, with red-brown pigment. Clamp-connections not observed.

HABITAT & DISTR. – Solitary or in small groups, saprotrophic and terrestrial in nutrient-rich places, along sunken roads and tracks, in deciduous woods and dune copses; rather rare in the Netherlands, known from the calcareous dune area, and southern Limburg, Sept.-Oct. Widespread and rare in temperate Europe, absent from boreal and alpine habitats.

Leucoagaricus croceovelutinus is easily recognizable because of the following combination of characters: a red discoloration of all parts in ammonia vapour, the spores with an indistinct apical papilla, the peculiar cheilocystidia and the pileus covering, made up of two layers of wide cells. Close relatives, like *L. badhamii* and *L. georginae*, discolour green in ammonia vapour and the pileus covering is made up of erect cystidioid elements.

9. Leucoagaricus pilatianus (Demoulin) Bon & Boiffard in Doc. mycol. 6 (24): 45. 1976. – Fig. 65.

Lepiota pilatiana Demoulin in Lejeunia, n.S. 39: 11. 1966; *Leucocoprinus pilatianus* (Demoulin) Mos., Röhrlinge Blätterpilze, 3. Aufl.: 186. 1967 (not valid); *Leucocoprinus pilatianus* (Demoulin) Bon & Boiffard in Bull. trimest. Soc. mycol. Fr. 88: 26. 1972 (not valid); *Leucocoprinus pilatianus* (Demoulin) Wasser in Nov. Sist. vyssh. nizsh. Rast. 1977: 219. ('1977') 1978; *Leucocoprinus badhamii* var. *pilatianus* (Demoulin) Krieglst. in Beitr. Kenntn. Pilze Mitteleur. 7: 57. 1991. – *Leucoagaricus salmoneophyllus* Bon & Guinb. in Doc. mycol. 22 (88): 31. 1993; *Leucoagaricus pilatianus* var. *salmoneophyllus* (Bon & Guinb.) Migl. & Gennari in Gennari & Migl. in Riv. Micol. 41: 293. ('1998') 1999. – *Lepiota rubens* Kühner & Maire in Bull. Soc. Hist. nat. Afr. N. 28: 109. 1937 (not valid).

MISAPPL. – *Lepiota rufovelutina* sensu Pilát in Acta Mus. natn. Prag. 9B (2): 12-18. 1953.

SEL. ICON. – Cetto, Funghi Vero 7: pl. 2603. 1993.

Pileus 22-58 mm, convex to applanate, not umbonate, when young with slightly incurved margin, finely blackish or dark brown squarrulose around disc, brownish to pale beige-brown, outwards squamose, almost smooth or finely punctate, but more commonly over whole surface very finely fibrillose or slightly erect-hairy, hardly showing underlying context (lens) and (greyish) brown, dark at centre, with orange-brown sheen (fox-tinged), later, exposed and on damaging, discolouring to dark reddish brown, vinaceous brown to slightly purplish brown. Lamellae, L = 80-120, l = 0-1, very crowded, free, thin, crowded, slightly ventricose, 4-7 mm broad, whitish with faint creamy pink tinge, with whitish fimbriate edge, reddish or brownish with age

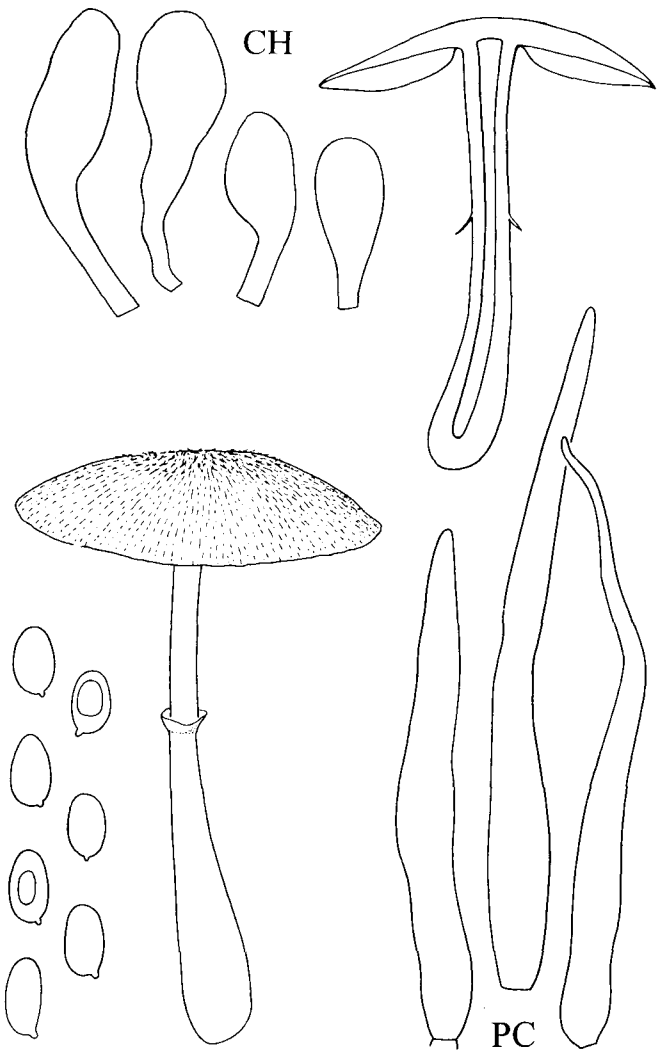

Fig. 65. *Leucoagaricus pilatianus*.

or after bruising near pileus margin. Stipe 35-75 × 3-7 mm, up to 5 mm wide at apex, and with gradually bulbous 10 mm wide base, tapering upwards or cylindrical, fistulose, with a distinct ring, white and smooth above annulus, slightly fibrillose in lower part, discolouring dark red-brown when rubbed. Annulus hanging, with brownish underside. Context white, reddening on exposure (this reaction can vary among basidiocarps). Smell absent, or strong and like cedar wood. Taste none. Spore print colour not known.

Ammonia on pileus of older specimens green, on lamellae and context glaucous green.

Spores 5.5-9.0 × 3.5-4.5 µm, on average 6.2-7.2 × 3.9-4.0 µm, Q = 1.5-2.0 (-2.2), Qav = 1.6-1.8, ellipsoid to oblong, slightly ovoid to amygdaliform, without germ pore, pale orange-brown in Melzer's Reagent, congophilous, cyanophilous, with pink inner wall in Cresyl Blue; wall strongly swelling in ammonia and acetic acid. Basidia 15-27 × 6-8.5 µm, 4-spored, in older specimens slightly thick-walled. Lamella edge sterile. Cheilocystidia 21-45(-52) × 8.5-13(-17) µm, narrowly clavate, clavate, without apical excrescences, rarely mucronate, reddish or brown-green in ammonia. Pleurocystidia absent. Pileus covering, relatively densely set with erect, cystidioid hairs, 60-340(-400) × (9-)12-20 µm, widest just above base, and gradually narrowing to rounded apex, pale pinkish to reddish brown in ammonia, with some reddish crystals; some short clavate elements rarely present; connecting hyphae sometimes with encrusting pigment. Stipitipellis a cutis of cylindrical to slightly inflated hyphae, 3-12 µm wide, brownish in ammonia, irregularly set with often flexuous, curved very narrowly clavate to cylindrical cystidioid hairs, 35-150 × 7-13 µm, with or without brown contents in ammonia. Clamp-connections not observed.

HABITAT & DISTR. – Solitary to gregarious in small groups, saprotrophic and terrestrial, in deciduous copse on loamy nutrient-rich soil. Very rare in the Netherlands, known from one locality in southern Limburg (Elsloo-Geulle, Bunderbos). Sept. Rare and scattered in Europe, not known from the nordic countries.

The description given above is based on one collection from the Netherlands, supplemented with data from Hungarian collections.

Young specimens, and freshly picked basidiocarps hardly discolour when bruised or treated with ammonia vapour, whereas older specimens do show a distinct discolouration. It was probably this variation in discolouration that led to the distinction of a separate variety (*Leucocoprinus pilatianus* var. *subrubens* (Wich.) Wasser). Reid (in Mycol. Res. 94: 665. 1990) distinguished this variety on account of spore shape (with a blunt apex; more amygdaliform in the typical variety). The Netherlands material showed more ellipsoid than amygdaliform spores; spores were of both types within the Hungarian collections studied.

The smell in the Dutch collection was strongly like cedar wood, as in *L. pilatianus* var. *salmoneophyllus* (Bon & Guinb.) Migl. & Gennari.

Leucoagaricus aurantiovergens Gennari & Migl. (in Riv. Micol. 41: 291-292. ('1998') 1999), described from Italy comes very close, but has longer spores and cystidia, and the stem discolours orange when scratched.

Leucoagaricus jubilaei (Joss.) M. Bon is a small species with clavate cystidia, in which the basidiocarps first turn citric yellow, then red (or not) when cut. Josserand (in Bull. mens. Soc. linn. Lyon, No. spéc. 43: 205-216. 1974) gave an extensive description of this taxon and comparison with other reddening species.

10. Leucoagaricus marriagei (D. Reid) M. Bon in Doc. mycol. 6 (24): 44. 1976. – Fig. 66

Lepiota marriagei D. Reid in Fung. rar. ic. Col. 1: 24. 1966. – *Leucoagaricus marriagei* var. *ammovirescens* M. Bon in Doc. mycol. 22 (88): 31. 1993.

SEL. ICON. – Candusso in Riv. Micol. 33: 12. 1990; Migl. & Perrone in Boll. Ass. micol. ecol. Romana 22: 27. 1991; D. Reid in Fung. rar. Ic. col. 1: pl. 6c & d. 1966.

SEL. DESCR. & FIGS. – Candusso in Riv. Micol. 33: 11-14. 1990; Migl. & Perrone in Boll. Ass. micol. ecol. Romana 22: 23-30. 1991; D. Reid in Fung. rar. Ic. col. 1: 20-22, figs. 11, 12, 14a & b. 1966.

VERN. NAME – Gespikkelde champignonparasol.

Pileus 12-25 mm, mostly plano-convex with distinct umbo, in some specimens concave with rounded margin and prominent umbo, pink (c. K. & W. 9D5 to 8D5) at centre, paler at margin, discolouring to lilac or brownish in older specimens, velvety at centre, with adnate fibrils towards margin. Lamellae, L = 45-50, l = 1-3, moderately crowded, free, sometimes with distinct collarium, whitish to creamy with orange tinge, with fine-flocculose white edge (lens). Stipe 25-92 × 2-4 mm, gradually widening downwards, hollow, glassy cream when moist, white when dry, pubescent over whole length, in older specimens only visible above annulus, with small fibrils turning brown with age in lower part. Annulus evanescent, with lilac edge. Context white in pileus, concolorous with surface in stipe. Smell fungoid. Taste not known. Spore print probably white.

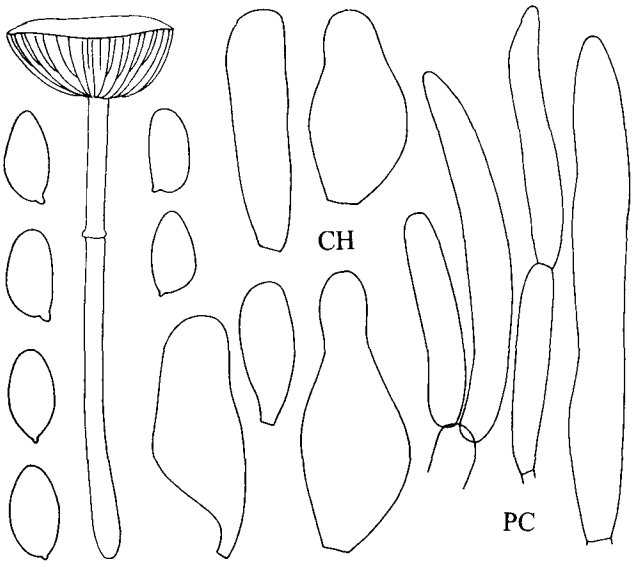

Fig. 66. *Leucoagaricus marriagei.*

Lamellae slightly turning green with ammonia vapour.

Spores 7.0-9.5 × 4.0-5.0 µm, on average 8.0-8.4 × 4.4 µm, Q = 1.6-2.1, Qav = 1.85-1.9, oblong, often with tapering apex, dextrinoid, congophilous, cyanophilous, with pink inner wall in Cresyl Blue, without germ pore. Basidia 16-25 × 6.5-9 µm, 4-spored. Lamella edge sterile. Cheilocystidia 20-40 × 8-17 µm, broadly utriform, cylindrical or slightly fusiform, not coloured, and rather thin-walled. Pleurocystidia not observed. Pileus covering with fibrils of cylindrical to slightly inflated elements with terminal elements with rounded, slightly tapering apex; terminal elements 40-145 × 10-17 µm, with brownish intracellular pigment; pigment slightly encrusting in penultimate elements. Stipitipellis a cutis of cylindrical colourless hyphae, 3.0-8.0 µm in diam., with some ascending cylindrical, non-differentiated hyphae. Clamp-connections absent in all tissues.

HABITAT & DISTR. – Solitary or in small groups, saprotrophic and terrestrial in deciduous woods on loamy or sandy soils, rich in humus and nutrients; very rare in the Netherlands, known from southern Limburg (Elsloo-Geulle, Bunderbos) and one locality in the province of Noord-Holland (Heiloo, Heilooër Bosch); Sept.-Oct. Not common, but recorded from several countries in Europe.

Leucoagaricus gauguei comes quite close in general aspects, but differs in the structure of the pileus covering, and the shape of the spores and cheilocystidia.

11. Leucoagaricus ionidicolor Bellù & Lanzoni in Riv. Micol. 31: 107. 1988. – Fig. 67

Leucocoprinus caeruleoviolaceus D. Reid in Mycol. Res. 93: 413. 1989; *Leucoagaricus caeruleoviolaceus* (D. Reid) M. Bon in Doc. mycol. 23 (91): 33. 1993; *Leucoagaricus ionidicolor* var. *caeruleoviolaceus* (D. Reid) D. Reid in Mycotaxon 53: 327. 1995.

SEL. ICON. – Bellù & Lanzoni in Riv. Micol. 31: 108. 1988; Contu & Serra in Micol. Veget. medit. 13: 55. 1998.

SEL. DESCR. & FIGS. – Bellù & Lanzoni in Riv. Micol. 31: 107-110. 1988; Contu & Serra in Micol. Veget. medit. 13: 55-56. 1998; D. Reid in Mycol. Res. 93: 413, fig. 1. 1989 (as *Leucocoprinus caeruleoviolaceus*); Vila et al. in Rev. catal. Micol. 20: 172. 1997.

VERN. NAME – Elfjeschampignonparasol.

Pileus 23-50 mm, campanulate-hemispherical when young, expanding to applanate without umbo, with more or less closed centre and radially arranged, small fibrils around centre, dark purple at centre (K. & W. 14EF4), violaceous purple (c. 13A3) around centre on white background; margin fringed and exceeding lamellae. Lamellae, L = 52, l = 1, moderately crowded, free (but barely), slightly ventricose, up to 6 mm wide, white with fimbriate, concolorous edge. Stipe 35-44 × 2-5 mm, widened to 8 mm wide base, hollow, over total length, or especially below annulus, set with short lengthwise oriented fibrils, pinkish-purplish (11A5-4), with yellowish background shining through. Annulus ascending, disappearing in age, with white, hairy-tomentose upper side, fringed upper margin, and violaceous underside (less pink than stipe) (14-15 A 4-5). Context white in pileus and brittle, whitish in stipe. Smell fungoid-lepiotoid, not distinctive. Taste not known. Spore print white.

Spores 6.0-7.0x (3.5-)4.0-4.5 µm, on average 6.7 × 4.0 µm, Q = 1.5-1.75, Qav = 1.65, ellipsoid to oblong, with rounded, sometimes with subacute apex, dextrinoid, congophilous, strongly metachromatic, thick-walled without germ pore. Basidia 14-21 × 5.5-6.5 µm, 4-spored. Lamella edge sterile. Cheilocystidia 23-40 × 8.0-10 µm, narrowly clavate, often a bit irregular, with curved pedicel; most cystidia with granular hyaline contents. Pleurocystidia absent. Pileus covering made up of adnate to ascending long tapering elements, 110-300 × 8.0-12 µm, widest just above base, with intracellular diffuse pigment, and refractive apical part; connecting elements short, 10-18 × 5.0-8.0 µm, sometimes with encrusting pigments. Stipitipellis a cutis of cylindrical, colourless hyphae, c. 5.0 µm wide, covered (below annulus) with wider, c. 10-15 µm wide, coloured hyphae, with intracellular brownish-lilacinous pigment, with terminal elements with abrupt long and thin excrescence; terminal elements up to 200 µm long. Clamp-connections not observed.

HABITAT & DISTR. – Solitary or in small groups, saprotrophic and terrestrial, on clayey soil. In the Netherlands recorded from one locality in southern Limburg (Stokhem), where it was growing under *Picea* covered with *Clematis vitalba*. Oct. Rare throughout Europe, and recorded from southern Sweden to Spain and southern Italy, and from Great Britain to the Czech Republic.

Leucoagaricus ianthinosquamulosus Guinb. comes close, but differs in longer spores (6.5-10 (-12.5) µm long), 2-spored basidia, and encrusting pigment in the pileus covering (Guinberteau in Doc. mycol. 22 (88): 10. 1993).

Another species with violaceous tinges is *L. ianthinophaeus* Locq. (in Bull. trimest. Soc. mycol. Fr. 68: 177. 1952.), with smaller spores (up to 6.0 µm long), and a pileus covering with tufts of cylindrical elements, intermixed with some inflated elements.

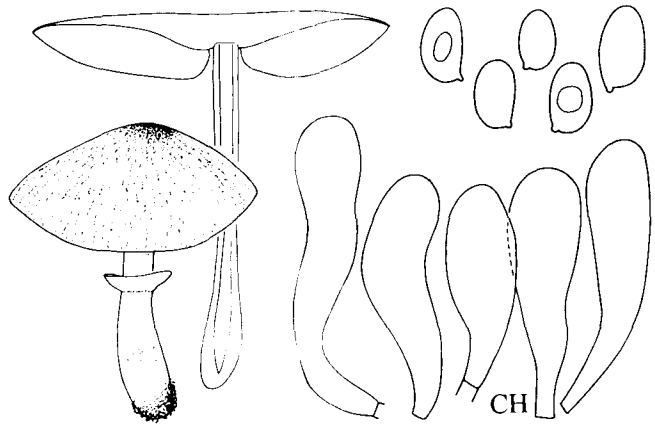

Fig. 67. *Leucoagaricus ionidicolor.*

12. Leucoagaricus melanotrichus (Mal. & Bert.) Trimb. in Doc. mycol. 5 (20): 42. 1975. – Fig. 70.

Lepiota melanotricha Mal. & Bert., Fl. Champ. sup. Maroc 1: 134. 1970.

VERN. NAME – Elegante champignonparasol.

KEY TO THE VARIETIES

1. Pileus very dark grey, with purplish or greenish hue ..... 12a. var. **melanotrichus**
1. Pileus pale grey-brown at centre ..... 12b. var. **fuligineobrunneus**

12a. var. **melanotrichus**. – Fig. 68.

Leucoagaricus melanotrichus var. *septentrionalis* D. Reid in Mycotaxon 53: 331. 1995.

SEL. ICON. – Contu & Currelli in Micol. Veget. medit. 11 (2): central page. 1996; Tabarés in Bolets Catalunya 10: pl. 483. 1991.

SEL. DESCR. & FIGS. – Babos in Agarica 6 (12): 206. 1985; Kuyp. & Schreurs in Coolia 26: 74-76. 1983; Mal. & Bert., Fl. Champ. sup. Maroc 1: 132-134. 1970; Trimb. in Doc. mycol. 5 (20): 42-45. 1975.

Pileus 7-20 mm, bluntly conical with inflexed margin when young, expanding to applanate or plano-concave with or without broad rounded umbo, at centre dark grey (almost closed) with purplish or greenish hue, or very dark purplish brown, felted subtomentose, towards margin with squamulose fibrils on yellowish-whitish or white background, not or faintly sulcate, thin-fleshed. Lamellae, L = 25-30, l = 0-3, moderately distant to fairly crowded, free, ventricose and up to 3 mm broad, white-cream with pinkish sheen or distinctly yellowish (Mu. 5 Y 8/4) with age, with white (minutely) flocculose edge, which might turn darker with age. Stipe 10-29 × 1-2 mm, cylindrical or slightly broadened downwards, rarely attenuated upwards, often bent, hollow, white or cream at apex, in lower half with more and more grey to purplish black fibrils, red-brown discolouring on touching. Annulus membranous and evanescent, often not present, thin, whitish with brownish to blackish edge. Context thin and white in pileus, concolorous to surface in stipe. Smell indistinct. Taste not known. Spore print white.

Spores 5.5-7.0 × 3.5-4.5(-5.0) µm, on average 6.1-6.6 × 3.9-4.0 µm, Q = 1.4-1.8, Qav = 1.55-1.65, ellipsoid to oblong with straight adaxial side in side-view, not or some spores slightly amygdaliform, not dextrinoid, though some becoming pale orange in Melzer's Reagent, congophilous, some spores cyanophilous, with pale pink inner wall in Cresyl Blue, without germ pore; walls slightly swelling in ammonia and acetic acid. Basidia 17-23 × 6.5-8.0 µm, 4-spored. Lamella edge sterile, loosely set with cheilocystidia. Cheilocystidia 28-50 × 7.0-17 µm, broadly cylindrical, sometimes a bit strangulate or flexuous, rarely clavate, without contents. Pleurocystidia not observed.

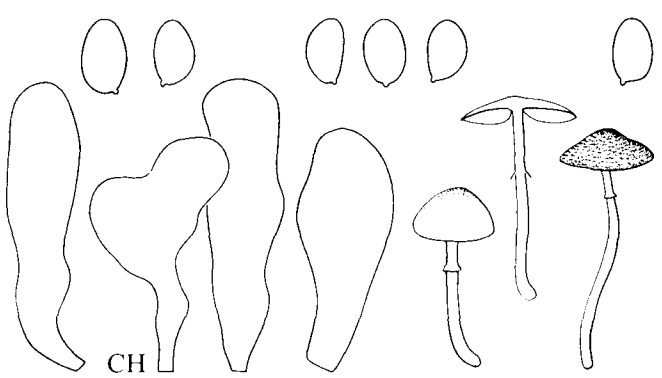

Fig. 68. *Leucoagaricus melanotrichus*.

Pileus covering with irregularly arranged and sometimes anastomosing, repent to ascending hyphae made up of up to 5 coloured, cylindrical elements; terminal elements not widened, 20-55 × 7.0-10 µm, with pale to dark brown intracellular pigment; walls sometimes slightly thickened. Stipitipellis a cutis of cylindrical, non-coloured hyphae, 3.0-7.0 µm in diam., in lower part with patent brown-coloured cylindrical elements 25-80 × 5.0-9.0 µm. Clamp-connections absent in all tissues.

HABITAT & DISTR. – Gregarious in small groups, saprotrophic and terrestrial in coniferous litter, and in deciduous woods, on clayey, rarely sandy, soils. Rare in the Netherlands, scattered; Aug.-Oct. Not common, but widespread in Europe, probably absent from boreal and (sub-)alpine regions.

A variant with relatively small basidiocarps and slightly amygdaliform spores was described as var. *septentrionalis* by Reid (in Mycotaxon 53: 331. 1995). Both size of basidiocarps and spore shape are variable in *L. melanotrichus*, and Reid's variety is not recognized here.

Leucocoprinus heinemannii Migl. (in Micol. ital. 16 (2): 8. 1987) resembles *L. melanotrichus*, but has different warmth requirements, as in Europe it has only been found in greenhouses, and the spores are longer: 6.0-9.0(-9.5) × 3.0-4.5(-5.0) µm, Qav = 1.8-1.85. Migliozzi & Zecchin (in Belg. J. Bot. 131: 174. ('1998') 1999) gave a tabular overview of the differences between the two species.

Two other dark brown to blackish, bigger species have been described from Europe: *L. fuligineodiffractus* Bellù & Lanzoni (see Candusso & Lanzoni, Lepiota: 363-366. 1990), and *L. griseodiscus* (M. Bon) Bon & Migl. Both have spores with an apical papilla, and differentiated terminal elements in the pileus covering (for further information see: Bon, Fl. mycol. Eur. 3, Lépiotes: 94. 1993).

12b. var. **fuligineobrunneus** Bon & Boiffard in M. Bon in Doc. mycol. 8 (29): 38. 1978.

Leucoagaricus melanotrichus f. *fuligineobrunneus* (Bon & Boiffard) M. Bon in Doc. mycol. 23 (91): 33. 1993. – *Leucoagaricus melanotrichus* var. *fuligineobrunneus* f. *citrifolius* Courtecuisse in Doc. mycol. 19 (75): 4. 1989 (not valid).

SEL. DESCR. & FIGS. – Bas in Coolia 34: 108-109. 1991.

CHARACTERISTICS – Pileus with grey-brown colours; lamellae very pale greyish buff or pale beige; stipe whitish, ochraceous near base.

Spores 6.0-7.0 × 3.5-4.5 µm, on average 6.4-6.7 × 3.9-4.1 µm, Q = 1.4-1.8, Qav = 1.65, ellipsoid to oblong with straight abaxial side, some slightly amygdaliform; pigment in pileus covering elements pale greyish brown.

HABITAT & DISTR. – As typical variety, but much rarer, known from southern Limburg and Muntendam (prov. Groningen); Sept.-Oct. Rare and hardly recorded in Europe.

The rather pale grey-brown colours distinguish this variety from the typical variety. Microscopical characters, except for the colour of the pigment in the pileus covering, are similar.

13. Leucoagaricus tener (P.D. Orton) M. Bon in Doc. mycol. 7 (27-28): 54. 1977. – Fig. 69

Lepiota tenera P.D. Orton in Trans. Br. mycol. Soc. 43: 288. 1960; *Leucoagaricus tener* (P.D. Orton) M. Bon in Bull. trimest. Soc. mycol. Fr. 92: 329. 1976 (not valid).

EXCL. – *Leucoagaricus tener* sensu Migl. & Coccia in Micol. ital. 19 (1): 22-24. 1990 (= *Leucoagaricus* spec.).

SEL. DESCR. & FIGS. – M. Bon in Bull. trimest. Soc. mycol. Fr. 92: 329-331, fig. 8. 1976; P.D. Orton in Trans. Br. mycol. Soc. 43: 288-

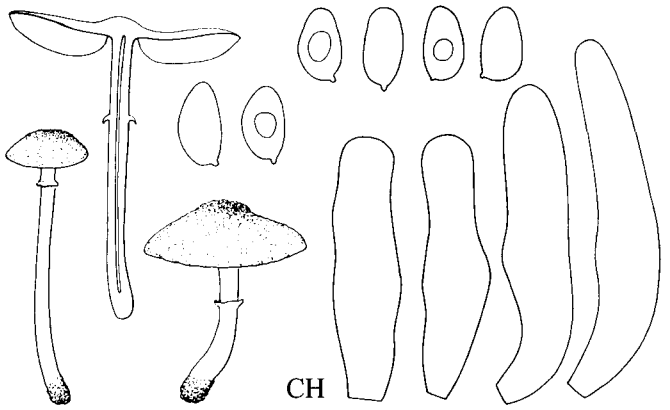

Fig. 69. *Leucoagaricus tener.*

289. 1960; D. Reid in Mycotaxon 53: 334-335, figs. 2c-f, 3a-d. 1995; Uljé in Coolia 27: 10-12. 1984.

VERN. NAME – Tere champignonparasol.

Pileus 11-36 mm, when young hemispherical-paraboloid, wide-conical, expanding via campanulate to plano-convex, or even plano-concave, with or without low umbo, at centre densely set with small fibrillose squamules, orange-red-brown, red-brown, or dark cinnamon-brown, (Mu. 5 YR 4/4, 7.5 YR 5/6, between 7/5 YR 4/6 and 5 YR 3/4, rarely 7.5 YR 3/4; K. & W. 6D6-6F6), around centre with small brown, radially arranged fibrils on white-cream background, slightly sulcate in marginal zone, with brown guttules when fresh, when young with white velar remnants adhered to margin. Surface becoming orange when touched. Lamellae, L = 45-50, l = 1, moderately crowded to moderately distant, free, ventricose, up to 6 mm wide, white, slightly greyish white, sometimes with a sheen of pink, with white flocculose edge. Stipe 20-40(-70) × 1.5-4 mm, cylindrical and often in basal part widened up to 4.5 mm, often curved in basal part, hollow, cream and glabrous, and even shiny in upper part, felted-fibrillose and orange-pink or brown-coloured in lower part, with white tomentum and mycelium cords at base, when fresh with yellow to brown guttules, especially on apex. Annulus small, halfway up stipe, or higher, fugacious, patent, whitish with brown margin. Context whitish and very thin in pileus, concolorous with surface in stipe. Smell indistinct, or distinct and then astringent like rubber, suggestive of *L. cristata*. Taste not known. Spore print colour not known.

Spores 6.5-8.0 × (3.5-)4.0-4.5(-5.0) µm, on average 7.0-7.4 × 3.9-4.2 µm, Q = 1.4-2.0, Qav = 1.6-1.8, ellipsoid to oblong, often amygdaliform in side-view, without germ pore, dextrinoid, congophilous, cyanophilous, and metachromatic in Cresyl Blue; wall strongly swelling in ammonia and acetic acid, or hardly swelling. Basidia 18-26 × 6.5-8.5 µm, 4-spored. Lamella edge sterile in young specimens, later with tufts of cheilocystidia. Cheilocystidia clustered, 19-75 × 6.5-13 µm, cylindrical, very narrowly clavate, slightly fusiform, sometimes with strange appendix on apex, colourless and slightly thick-walled. Pleurocystidia not present. Pileus covered with repent and ascending hyphae, made up of cylindrical elements; terminal elements 30-130 × 6.0-9.0 µm, with brown intracellular pigment; pigment intracellular or encrusting in penultimate elements. Stipitipellis a cutis of cylindrical, colourless hyphae, c. 5 µm in diam., with in lower part of stipe, irregular, flexuous, brown-coloured hyphae, with terminal elements narrowly clavate, 10-12 µm in diam. Clamp-connections absent in all tissues.

HABITAT & DISTR. – Gregarious, saprotrophic and terrestrial on clay or humus-rich sandy soil, in both coniferous and deciduous woods. In the Netherlands very rare, known from several localities in the western provinces (Amsterdam, Amstelpark and Amsterdamse Bos; Rijswijk, Ter Werve; Ter Aar, De Put). Sept.-Oct. In Europe rare and scattered. Not known from the nordic countries.

The cheilocystidia in the Dutch material are cylindrical, though in literature (see selected descriptions) they have been described as clavate. The cystidia are arranged in tufts, clearly visible in mature basidiocarps.

Leucoagaricus brunneocingulatus (P.D. Orton) M. Bon is another fragile red-brown species, characterized by the absence of guttules, and a brown-bordered annulus. Since its original description (Orton in Trans. Br. mycol. Soc. 43: 282. 1960) it has been reported only once from continental Europe (Migliozzi & Perrone in Boll. Ass. micol. ecol. Romana 23: 3-6. 1991).

14. Leucoagaricus sublittoralis (Kühner ex Hora) Sing. in Beih. Nova Hedwigia 29: 163. 1969. – Fig. 70.

Lepiota sublittoralis Kühner in Bull. trimest. Soc. mycol. Fr. 52: 216. 1936 (not valid); *Leucocoprinus sublittoralis* (Kühn.) Locq. in Bull. mens. Soc. linn. Lyon 14: 93. 1945 (not valid); *Leucoagaricus sublittoralis* (Kühner) Sing. in Lilloa 22: 422. ('1949') 1951 (not valid); *Lepiota sublittoralis* Kühner ex Hora in Trans. Br. mycol. Soc. 43: 450. 1960.

EXCL. – *Leucoagaricus sublittoralis* sensu Babos in Ceská Mykol. 24: 217-219. 1970; sensu D. Reid in Fung. rar. Ic. col. 2: 1-2. 1967 (= in both cases *L. wichanskyi*).

SEL. ICON. – Migl. & Mohr in Micol. ital. 21 (1): pl. 63, 64. 1992; Partacini in Riv. Micol. 38: 281. 1995.

SEL. DESCR. & FIGS. – Kelderman, Parasolzw. Zuid-Limburg: 156-157. 1994; Kühner in Bull. trimest. Soc. mycol. Fr. 52: 216-218. 1936 (as *Lepiota sublittoralis*); Partacini in Riv. Micol. 38: 280-282. 1995.

VERN. NAME – Duinboschampignonparasol.

Pileus 30-55(-70) mm, c. hemispherical expanding to plano-convex, applanate, with low broad umbo, and slightly deflexed margin, at centre pinkish brown (Mu. 7.5 YR 6/5, 6/4), around centre pale pinkish-brownish, at centre closed and slightly felted, sometimes with fine cracks, towards margin radially fibrillose to squamulose, adnate on whitish to cream background, with fringed margin especially when young, exceeding lamellae. Lamellae, L = c. 70-90, l = 0-1(-3), moderately distant to crowded, free, and more than 1 mm remote from stipe, segmentiform to ventricose, 3-5 mm broad, white when young, slightly cream with age, with white flocculose edge. Stipe 50-65(-100) × 4-5.5 mm, with (slightly) broadened base up to 12 mm wide, hollow, shiny white all over, somewhat brownish in lower part with age,

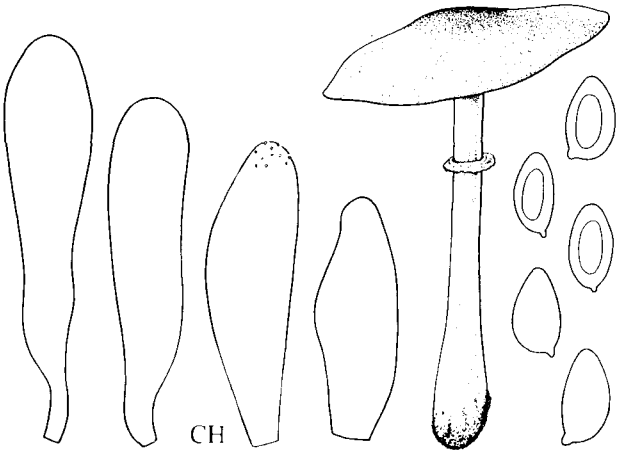

Fig. 70. *Leucoagaricus sublittoralis.*

innately fibrillose. Annulus ascending, white, with pinkish brownish edge, disappearing with age. Context white in stipe and pileus. Smell fungoid, like the rubber component of smell of *L. cristata*. Taste as smell. Spore print probably white.

Spores 6.5-10.0 × 3.5-5.0 µm, on average 7.4-8.5 × 3.8-4.3 µm, Q = 1.5-2.2, Qav = 1.7-2.0, oblong-amygdaliform, often with apical papilla, rarely with rounded apex, without germ pore, dextrinoid, congophilous, cyanophilous, metachromatic in Cresyl Blue. Basidia 17-26 × 6.0-8.0 µm, 4-spored. Lamella edge sterile. Cheilocystidia 21-70 × 6.0-14 µm, cylindrical, narrowly clavate, narrowly utriform, sometimes subcapitate, colourless, most without, rarely with some crystals on apex, often inside the cystidia. Pleurocystidia absent. Pileus covering with long, radially arranged adnate cylindrical hyphae, 3.0-6.0 µm wide, with encrusting pigment, locally with clusters of short hyphae and narrowly clavate-fusiform elements, 60-130 × 14-24 µm. Stipitipellis a cutis of cylindrical, colourless hyphae. Clamp-connections absent.

HABITAT & DISTR. – Solitary to gregarious in small groups, saprotrophic and terrestrial on both sandy and clayey-loamy soils, in copses, deciduous woods etc. In the Netherlands recorded from the dune area (especially the inner dune region) and from several localities in southern Limburg. Sept.-Nov. Recorded from several countries in Europe, where the species occurs inland as well as in the coastal regions, not recorded north of Denmark.

Leucoagaricus sublittoralis is very close to or perhaps identical with *L. littoralis* (Ménier) M. Bon. Kühner (in Bull. trimest. Soc. mycol. Fr. 52: 216-218. 1936) described *L. sublittoralis* from inland, and not from the coast as Ménier's *L. littoralis*. According to Bon (Fl. mycol. Eur. 3, Lépiotes: 98. 1993) the main difference between *L. littoralis* and *L. sublittoralis* is the width of the pilear elements: 6-10(-15) µm in *L. littoralis*, and (10-)15-20(-25) µm in *L. sublittoralis*. Furthermore, *L. littoralis* is the more sturdy of the two taxa. According to Kühner the elements are 10-19 µm wide in *L. sublittoralis*. In the Dutch specimens, originating from both inland and the coastal area, the terminal elements are narrowly clavate-fusiform, 14-25 µm wide. Hora (in Trans. Br. mycol. Soc. 43: 450. 1960), who validly described *L. sublittoralis*, literally translated Kühner's description, but indicated a British collection as type, which subsequently got lost. The neotype, designated by Reid (in Fung. rar. Ic. col. 2: 1-2. 1967), represents *L. wichanskyi*.

Some authors (see excluded names) have considered *L. sublittoralis* and *L. wichanskyi* synonyms. But the two taxa are easily separated by some macroscopical characters (presence of a velar patch on the pileus of *L. wichanskyi*, and a bulbous stipe base in the same species), and some microscopical characters, especially shape of the cheilocystidia and construction of the pileus covering.

Occasionally squamose variants of *L. sublittoralis* are found. These have been excluded from the above description. The squamosity may be caused by dry growing conditions.

Leucoagaricus gaillardii Bon & Boiffard (in Bull. trimest. Soc. mycol. Fr. 90: 295. ('1974') 1975) is a big, fleshy representative of this group, with a rather squamose pileus covering and non-amygdaliform spores. This species has been found along the southern French Atlantic and the mediterranean coasts. Priou et al. (in Doc. mycol. 25 (98-100): 349-358. 1995) gave an extensive overview on the morphology, ecology and distribution of this species.

Leucoagaricus glabridiscus (Sundb.) Wuilbaut, originally described from the western U.S.A., and reported from Belgium by Wuilbaut (in Doc. mycol. 17 (65): 46. 1986), is close to *L. sublittoralis*, but differs in the copper to brown-red colours of the pileus.

Leucoagaricus subolivaceus Migl. & Perrone (in Boll. Ass. micol. ecol. romana 9 (27): 44-45. 1992) is also close, but characterized by olivaceous colours in the pileus; it occurred in sandy terrain under *Quercus ilex* in the mediterranean region.

15. Leucoagaricus wichanskyi (Pilát) Bon & Boiffard in Bull. trimest. Soc. mycol. Fr. 90: 303. ('1974') 1975 (as *L. wychanskyi*). – Fig. 71

Lepiota wichanskyi Pilát in Acta Mus. natn. Prag. 9B (2): 4-11. 1953.

MISAPPL. – *Lepiota sublittoralis* sensu D. Reid in Fung. rar. Ic. col. 2: 1-2. 1967.

SEL. ICON. – Cetto, Funghi Vero 7: pl. 2601. 1993; Zuccherelli, Funghi Pinete Zone medit.: pl. 275. 1993.

SEL. DESCR. & FIGS. – Kelderman, Parasolzw. Zuid-Limburg: 158-159. 1994; Pilát in Acta Mus. natn. Prag. 9B (2): 4-11. 1953.

VERN. NAME – Knolchampignonparasol.

Pileus 35-80 mm, when young hemispherical, with age expanding to plano-convex and (sub-)umbonate, sometimes with shallow depression around umbo, flattened at umbo, which is covered with some white velum patches, reddish brown, pink-brown, purplish brown (Mu. 2.5 YR 6/4, 5-10 YR 7/6), paler at margin, to slightly ochraceous brown or almost white (5 YR 7/3-8/4 and paler); at first covering made up of 'closed' fibrils, later, except for centre, breaking up into looser fibrils or squamules, showing the white to pink-white context, under dry circumstances more squamose, under wet conditions more fibrillose; mar-

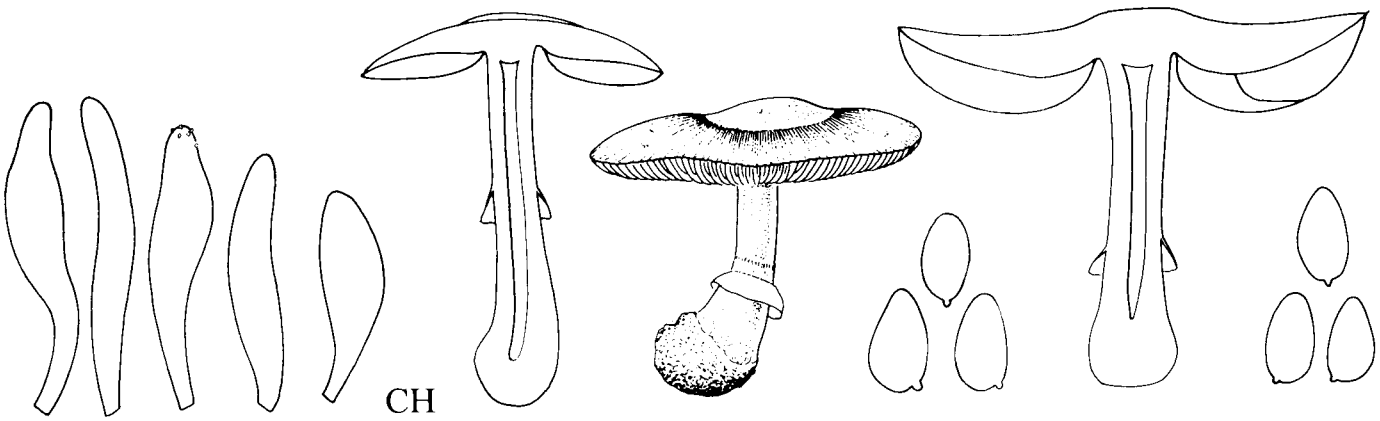

Fig. 71. *Leucoagaricus wichanskii*

gin sometimes fringed with white velar flocks. Lamellae, L = 70-110, l = 1-5, crowded, rather crowded, free and forming a collarium, slightly ventricose, 2.5-6.0 mm wide, first white, later creamy, often with sordid grey tinge, with even or slightly flocculose (lens), concolorous edge. Stipe 30-85 × 4-10 mm, with distinctly widened abrupt, rarely clavate, often submarginate bulb, 10-20 mm wide, in very young specimens with some velum remnants on bulb margin, tapering towards apex, hollow, white, not or hardly discolouring (brown) on bruising, shiny and lengthwise innately fibrillose. Annulus descending, rarely ascending, evanescent with age, white with ultimate edge pink-brown as on pileus. Context in pileus white, rather thick, white in stipe, with age yellowish or slightly (orange-)brown in bulb. Smell of young specimens none, later faintly like the smell of *L. cristata*. Taste none. Spore print white.

Spores (6.5-)7.0-9.5(-10.0) µm, on average 7.4-8.5 × 4.1-4.6 µm, Q = 1.5-2.25, Qav = 1.65-1.9, in side-view amygdaliform, often with indistinct apical papilla, very rarely oblong and not amygdaliform, dextrinoid, congophilous, cyanophilous, with metachromatic inner wall in Cresyl Blue, without germ pore. Basidia 18-27 × 6.5-10 µm, predominantly 4-spored; number of 2-spored basidia variable. Lamella edge sterile. Cheilocystidia 18-55 × 4.0-11.5 µm, cylindrical, narrowly lageniform, narrowly clavate, or narrowly utriform, sometimes some subcapitate, in dried specimens with pale grey contents, sometimes with some small external apical crystals. Pleurocystidia not observed. Pileus covering made up of long, tapering colourless elements, with or without septa, 75-250 × 5.0-16 µm, originating in groups from short connecting elements, with densely encrusting brown pigment. Stipitipellis a cutis of non-coloured cylindrical elements, 3.0-6.0 µm wide. Clamp-connections not observed.

HABITAT & DISTR. – Gregarious in small groups or solitary, saprotrophic and terrestrial, on sandy and on clayey-loamy soils, in deciduous woods, in a lawn, in copses. In the Netherlands very rare, known from a few localities in the dune region (Heiloo, Heilooër bosch; Heemstede, Leyduin) and with certainty from one locality in southern Limburg (Neercanne, Cannerberg), perhaps more widespread in that area; Sept.-Oct. Rarely recorded in Europe, probably because it is not always recognized; with distribution centres both in central Europe and in coastal areas.

The above description is based on Netherlands and extralimital material.

Leucoagaricus wichanskyi is macroscopically characterized by the remains of the veil on the pileus centre, and the bulbous base with velar remnants on its rim. Microscopically the rather narrow cheilocystidia with grey contents and the structure of the pileus covering are remarkable. Spore sizes can not be used to distinguish species in this group, as the number of 2-spored basidia varies, and spores are easily misshapen by storage.

Some authors (e.g. Babos in Ceská Mykol. 24: 217-219. 1970; Reid in Fung. rar. Ic. col. 6: 16-17. 1972) considered *L. sublittoralis* and *L. wichanskyi* conspecific. However, the differences between the two species are quite obvious, both in macroscopic and in microscopic characters.

Leucoagaricus idae-fragum Guinb. et al., described from France, (Guinb. et al. in Bull. trimest. Soc. mycol. Fr. 114: 1-18. 1998) is also characterized by a velar patch on the pileus, but differs from *L. wichanskyi* by the raspberry-red pileus, the spores with rounded apex, and the clavate cheilocystidia.

Leucoagaricus rubrotinctus (Peck) Sing. is a North American species, occasionally reported from Europe, especially from greenhouses and the mediterranean region (Bon, Fl. mycol. Eur. 3, Lépiotes: 100. 1993), and characterized by a reddish pileus, without a velar patch, non-amygdaliform spores, and long cylindrical cheilocystidia.

16. Leucoagaricus purpureolilacinus Huijsman in Fungus 25: 33. 1955. – Fig. 72.

Leucoagaricus purpureorimosus Bon & Boiffard in M. Bon in Doc. mycol. 8 (29): 37. 1978. – *Leucoagaricus purpureorimosus* f. *pallidus* Bon & Boiffard in M. Bon in Doc. mycol. 8 (29): 37. 1978.

SEL. ICON. – Lonati in Micol. Veget. medit. 6: pl. 8. 1991; Migl. & Mohr in Micol. ital. 21 (1): pl. 64. 1992 (both as *L. purpureorimosus*).

SEL. DESCR. & FIGS. – Huijsman in Fungus 25: 33. 1955.

VERN. NAME – Purperen champignonparasol.

Pileus 35-60 mm, paraboloid-hemispherical at first, bluntly conical, expanding to applanate with low broad umbo, purplish brown, dark purplish red-brown, dark vinaceous brown (Mu. 5 YR 5/3, near 10 R 3/1.5) at centre, in rest of pileus pink-brown, pale brown, pale ochraceous (5 YR 6/4, 10 YR 6/3), finely fibrillose-squamulose, in bigger specimens with radially radiating, reticulately connected, slightly raised to sharp ridged darker venation, with a covering which is broken up at pileus margin, showing the white underground, with white velar remnants at margin, at least when young. Lamellae, L = 65-80, l = 1-3, crowded, free and remote from stipe, segmentiform, subventricose, 4-6 mm wide, white to pale cream, with concolorous or white flocculose edge. Stipe 45-75 × 6-14 mm, gradually widened, but more often tapering towards base, straight or flexuous, hollow, with rooting basal part, white, with faint lilacinous tinge at base, finely fibrillose, slightly shiny, glabrous. Annulus evanescent, ascending, or descending, membranous-felted, white, later brownish. Context in pileus thick, white and dull, white and shiny in stipe, not discolouring. Spore print white with a pale pinkish tinge.

Spores 7.5-11.5 × 4.0-6.5 µm, on average 8.7-10.3 × 4.2-5.3 µm, Q = 1.6-2.3, Qav = 1.8-1.95, amygdaliform in side-view, often with apical papilla, rounded-fusiform in frontal view, without germ pore, dextrinoid, congophilous, cyanophilous, with pink inner wall in Cresyl Blue. Basidia 18-29 × 6.5-10 µm, 4-spored, rarely 2-spored. Lamella edge sterile. Cheilocystidia 19-41 × 6.0-15 µm, variable in shape,

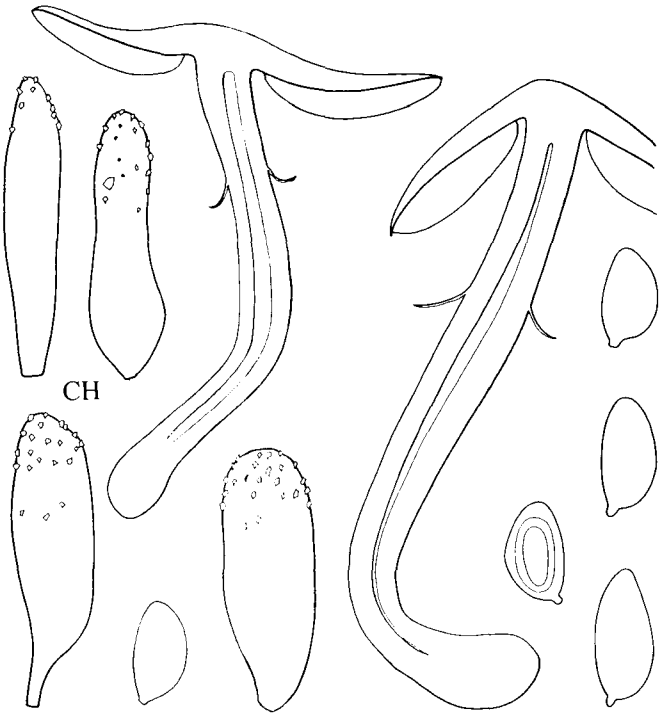

Fig. 72. *Leucoagaricus purpureolilacinus*.

clavate, rarely broadly clavate, cylindrical, often with median constriction, narrowly lageniform, slightly thick-walled, with crystals in upper part or on apex only. Pleurocystidia absent. Pileus covering in centre of pileus with gelatinized adnate hyphae, c. 3.0 µm in diam., lying on top of ellipsoid, coloured elements; near pileus margin with long cylindrical adnate elements, up to 300 × 15 µm, with encrusting pigment. Stipitipellis a cutis of narrow, 3.0-10 µm wide, colourless, cylindrical elements. Clamp-connections absent.

HABITAT & DISTR. – Solitary or in small groups, saprotrophic and terrestrial, in dune grasslands, in woods on the inner side of the dunes, probably also in woods on loamy calcareous soil in Limburg, rare in the Netherlands. Oct.-Nov. Rare and widespread along the coasts in Europe from the Netherlands southwards.

Leucoagaricus purpureolilacinus is characterized by the dark purplish colours at the centre of the pileus, cystidia crowned with crystals, and rather big spores which resemble those of *Lepiota subgracilis* in shape.

Leucoagaricus purpureorimosus Bon & Boiffard is considered a synonym, as no discriminating characters could be found. Both taxa are reported from dune areas.

17. Leucoagaricus gauguei Bon & Boiffard in in Bull. trimest. Soc. mycol. Fr. 90: 290. ('1974') 1975. – Fig. 73

Sericeomyces gauguei (Bon & Boiffard) Heinem. in Bull. Jard. bot. natn. Belg. 48: 405. 1978.

EXCL. – *Leucoagaricus gauguei* sensu Migl. & Perrone in Micol. ital. 21 (1): 37-39. 1991 (= *Leucoagaricus* spec.)

SEL. ICON. – Lonati in Boll. Ass. micol. ecol. Romana 8-9: 8. 1986.

SEL. DESCR. & FIGS. – Kelderman, Parasolzw. Zuid-Limburg: 152-153. 1994.

VERN. NAME – Lilavezelige champignonparasol.

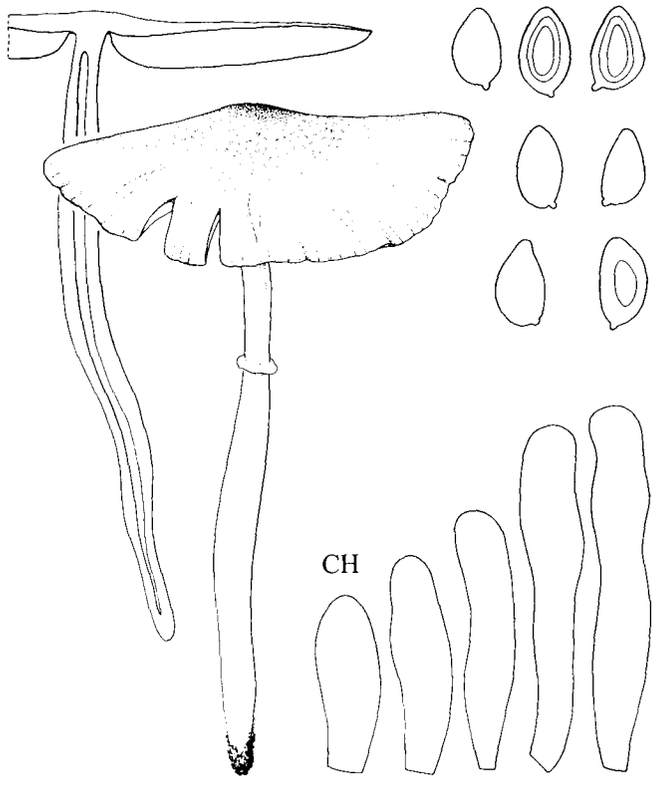

Fig. 73. *Leucoagaricus gauguei*.

Pileus 14-60 mm, when young campanulate, expanding to applanate with low umbo and deflexed margin, first totally white to cream, then at centre with granular-erect yellow-brown-pink, pink-brown to lilac-brown squamules, towards margin more and more spread out, showing the whitish fibrillose and squamulose background, finally brown to dark brown, grooved and fringed in marginal 0.5 cm. Lamellae, L = c. 60, l = 1-2, crowded, pale cream-white, free, slightly ventricose, or segmentiform, up to 4.5 mm wide, with white flocculose edge. Stipe 35-65 × 2-5 mm, tapering towards apex, or cylindrical, straight or bent, hollow, pinkish cream, with annulus, adnately tomentose-fibrillose, below annulus slightly squamulose, becoming brownish when touched. Annulus halfway up stipe, with band as cuff around stipe, with rim up to 2 mm wide, with slightly orange tinge at fringed margin; upper side woolly-granulose. Context whitish in pileus, in stipe silky shiny and becoming ochraceous brown. Smell indistinct, slightly fungoid. Taste not distinct. Spore print white creamy.

Spores 6.5-8.5 × 4.0-5.0 µm, on average 7.2 × 4.2 µm, Q = 1.55-1.9, Qav = 1.8, amygdaliform, with, rarely without, small apical papilla, dextrinoid, congophilous, cyanophilous, metachromatic in Cresyl Blue, without germ pore;. Basidia 15-24 × 6.0-9.0 µm, predominantly 4-spored. Lamella edge sterile. Cheilocystidia 24-57 × 6.5-10 µm, cylindrical, often slightly thickened at apex. Pleurocystidia absent. Pileus squamules made up of erect elements, 20-130 × 6-14 µm, cylindrical with rounded apex, or tapering towards apex, with diffuse, pale intracellular pigment; these terminal elements are situated on short, isodiagonal elements, e.g. 5.0-10 µm wide, with refringent walls. Clamp-connections absent.

HABITAT & DISTR. – Solitary or in small groups, saprotrophic and terrestrial in deciduous woods, both on humus-rich sand, and on calcareous clay. Very rare in the Netherlands, recorded from the dune region (Bloemendaal, Oud Woestduin; Amsterdamse Waterleidingduinen), and southern Limburg (Bemelen). Sept.-Oct. Rare and scattered in Europe, but not known from the nordic countries.

The spore sizes reported by Kelderman (Parasolzw. Zuid-Limburg: 153. 1994) for this species are smaller than given here, as his description is based on young material, without fully mature spores.

18. Leucoagaricus sericifer (Locq.) Vellinga in Persoonia 17: 477. 2000. – Fig. 74.

Lepiota cristata var. *sericea* Cool in Meded. Ned. mycol. Vereen. 12: 23. 1922; *Lepiota sericea* (Cool) Huijsman in Meded. Ned. mycol. Vereen. 28: 46. 1943, non *Lepiota sericea* Mass., 1912; *Leucoagaricus sericeus* (Cool) Bon & Boiffard in M. Bon in Doc. mycol. 9 (35): 40. 1979 (not valid); *Sericeomyces sericeus* (Cool) Contu in Cryptog., Mycol. 12: 6. 1991 (not valid); *Pseudobaeospora sericifera* Locq. in Bull. trimest. Soc. mycol. Fr. 68: 169. 1952; *Lepiota sericifera* (Locq.) Locq. in Friesia 5: 294. 1956; *Sericeomyces sericifer* (Locq.) Døssing in Knudsen & Hansen in Nordic J. Bot. 11: 481. 1991; *Lepiota sericata* Kühn. & Romagn., Fl. anal. Champ. sup.: 405. 1953 (superfluous); *Sericeomyces sericatus* (Kühn. & Romagn.) Heinem. in Bull. Jard. bot. natn. Belg. 48: 404. 1978. – *Lepiota sericatella* Malenç. in Mal. & Bert., Fl. Champ. sup. Maroc 1: 152. 1970; *Leucoagaricus sericatellus* (Malenç.) M. Bon in Doc. mycol. 9 (35): 40. 1979; *Sericeomyces sericatellus* (Malenç.) M. Bon in Bull. trimest. Soc. mycol. Fr. 96: 172. 1980; *Sericeomyces sericatus* var. *sericatellus* (Malenç.) Heinem. in Bull. Jard. bot. natn. Belg. 48: 404. 1978; *Leucoagaricus sericifer* f. *sericatellus* (Malenç.) Vellinga in Persoonia 17: 479. 2000.

MISAPPL. – *Lepiota serena* sensu J. Lange, Fl. agar. dan. 1: pl. 11B. 1935.

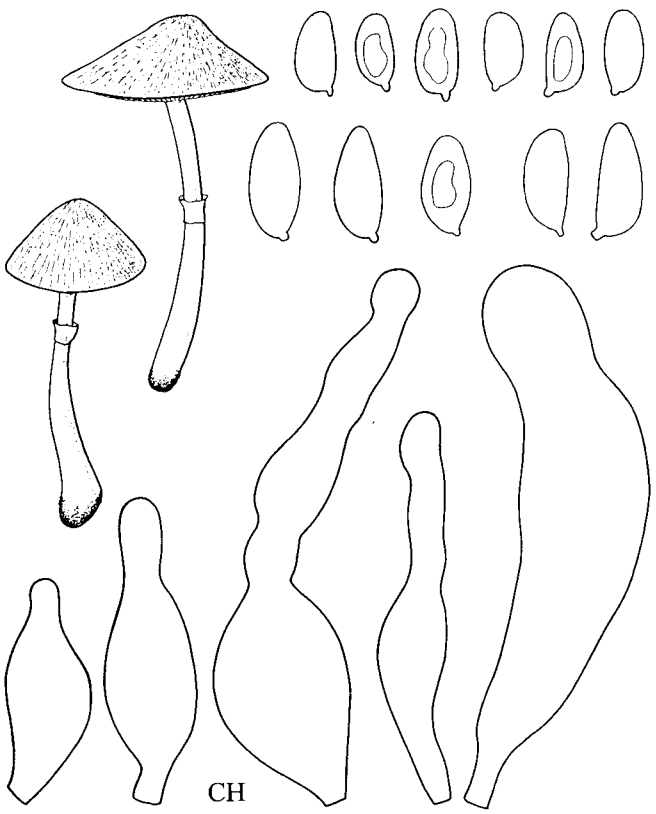

Fig. 74. *Leucoagaricus sericifer.*

SEL. ICON. – Migl. in Boll. Gruppo micol. G. Bres. 40 (1): 21. 1997 (as *Sericeomyces sericifer*); Migl. & Coccia in Micol. ital. 20 (2): pl. 62. 1991 (as *L. sericeus*).

SEL. DESCR. & FIGS. – Huijsman in Meded. Ned. mycol. Vereen. 28: 44-46. 1943 (as *Lepiota sericea*); Kelderman, Parasolzw. Zuid-Limburg: 146-149. 1994 (as *L. sericatellus* and *L. sericeus* resp.); Locq. in Friesia 5: 294-295. 1956 (as *Lepiota sericifera*); Mal. & Bert., Fl. Champ. sup. Maroc 1: 150-151, fig. 26. 1970 (as *Lepiota sericatella*); Migl. & Bizzi in Micol. ital. 24 (3): 81, 84, fig. 7. 1995 (as *Sericeomyces sericatellus*); Migl. & Coccia in Micol. ital. 20 (2): 24-28. 1991 (as *L. sericeus*).

VERN. NAME – Zijdechampignonparasol, incl. Tweesporige champignonparasol.

KEY TO THE FORMAE

1. Basidia predominantly 4-spored; spores 6.0-9.5 × 3.0-4.5(-5.0) µm f. **sericifer**
1. Basidia predominantly 2-spored; spores 8.0-12.5 × 4.0-5.5 µm (longer from 1-spored basidia) ..... f. **sericatellus**

Pileus 11-45 mm, bluntly conical, conico-convex, expanding to plano-convex, to almost applanate, always with small umbo, with very pale ochraceous cream, yellowish centre, (Mu. 2.5 Y 8/4 to 10 YR 8/4), white around centre, with age tending to become very pale pinkish (7.5 YR 8/4 to 5 YR 8/3), felted at centre, around centre with radially arranged, shiny-satiny fibrils, more or less squamulose-fibrillose; those fibrils (hazel-)brown with age and on drying; margin irregularly fringed when young and exceeding lamellae, becoming brown by one day after picking. Lamellae, L = c. 55-70, l = 0-3, very crowded to moderately crowded, free, segmentiform to slightly ventricose, up to 3.5 mm wide, white to cream, pale pink-brown (7.5 YR 8/4) with age, with white, entire to eroded edge. Stipe 20-90 × 2.5-4 mm, broadening downward to slightly inflated to subclavate base, 3-9 mm wide, hollow, white at apex, to pale pinkish or pinkish-brownish below (by contact), subpruinose at apex to glabrous and shiny, with or without annulus. Annulus evanescent, ascending, with cuff around stipe, and narrow flaring part, whitish with slightly darker edge, especially after drying and handling. Context thin, soft, white and dull in pileus, shiny, whitish, cream-coloured to pale pinkish brown in stipe. Smell rather indistinct, not unpleasant, a bit sweetish. Taste indistinct. Spore print probably white.

Spores in side-view 6.0-9.5(-10.0) × 3.0-4.5(-5.0) µm, on average 7.1-8.2 × 3.5-4.3 µm, Q = 1.65-2.35, Qav = 1.8-2.05, oblong-amygdaliform to cylindrical-amygdaliform, without, or with apical papilla; in f. *sericatellus* 8.0-12.5 × 4.0-5.5 µm, on average 9.2-10.7 × 4.2-4.5 µm, Q = 1.75-2.6, Qav = 2.1-2.35; oblong to cylindrical with amygdaliform aspect, some more fusiform, with the same kind of shape as spores of *Lepiota clypeolaria*, dextrinoid, congophilous, cyanophilous, metachromatic in Cresyl Blue. Basidia 15-34 × 6.0-9.5 µm, predominantly 4-spored in f. *sericifer*, 2-spored with some 1-spored basidia in f. *sericatellus*. Lamella edge with tufts of cheilocystidia. Cheilocystidia very variable in shape and size, 17-90 × 6.5-22 µm (including neck), lageniform with broad body, slender neck and slightly widened capitulum, lageniform, clavate, narrowly lageniform and slender, or irregularly shaped, colourless, when lageniform neck thin-walled, and body thick-walled. Pleurocystidia not observed. Pileipellis a cutis with bundles of radially arranged hyphae, inflated, 7.0-25 µm wide, with rounded apices at the ends; pigment pale yellow-brown and intracellular in the bigger elements. Stipitipellis a cutis of cylindrical hyphae, 3.0-5.0 µm wide; pale brown intracellular pigment present in underlying wider hyphae. Clamp-connections absent.

HABITAT & DISTR. – Solitary or in small groups, saprotrophic and terrestrial on sandy, loamy and clayey soils, in deciduous woods, rather rare, scattered throughout the country, with the typical form more common than f. *sericatellus*. Aug.-Oct. Widespread in Europe.

Leucoagaricus sericifer is variable in terms of spore size, and the shape and size of the cheilocystidia (Vellinga in Persoonia 17: 477-479. 2000).

Kelderman (Parasolzw. Zuid-Limburg: 149. 1994) reported that *L. sericifer* has abundant crystals on the cystidia, but this could not be confirmed.

The spores formed on 1-spored basidia, which are often present in f. *sericatellus*, are even longer than the sizes given above; lengths up to 15 µm have been found.

Leucoagaricus medioflavoides M. Bon (in Doc. mycol. 6 (24): 44. 1976) differs from *L. sericifer* in the yellow to sulphur coloured pileus centre, and the small (up to 6.5 µm long) spores. This species has been recorded from Denmark to Italy.

19. Leucoagaricus serenus (Fr.) Bon & Boiffard in Bull. trimest. Soc. mycol. Fr. 90: 301. 1974. – Fig. 75.

Agaricus serenus Fr., Hymenomyc. Eur.: 38: 1874; *Lepiota serena* (Fr.) Quél. in Bull. Soc. bot. France 26: 45. 1880; *Pseudobaeospora serena* (Fr.) Locq. in Bull. trimest. Soc. mycol. Fr. 68: 169. 1952; *Sericeomyces serenus* (Fr.) Heinem. in Bull. Jard. bot. natn. Belg. 48: 403. 1978.

EXCL. – *Lepiota serena* sensu J. Lange, Fl. agar. dan. 1: pl. 11B. 1935 (= *L. sericifer*). – *Lepiota serena* sensu A. Pears. in Trans. Br. mycol. Soc. 32: 258. 1949 (= *L. pinguipes*). – *Leucoagaricus serenus* sensu M. Bon in Doc. mycol. 11 (43): 52. 1981; sensu Candusso in Riv. Micol. 33: 19-23. 1990; sensu Chr. Lange in Doc. mycol. 25 (98-

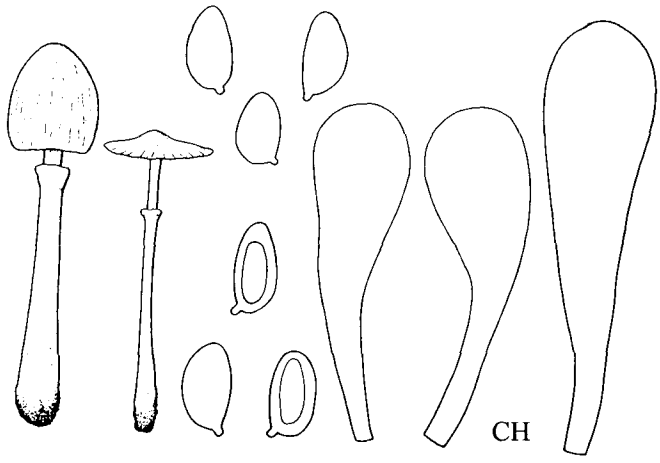

Fig. 75. *Leucoagaricus serenus*.

100): 251-253. 1995; *Sericeomyces serenus* sensu M. Bon, Fl. mycol. Eur. 3, Lépiotes: 85. 1993; sensu Migl. & Bizzi in Micol. ital. 24 (3): 80-81. 1995; sensu Rodríguez Armas et al. in Doc. mycol. 18 (72): 67-69. 1988 (in all cases *L. crystallifer*).

SEL. DESCR. & FIGS. – Huijsman in Meded. Ned. mycol. Vereen. 28: 42-44. 1943 (as *Lepiota serena*); Kelderman, Parasolzw. Zuid-Limburg: 144-145. 1994; Kühner in Bull. trimest. Soc. mycol. Fr. 52: 213-214. 1936 (as *Lepiota serena*); Mal. & Bert., Fl. champ. sup. Maroc 1: 145-147, fig. 23. 1970 (as *Lepiota serena*); Wuilbaut in Doc. mycol. 17 (65): 44-45, figs. 5-8. 1986 (as *Sericeomyces serenus*).

VERN. NAME – Witte champignonparasol.

Pileus 10-35 mm, when young paraboloid, expanding to convex, plano-convex, or applanate with umbo, rather smooth and creamy, cream-coloured, ochraceous cream to pale grey-brown at centre, around centre radially fibrillose to fibrillose-squamulose to slightly sulcate in outer marginal zone, shiny, pure white to pale cream, often with white fine-flocculose edge. Lamellae, L = 32-70, l = (0-)1, moderately crowded, free, rounded near stipe, often remote from stipe, (sub)ventricose, up to 3.5 mm wide, white to pale cream with age, with white, rather even to flocculose edge. Stipe 25-85 × 1.5-3 mm, broadening towards clavate base (up to 5 mm), hollow, white to whitish lengthwise fibrillose over total length, in lower half on slightly brownish background, sometimes finely hairy-pubescent or short-fibrillose, in general shiny. Annulus ascending with flaring margin, white cottony, often rather loose around stipe. Context thin, white and shiny in pileus, white to pale cream and dull in stipe. Smell of cut basidiocarp like rubber (*Lepiota cristata*), rarely slightly fruity, astringent or indistinctly fungoid. Taste not known. Spore print probably white.

Spores in side-view 6.0-9.5 × 3.0-5.0 µm, on average 6.7-7.9 × 3.8-4.2 mm, Q = 1.55-2.3, Qav = 1.75-1.9, in side-view amygdaliform, more rarely with rounded apex, some with distinct apical papilla, in frontal view narrowly ovoid, dextrinoid, congophilous, cyanophilous, metachromatic in Cresyl Blue. Basidia 16-29 × 6.5-9.5 µm, 4-spored, very rarely 2-spored. Lamella edge heterogeneous to totally sterile. Cheilocystidia 20-65 × 8.5-16 µm, clavate, rarely utriform-clavate, without crystals, rather thin-walled, with greyish contents, deep rooting. Pleurocystidia absent. Pileus covering a thin cutis of narrow, c. 2.0-4.0 µm wide, cylindrical, colourless hyphae; hyphae arranged in adnate bundles and slightly ascending at the tips. Hyphae of trama inflated, up to 25 µm wide. Stipitipellis a cutis of narrow cylindrical, colourless hyphae, c. 2.0-5.0 µm wide, with some irregular colourless hairs. Clamp-connections absent.

HABITAT & DISTR. – Solitary or in small groups, saprotrophic and terrestrial in humus-rich, nutrient-rich sandy and loamy soils, in deciduous woods, in the inner dune area of Holland, but more widespread in southern Limburg; rare. Sept.-Oct. Widespread in Europe, and recorded from many countries.

The name *Leucoagaricus serenus* has been used for several different species (see under misapplied names). Kühner's interpretation of the species (in Bull. trimest. Soc. mycol. Fr. 52: 213-214. 1936) is followed here (see also Vellinga in Persoonia 17: 474-475. 2000). *Leucoagaricus serenus* in the present sense is a white species, which does not discolour on drying, with a dry pileus covering, without a really distinctly bulbous base, provided with clavate cheilocystidia without or with some crystals on the apex. A species with narrow cystidia with crystals on the apex is now distinguished as separate, and described here under the name *L. crystallifer*. Moser (Röhrlinge Blätterpilze, 5. Aufl.: 244. 1983) placed both species together under *S. serenus*. Breitenbach & Kränzlin (Pilze Schweiz 4: pl. 260, p. 222. 1995) depicted the cheilocystidia of *S. serenus* as fusiform-clavate, and often with crystals, but very wide (up to 20 µm). Their collection may belong to a different species, close to *L. crystallifer*.

The cheilocystidia have a rather long pedicel, and are relatively thin-walled, which causes rupture of the wall in microscope slides.

Leucoagaricus erioderma (Malenç.) M. Bon, described from Morocco, has a distinctly squamulose pileus covering, and slightly narrower cheilocystidia (Malençon in Malençon & Bertault, Fl. Champ. sup. Maroc 1: 147-148, fig. 24. 1970, as *Lepiota serena* var. *erioderma*).

Leucoagaricus amylosporus (Malenç.) M. Bon may show a superficial resemblance to *L. serenus*, but differs in the differentiated hyphae of the pileus covering and the spores which are discolouring dark violet in Melzer's Reagent (Malençon in Malençon & Bertault, Fl. Champ. sup. Maroc 1: 148-150, fig. 25. 1970, as *Lepiota amylospora*).

20. Leucoagaricus crystallifer Vellinga in Persoonia 17: 475. 2000. – Fig. 76.

MISAPPL. – *Leucoagaricus serenus* sensu M. Bon in Doc. mycol. 11 (43): 52. 1981; sensu Candusso in Riv. Micol. 33: 19-23. 1990; sensu Chr. Lange in Doc. mycol. 25 (98-100): 251-253. 1995; *Sericeomyces serenus* sensu M. Bon, Fl. mycol. Eur. 3, Lépiotes: 85. 1993; sensu Migl. & Bizzi in Micol. ital. 24 (3): 80-81. 1995; sensu Rodríguez Armas et al. in Doc. mycol. 18 (72): 67-69. 1988.

SEL. ICON. – Candusso in Riv. Micol. 33: 20. 1990.

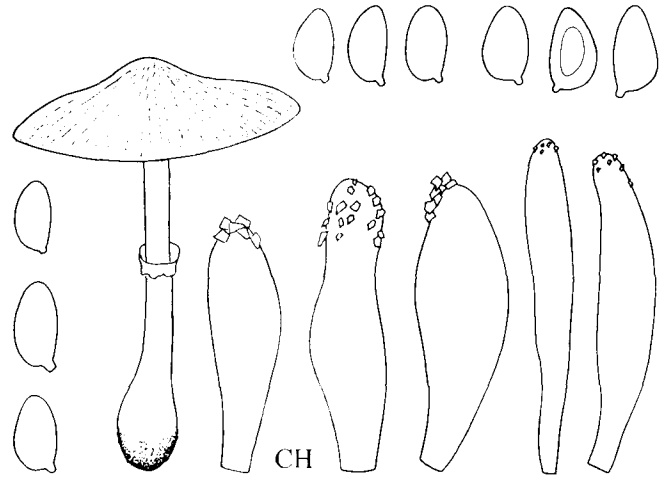

Fig. 76. *Leucoagaricus crystallifer*.

SEL. DESCR. & FIGS. – Migl. & Bizzi in Micol. ital. 24 (3): 80-81, fig. 5. 1995; Rodríguez Armas et al. in Doc. mycol. 18 (72): 67-69. 1988.

Pileus 15-40 mm, campanulate, expanding to plano-convex, and applanate with low umbo, with slightly inflexed margin, with cream to pale ochre coloured umbo, more intensely coloured by 2 days after picking, around umbo white and radially short-fibrillose to silky-fibrillose, sometimes slightly squamose, with margin slightly exceeding lamellae, rarely with part of annulus attached to it. Lamellae, L = 45-70, l = 0-5, moderately crowded to very crowded, free, and often remote from stipe, sometimes anastomosing, subventricose, 1-3.5 mm wide, cream, very pale beige, with concolorous to white flocculose, rarely even, edge. Stipe 20-70 × 2.5-6 mm, broadening downwards to often bulbous base (up to 8 mm), hollow, white and shiny, lengthwise fibrillose, white-tomentose at basal part, becoming yellow on damaging. Annulus ascending, sometimes with a very distinct cuff around stipe with a straight lower edge, and a fringed upper margin, and a narrow flaring part, white. Context white and dull in pileus, white and shiny in stipe. Smell indistinct, of cut basidiocarp variable: fungoid, unpleasant, astringent-fungoid, slightly rubberish (like *Lepiota cristata*). Taste indistinct or absent. Spore print probably white.

Spores in side-view 5.5-9.0 × 3.5-4.5(-5.0) µm, on average 6.3-7.7 × 3.9-4.2 µm, Q = 1.45-2.1, Qav = 1.65-1.9, varying from ellipsoid to oblong with rounded apex to oblong-amygdaliform without or with apical papilla, oblong-ovoid, dextrinoid, congophilous, cyanophilous, metachromatic in Cresyl Blue. Basidia 17-28 × 6.5-8.5 µm, 4-spored. Lamella edge sterile. Cheilocystidia in tufts 23-51 × 5.5-13 µm, cylindrical, cylindrical-fusiform, narrowly clavate, some with a tendency to be utriform, colourless, with (some without) small to big crystals on apex. Pleurocystidia not observed. Pileus covering a cutis with bundles of adnate radially arranged hyphae, 3.0-12 µm wide, with adnate to slightly ascending terminal elements with rounded apex, colourless, rarely with some pale brown intracellular pigment. Stipitipellis a cutis of narrow, colourless, 2.0-4.0 µm wide cylindrical hyphae, rarely with a loose covering of wider, cylindrical and branched, colourless, hyphae. Clamp-connections absent.

HABITAT & DISTR. – Solitary or in small groups, saprotrophic and terrestrial on humus-rich sandy and loamy soils, in deciduous woods, in the inner dune region, and in southern Limburg, rather rare. Sept.-Oct. Widespread in Europe.

Leucoagaricus crystallifer is what several authors (see under misapplied names) described as *L. serenus*. *Leucoagaricus serenus* itself has broadly clavate and clavate cheilocystidia without crystals. Moser (Röhrlinge Blätterpilze, 5. Aufl.: 244. 1983) merged the two interpretations, as he stated that 'sterile hairs are clavate or cylindrical'. The walls of the cheilocystidia in *L. crystallifer* are sturdier than in *L. serenus* and stay intact in microscope slides of dried material.

Another species with crystals on the cheilocystidia is *Sericeomyces cinereopallidus* Contu (in Micol. ital. 23 (2): 117. 1994) with a pale grey, viscid pileus, and thick-walled cystidia.

Leucoagaricus menieri (Sacc.) Sing., is very close to *L. crystallifer*, but is in general more sturdy, with an abrupt bulbous base. The cheilocystidia in *L. menieri* are variably shaped, and often misshapen in the Dutch material, with small crystals.

Leucoagaricus subvolvatus (Mal. & Bert.) M. Bon is another sturdy species, with velar remnants at the bulbous base, and it has ellipsoid spores without tendencies to amygdaliformity, and regularly shaped, narrowly lageniform to cylindrical cheilocystidia, with a tuft of crystals on the apex. Both *L. menieri* and *L. subvolvatus* were described from sandy areas in the mediterranean region.

21. Leucoagaricus menieri (Sacc.) Sing. in Mycopath. Mycol. appl. 34: 131. 1968. – Fig. 77.

Lepiota arenicola Ménier in Bull. Soc. mycol. Fr. 5: 174. 1890, non *Lepiota arenicola* Peck, 1888; *Lepiota menieri* Sacc., Syll. Fung. 9: 4. 1891, non *Lepiota menieri* Quél., 1896; *Leucoagaricus arenicola* (Ménier) M. Bon in Bull. trimest. Soc. mycol. Fr. 86: 97. 1970 (not valid); *Leucoagaricus arenicola* (Ménier) Bon & Boiffard in Bull. trimest. Soc. mycol. Fr. 88: 21. 1972 (not valid); *Sericeomyces menieri* (Sacc.) Contu in Cryptog., Mycol. 12: 4. 1991.

EXCL. – *Leucoagaricus menieri* sensu Sing. in Mycopath. Mycol. appl. 34: 131. 1968 (= *Leucoagaricus* spec.).

SEL. DESCR. & FIGS. – Kelderman, Parasolzw. Zuid-Limburg: 142-143. 1994; Ménier in Bull. Soc. mycol. Fr. 5: 174, pl. 18. 1890.

VERN. NAME –Zandchampignonparasol.

Pileus 20-60 mm, convex to applanate, without or with blunt wide umbo, when old with uplifted, wavy margin, white to cream, somewhat ochraceous at centre, radially fine-fibrillose, satiny shiny; margin fringed with white fibrils. Lamellae, L = c. 90-100, l = 1-5, very crowded, crowded, free, segmentiform to slightly ventricose, 4-6 mm wide, white to cream-coloured with white, fimbriate edge. Stipe 40-65 × 4-6 mm, widened towards base, and there abruptly and slightly marginately bulbous and up to 13 mm wide, hollow, white, lengthwise innately fibrillose and shiny. Annulus halfway or lower, ascending or pendant, white. Context white and thick in pileus, white shiny in stipe, slightly ochraceous in base. Smell indistinct. Taste indistinct. Spore print whitish.

Spores 5.5-8.5(-9.0) × 4.0-5.0 mm, on average 6.3-7.7 × 4.2-4.7 µm, Q = 1.3-2.0, Qav = 1.4-1.85, in side-view ellipsoid-amygdaliform or oblong-amygdaliform with acute apex, dextrinoid, congophilous, cyanophilous, metachromatic in Cresyl Blue, without germ pore. Basidia 21-27 × 7.5-9.0 µm, 4-spored. Lamella edge sterile. Cheilocystidia very variable, 20-70 × 6.0-18 µm, varying from clavate to narrowly lageniform, misshapen, sometimes with two apices, rather thin-walled and most with small crystals on the apex. Pleurocystidia absent. Pileus covering a cutis of narrow cylindrical hyphae, 5.0-7.0 µm wide, with slightly wider ascending terminal elements. Clamp-connections absent.

HABITAT & DISTR. – Gregarious in small groups, solitary, saprotrophic and terrestrial in deciduous woods on soil relatively poor in

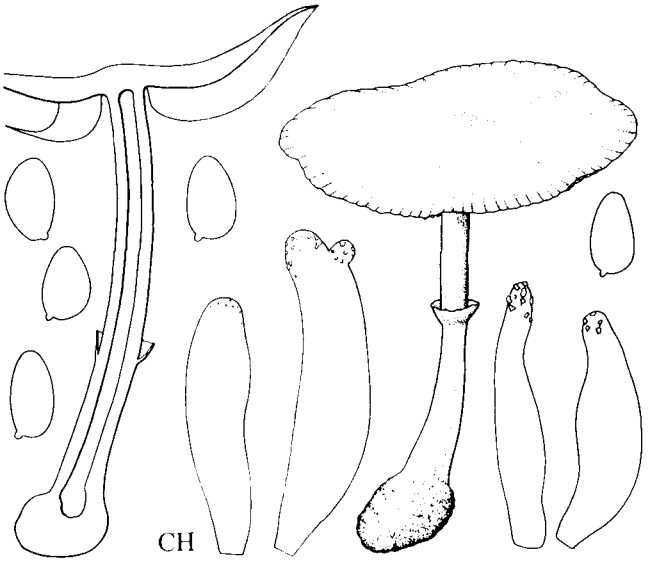

Fig. 77. *Leucoagaricus menieri* (habit del. P. Kelderman).

nutrients; in the Netherlands only known from a few places in southern Limburg. Sept.-Oct. Known from sandy, dry habitats, along the Mediterranean and southern Atlantic coasts and from central Europe.

The above description is based on two collections from the same locality in the Netherlands.

Leucoagaricus menieri comes very close to *L. crystallifer*, and the differences between the two species are rather subtle; *L. menieri* being the bigger, thicker-fleshed species, with an abrupt bulbous base, with lageniform cystidia. The cystidia in the Dutch material were atypical in that they were misshapen and relatively thin-walled. Dried material of both *L. crystallifer* and *L. menieri* remains still cream-coloured, and does not discolour brown as in *L. sericifer*.

Leucoagaricus subvolvatus (Mal. & Bert.) M. Bon comes very close to the present concept of *L. menieri*, but differs in spores with rounded, not acute, apex, and regular, narrowly lageniform to cylindrical cheilocystidia, which bear crystals on the apex. A good description is given by Malençon & Bertault (in Acta phytotax. barc. 8: 41. 1971).

Sericeomyces singeri M. Bon ex Contu & Signorello (in Signorello & Contu in Micol. Veget. medit. 13: 64. 1998) was described to accommodate Singer's interpretation of an Uruguayan collection of *L. menieri*, but a Sardinian gathering served as the type collection. This species was earlier invalidly described as *S. cylindrosporus* Contu (in Cryptog. Mycol. 12: 8. 1991), and is characterized by a slightly gelatinized pileus covering and subcylindrical spores. Whether it really is identical to Singer's collections, as described in Mycopath. Mycol. appl. 34: 131. 1968, has still to be proven. Furthermore, Singer's specimens may represent *L. menieri* in the European sense.

Another species in this complex is *Leucoagaricus mairei* M. Bon (in Doc. mycol. 11 (43): 59. 1981), based on Maire's interpretation of *L. menieri*. Cheilocystidia are absent in this species.

This whole group of species, with a predominantly mediterranean distribution, is in need of revision.

Leucoagaricus menieri was described from sandy habitats in the mediterranean region, and its occurrence in southern Limburg in the Netherlands, is rather unexpected.

7. **Lepiota** (Pers.: Fr.) S.F. Gray

ELSE C. VELLINGA

Agaricus sect. *Lepiota* Pers., Tent. Disp. meth. Fung.: 68. 1797; *Agaricus* tribus *Lepiota* Pers.: Fr., Syst. mycol. 1: 19. 1821; *Lepiota* (Pers.: Fr.) S.F. Gray, Nat. Arr. Br. Pl. 1: 601. 1821. – *Fusispora* Fay. in Ann. Sc. nat., Bot. Sér. VII, 9: 351. 1889. – *Lepiotula* (Maire) Locq. ex Horak, Syn. Gen. Agar.: 337. 1968. – *Echinoderma* (Locq. ex M. Bon) M. Bon in Doc. mycol. 21 (82): 61. 1991.

SELECTED LITERATURE – M. Bon in Doc. mycol. 11 (43): 27-50. 1981; M. Bon, Fl. mycol. Eur. 3, Lépiotes: 44-82. 1993; Candusso & Lanzoni, Lepiota: 115-322. 1990; Kelderman, Parasolzw. Zuid-Limburg: 43-139. 1994; Knudsen in Bot. Tidsskr. 75: 121-155. 1980 (sect. *Echinatae*); Vellinga & Huijser in Persoonia 15: 223-240. 1993 (species with spurred spores); Vellinga & Huijser in Belg. J. Bot. 131: 191-210. ('1998') 1999 (species with hymeniform pileus covering).

Basidiocarp pluteoid with persistent velum universale; pileus surface in most species squamulose; lamellae free; annulus or annular zone, remnants of velum partiale, often present in mature specimens; spore print white to cream.

Spores smooth, in a few species, especially with spurred spores, minutely rough, hyaline, dextrinoid, rarely not dextrinoid, congophilous, cyanophilous, not metachromatic in Cresyl Blue, or with pink inner wall, with walls slightly or not swelling in ammonia ($NH_{3(aq)}$) and acetic acid ($CH_3COOH_{(aq)}$), binucleate, in a few species uninucleate; cheilocystidia present in most species; pleurocystidia not present in Netherlands' species; hymenophoral trama regular; clamp-connections present in most species. Development bivelangiocarpic and pileostipitocarpic or stipitocarpic. – Typus conservandus *Agaricus colubrinus* Pers. (= *Lepiota clypeolaria* (Bull.: Fr.) Kumm.).

HABITAT & DISTRIBUTION – Saprotrophic and terrestrial, often in nutrient-rich areas, in woods and in grasslands, cosmopolitan, but absent from arctic and high alpine regions.

The genus *Lepiota* differs from *Cystolepiota* Sing. in the structure of the velum universale; in *Cystolepiota* the universal veil consists of loosely arranged globose or inflated elements; in most *Lepiota*-species the velum is made up of long, cylindrical or clavate, erect or ascending elements; in one section globose elements are present, but these are connected with hyphae, with a gradual change from globose to longitudinal elements, and these chains are agglutinated into pyramidal squamules. Whether the differences really warrant recognition of two genera has to be proved by further research.

The genus *Macrolepiota* Sing. is not included within *Lepiota*, as proposed by Ballero & Contu (in Candollea 46: 480-481. 1991), because of the fundamental differences between the two genera in hymenophoral trama, spore wall composition, and structure of the velum universale.

Lepiota lignicola P. Karst. is excluded from the genus *Lepiota*, and accepted as *Leucopholiota decorosa* (Peck) O.K. Miller et al. (in Mycologia 88: 138. 1996), within the family Tricholomataceae.

A simple infrageneric classification, in which six sections are recognized, is applied here, pending further research on molecular and additional morphological characters. Candusso & Lanzoni (Lepiota: 738-740. 1990) gave the same six sections, whereas Bon (Fl. mycol. Eur. 3, Lépiotes: 44-82. 1993) gave a much more extensive division of the genus.

Many *Lepiota*-species, especially the group of species with ellipsoid spores and a pileus covering made up of elongate elements only, contain amanitin, and are highly toxic, causing severe liver damage which can result in death.

The neutral term 'pileus covering' is used for all the covering layers of the pileus, not taking into account their origin (whether they are metableme, archibleme, teleobleme or pellis in the terminology of Clémençon, Anat. Hymenomyc.: 802-804. 1997).

The size and shape of the elements of the pileus covering have been observed just outside the central region or the 'calotte'.

KEYS TO THE SPECIES

1. Spores spurred, or with straight base (Fig. 78a) ..... **Key one**
1. Spores not spurred, but ellipsoid, oblong, fusiform-amygdaliform or shaped as some *Boletus*-spores (with straight abaxial side, convex adaxial side and suprahilar depression)
   2. Spores shaped as some *Boletus*-spores (Fig. 78b) ..... **Key two**
   2. Spores either fusiform-amygdaliform, or (broadly) ellipsoid to oblong
      3. Spores fusiform-amygdaliform with convex abaxial and convex adaxial sides (Fig. 78c) ..... **Key three**
      3. Spores ellipsoid, oblong, broadly ellipsoid (Fig. 78d)
         4. Pileus surface smooth, closed or breaking open into smooth patches; covering made up of clavate to cylindrical elements, tightly packed, forming a hymeniderm (Fig. 79a) ..... **Key four**
         4. Pileus surface squamulose; pileus covering made up either of long elements, or of inflated to rounded elements in chains
            5. Pileus set with acute, pyramidal squamules, made up of agglutinated chains of elements, from cylindrical to inflated elements at base of squamules, gradually changing into ellipsoid to globose terminal elements (Fig. 79b) ..... **Key five**
            5. Pileus set with squamules, made up of elongate, cylindrical elements, without or with septa, which are provided with or without clamp-connections (Fig. 79c, two types) ..... **Key six**

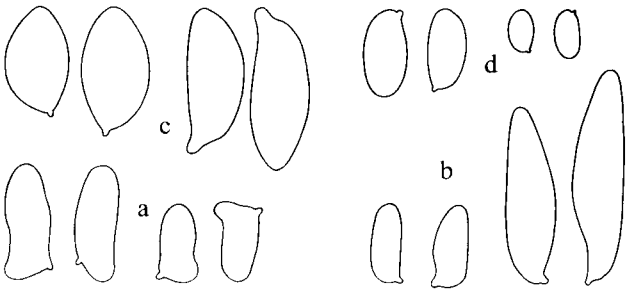

Fig. 78. *Lepiota*: spore shape.— a. spurred; b. with straight abaxial side, convex adaxial side and suprahilar depression; c. fusiform-amygdaloid; d. ellipsoid.

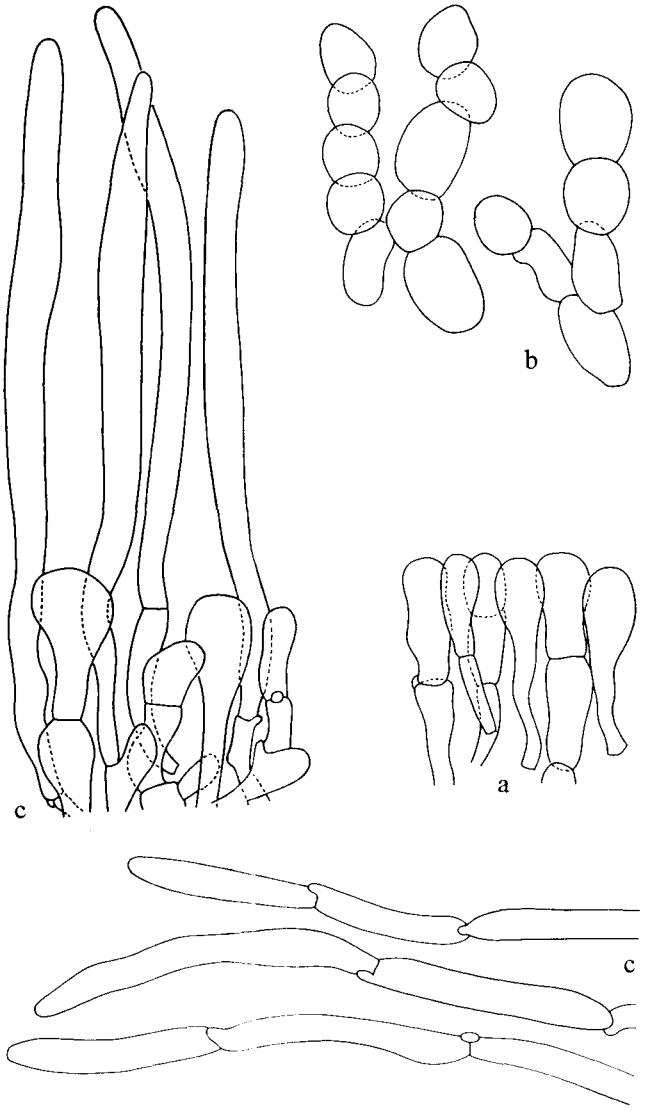

Fig. 79. *Lepiota*: pileus covering.— a. hymeniderm; b. terminal elements of acute squamules; c. long elements.

ALTERNATIVE KEY

1. Pileus surface set with acute, pyramidal to recurved squamules, made up of agglutinated chains of elements, from cylindrical to inflated elements at base of squamules, gradually changing into ellipsoid to globose terminal elements (Fig. 79b) ..... **Key five**
1. Pileus surface smooth, closed or with patches and pileus covering a hymeniderm, or squamulose and breaking up into squamules, made up of elongate elements
   2. Pileus smooth and closed or breaking up into patches; pileus covering a hymeniderm (Fig. 79a) .... **Key four**
   2. Pileus with squamules, made up of elongate, erect or adnate to ascending elements (Fig. 79c)
      3. Spores ellipsoid, more rarely broadly ellipsoid or oblong, or fusiform to amygdaliform (i.e. with abaxial and adaxial side convex)
         4. Spores amygdaliform to fusiform (Fig. 78c) ..... **Key three**
         4. Spores ellipsoid to oblong, rarely broadly ellipsoid (Fig. 78d) ..... **Key six**
      3. Spores with broadened base, triangular in outline, spurred, or with straight abaxial and convex adaxial side and suprahilar depression
         5. Spores triangular to spurred (Fig. 78a) ..... **Key one**
         5. Spores shaped as some *Boletus*-spores (with straight abaxial and convex adaxial side, and suprahilar depression; 'penguin-shaped', Fig. 79b) ..... **Key two**

KEY ONE

Species with spurred spores
N.B. Spore width measured in middle of spores, in side-view

1. Pileus covering a hymeniderm
   2. Smell fruity-sweet and rubber-like ..... **28. L. cristata**
   2. Smell saponaceous ..... **Lepiota saponella**
      Bodin & Priou in in Doc. mycol. 23 (92): 62. 1994. Described from southwestern France, not yet recorded from the Netherlands
1. Pileus covering made up adnate, ascending or erect long and slender elements
   3. Pileus covering made up of adnate and ascending, articulate hyphae (Fig. 79c), with clamp-connections at the septa, with intracellular brown pigment, very rarely lacking pigment ..... **21. L. boudieri**
   3. Pileus covering made up of adnate to erect elements, unicellular or with septa without clamp-connections, without or with pigment, which can be intracellular or parietal
      4. Basidiocarp white to ochraceous cream ..... **22. L. subalba**
      4. Basidiocarp grey-brown, brown, dark green, greenish etc., not white
         5. Pileus predominantly with brown, orange-brown, red-brown or purplish brown colours
            6. Pileus at centre (when young) dark red-brown, red-brown, orange-brown; context in stipe, and often also pileus and stipe surfaces discolouring orange; pileus covering made up of erect, (non-)septate elements and a layer of flexuous repent coloured hyphae ..... **19. L. castanea**
            6. Pileus at centre dark brown, dark grey-brown; context in stipe not turning orange; pileus covering made up of more or less erect elements only; a layer of repent coloured hyphae not present
               7. Distinct girdles or bands of squamules present in lower half of stipe; pileus surface splitting up into concentrical zones around centre; pileus (20-)30-55(-80) mm ..... **20. L. cingulum**
               7. Distinct girdles or bands on stipe lacking, some scattered squamules on stipe often present; pileus surface around centre irregularly breaking open; pileus 10-30(-40) mm ..... **23. L. tomentella**
         5. Pileus predominantly with grey or (grey-)green colours (though context may discolour orange)
            8. Pileus at centre green-black to blue-green, or blue-brown, with distinct squamules around centre; background turning orange; elements of pileus covering normally with up to 3 clamp-less septa, with intracellular pigment, which is soluble in ammonia ..... **27. L. grangei**
            8. Pileus at centre pinkish brown to dark grey (with or without greenish tinges), with granular, plush-like or more clearly delimited squamules on background which turns orange or not; elements of pileus covering without or with up to 2 clamp-less septa, with predominantly parietal pigment
               9. Pileus background not turning orange with age or damaging
                  10. Pileus when young with pinkish brown or greyish brown tinges; elements of pileus covering with up to 2 (-3), clamp-less septa ..... **23. L. tomentella**

10. Pileus when young very dark, often with olive or lilacinous tinges; elements of pileus covering normally without septa, sometimes in lower part 1(-2) septate ..... **25. L. griseovirens**

9. Pileus background turning (slowly) orange with age or on damaging
11. Spores short (avl = 6.6-7.4 µm); elements of pileus covering short ((45-)70-180(-200) µm long) and often irregular ..... **26. L. poliochloodes**
11. Spores long (avl = 7.0-9.6 µm); elements of pileus covering long ((55-)85-320(-400) µm long) and straight
12. Pileus only when very young dark grey or olive, soon dull orange brown, dark brown or ochraceous brown at centre, with granulate, rather thin-layered squamules around centre; cheilocystidia broad (5.0-15(-18) µm wide) ..... **24. L. pilodes**
12. Pileus dark grey, black greyish olive-brown at centre, to pale grey-brown at margin, with wart-like squamules around centre; cheilocystidia narrow (5.0-10.5 µm wide)
25. L. griseovirens

KEY TWO

Species with 'penguin-shaped' spores (as in some *Boletus*-species, with straight abaxial side, and suprahilar depression)

1. Pileus covered in acute squamules (with terminal elements globose to ellipsoid)
2. Lamella edge dark; cheilocystidia with dark contents ..... **39. L. hystrix**
2. Lamella edge white or concolorous with sides; cheilocystidia not coloured
3. Basidiocarps big (pileus up to 115(-150) mm), with big hanging annulus, with squamules on underside; spores 6.0-9.0(-9.5) × 2.5-3.5(-4.0) µm; cheilocystidia clavate to spheropedunculate ..... **37. L. aspera**
3. Basidiocarps medium (pileus up to 55 mm; stipe with annular zone, without hanging annulus; spores 5.0-6.5 × 2.5-3.0 µm; cheilocystidia fusiform, narrowly clavate, cylindrical ..... **38. L. perplexa**

1. Pileus surface breaking up into smooth patches or into woolly, or felted squamules, which might be squarrose at centre; annulus absent, if present membranaceous, or only as a woolly zone on stipe
4. Pileus surface smooth, breaking up into patches around a distinct 'calotte'; stipe glabrous, devoid of squamules; pileus surface made up of tightly packed narrowly clavate elements ..... **28. L. cristata**
4. Pileus surface squamulose to ragged; stipe woolly or tomentose in lower part; squamules made up of long, hairy elements
5. Stipe woolly in lower part; spores (12.0-)13.5-25.0 × 4.0-6.0 µm ..... **2. L. magnispora**
5. Stipe glabrous to fibrillose, tomentose in lower part; spores (6.5-)7.0-9.0(-10.0) × (2.5-)3.0-3.5(-4.0) µm
5. L. cortinarius

KEY THREE

Species with fusiform to amygdaliform spores and a pileus covering made up of long elements
N.B. Spore length measured without hilar appendage

1. Spores 'penguin-shaped' with straight abaxial side, convex adaxial side and suprahilar depression (Fig. 78b)
2. Spores (12.0-)13.5-25.0 × 4.0-6.0 µm ..... **2. L. magnispora**
2. Spores (6.5-)7.0-9.0(-10.0) × (2.5-)3.0-3.5(-4.0) µm ..... **5. L. cortinarius**

1. Spores fusiform-amygdaliform, with convex abaxial and adaxial sides (Fig. 78c)
3. Pileus without discrete squamules, white to (pale) brown at centre
4. Pileus white to pale brown at centre (colours in the range of Mu. 10 YR); spores 10.0-21.0(-23.0) × 5.0-7.0(-8.0) µm, avw = 5.5-6.1 µm ..... **3. L. erminea**
4. Pileus pale brown to brown at centre (colours in the range of Mu. 7.5 YR); spores on average narrower than in *L. erminea*: 10.0-16.5 × 4.5-6.5 µm, avw = 4.8-5.5 µm ..... **4. L. oreadiformis**
3. Pileus with brown to pale brown squamules contrasting with background
5. Stipe in lower part discolouring orange with age and when touched; basidiocarps relatively big: pileus 50-90 mm; stipe 70-105 × 10-15 mm; spores 8.5-11.0(-12.5) × 5.0-6.0(-6.5) µm, Qav = 1.75-1.95
7. L. ignivolvata
5. Stipe not discolouring orange; basidiocarps small to big: pileus 20-100 mm; stipe 40-100 × 2-10 mm; spores 9.0-18.5 × 4.0-6.0(-6.5) µm, Qav = 1.9-2.85
6. Spores 11.0-18.5 × (4.0-)4.5-6.0(-6.5) µm, Qav = 2.4-2.85; stipe with annular zone, and lanate covering below ..... **1. L. clypeolaria**
6. Spores 9.0-13.5 × 4.0-6.0(-6.5) µm, Qav = 1.9-2.1; stipe often with a lanate annular zone and in lower part a brown ring, especially when young, with bands or squamules in lower part ..... **6. L. subgracilis**

KEY FOUR

Species with a hymeniform pileus covering

1. Pileus surface smooth and glabrous, viscid when moist; pleurocystidia present, similar to cheilocystidia, conspicuous ..... **Chamaemyces fracidus**
1. Pileus surface dry, smooth or breaking up into patches; pleurocystidia absent; cheilocystidia present or absent
   2. Basidiocarps with bright orange-red pileus and stipe; surface of pileus not broken up into squamules or patches **34. L. pyrochroa**
   2. Basidiocarps with whitish cream to dark brown or almost black colours on pileus, with whitish to reddish or lilacinous stipe; surface of pileus broken up into squamules or not (if surface closed, colour of pileus cream, pale brown)
      3. Spores in side-view spurred, triangular, with a distinct sac at base, or 'penguin-shaped' ..... **28. L. cristata**
      3. Spores ellipsoid in side-view
         4. Lamellae separated from stipe by a kind of collarium; basidiocarps big: pileus 25-70(-100) mm and orange-brown to leather-brown; smell soapy-perfumy; spores dextrinoid, not or slightly metachromatic in Cresyl Blue ..... **33. L. ochraceofulva**
         4. Collarium-like structure absent; pileus in most species smaller, and with other colours; spores in most species not distinctly dextrinoid, but metachromatic in Cresyl Blue, sometimes weakly dextrinoid and weakly metachromatic
            5. Annulus conspicuous with broadened rim, with coloured patches on it; pileus surface broken into patches leaving a discrete disc at centre; colour of pileus varying from very pale brown to almost black, when young often with lilacinous tinges ..... **32. L. lilacea**
            5. Annulus, if present, membranaceous and/or fugacious, without coloured patches, or absent; pileus surface broken up or not; colour either dark chocolate-brown, orange-brown or pale brown, creamy, not lilacinous when young
               6. Cheilocystidia absent
                  7. Pileus surface breaking up into patches; remnants of partial veil adhering to pileus margin; spores dextrinoid, but not strongly so, sometimes only after 10 minutes visible, weakly metachromatic in Cresyl Blue, 4.5-6.5 × 3.0-4.0 µm ..... **29. L. apatelia**
                  7. Pileus surface not breaking up or breaking up into small patches; ring ascending on stipe; spores non-dextrinoid, but metachromatic in Cresyl Blue, 3.5-5.0(-5.5) × 2.5-3.5 µm **30. L. cristatoides**
               6. Cheilocystidia present
                  8. Annulus present ..... **35. L. psalion**
                  8. Annulus absent
                     9. Pileus surface broken up into dark brown patches; some brown patches present at base of stipe; spores 4.0-6.0(-7.0) × 2.5-3.5 µm, Qav = 1.6-1.7 ..... **31. L. hymenoderma**
                     9. Pileus surface creamy, pale brown or ochraceous, closed or broken up into patches
                        10. Pileus surface not breaking up into squamules or patches; spores 3.0-4.5 × 2.5-3.0(-3.5) µm **36. L. rufipes**
                        10. Pileus surface squamulose, made up of clavate elements. giving rise to globose terminal elements; spores 6.0-8.0 × 3.5-4.5 µm ..... **L. cystophoroides**
                        Joss. & L. Riousset in Bull. mens. Soc. linn. Lyon 41: 317. 1972. Described from southern France, also recorded from northern France, not yet recorded from the Netherlands

KEY FIVE

Species with acute squamules on pileus, made up agglutinated chains of elements, with ellipsoid to globose terminal elements

1. Annulus membranaceous, hanging, provided with (brown) squamules; lamella edge white or concolorous with sides; spores 6.0-9.0(-9.5) × 2.5-3.5(-4.0) µm, Q = 1.9-3.3, Qav = 2.2-2.7; basidiocarps big: pileus 50-115(-150) mm; stipe 50-120 × 9-22 mm ..... **37. L. aspera**
1. Membranaceous (hanging) annulus absent (if such annulus present, clamp-connections absent); lamella edge white, concolorous with sides or dark; spores 3.5-7.0 × 2.0-3.5 µm, Q = 1.35-2.6, Qav < 2.4; basidiocarps small to medium: pileus up to 85 mm; stipe up to 90 × 14 mm
   2. Lamella edge dark coloured

3. Pileus, especially at centre, densely set with small, blackish, squamules; spores 5.5-7.0 × 2.5-3.0 µm, Q = 2.0-2.6, Qav = 2.3; pigment in pileus elements, both intracellular and soluble in ammonia, and parietal **39. L. hystrix**
3. Pileus surface strongly fibrillose-squamose, with long, up to 5 mm, brown to dark brown squamules; spores 4.0-6.0 × 2.0-3.5 µm, Q = 1.55-2.15, Qav = 1.6-1.85; pigment in pileus elements only parietal **40. L. calcicola**

2. Lamella edge white or concolorous with sides
4. Membranaceous hanging annulus present; clamp-connections absent from all tissues ..... **41. L. efibulis**
4. Membranaceous and hanging annulus absent; an annular zone might be present; clamp-connections present in all tissues (easily be seen at cylindrical elements on pileus)
5. Spores non-dextrinoid
6. Squamules on pileus made up of only one type of elements, viz. globose elements; terminal globose elements easily detached; cheilocystidia narrowly clavate to obovate, usually with cylindrical, moniliform or branched, excrescence at apex ..... **Cystolepiota moelleri**
6. Squamules on pileus made up of globose terminal elements in chains, and coloured cylindrical elements; terminal elements stuck to the chains; cheilocystidia narrowly clavate to clavate, without excrescence **46. L. boertmannii**
5. Spores dextrinoid
7. Cheilocystidia absent or only some inconspicuous, basidiole-like structures present
8. Stipe more or less twice as long as pileus width (ratio of pileus width and stipe length 0.5-0.6) **45. L. pseudoasperula**
8. Stipe more or less as long as pileus width (ratio of pileus width and stipe length 0.8-1.0)
9. Terminal elements of squamules on pileus 10-25(-45) × 10-21(-35) µm ..... **44. L. carinii**
9. Terminal elements of squamules on pileus 15-65 × 10-50 µm
10. Basidiocarp, though set with dark brown squamules, orange-brown; spines on stipe isolated, not covered in wool, or absent ..... **42. L. echinacea**
10. Colours of basidiocarp sombre; spines of stipe covered in wool ..... **43. L. jacobi**
7. Cheilocystidia present and distinctly different from basidia and basidioles
11. Spores 5.0-6.5 × 2.5-3.0 µm, Q = 1.8-2.6, Qav = 2.05-2.35, 'penguin-shaped' .. **38. L. perplexa**
11. Spores 3.5-6.0(-6.5) × 2.0-3.5 µm, Q = 1.35-2.15, Qav = 1.6-1.85, ellipsoid
12. Apical elements of squamules on pileus ellipsoid to oblong ..... **40. L. calcicola**
12. Apical elements of squamules on pileus globose to ellipsoid
13. Apical elements of squamules on pileus ranging from small to big: 15-62 × 10-50 µm **42. L. echinacea**
13. Apical elements of squamules on pileus small: 10-25(-45) × 10-21(-35) µm **44. L. carinii**

KEY SIX

Species with a pileus covering made up of long (erect or adnate) elements; spores ellipsoid to oblong

1. Pileus covering made up of only repent, septate or articulate elements with ascending terminal elements
2. Clamp-connections absent; pileus covering made up of long repent hyphae ..... **18. L. fuscovinacea**
2. Clamp-connections present
3. Pileus with brown colours; annulus absent, or only present as an annular zone on stipe; cheilocystidia present; elements of pileus covering brown and thick-walled (walls up to 2 µm thick); in greenhouses **16. L. rubella**
3. Pileus white; annulus present; cheilocystidia absent; elements of pileus thin-walled; in woods **17. L. parvannulata**

1. Pileus covering made up of often tufted, erect elements, occasionally septate; repent coloured hyphae may be present as well
4. Only one type of elements, usually long erect elements, present in pileus covering
5. Basidiocarps with sulphur-yellow or olivaceous yellow tinges, especially in lamellae, context and stipe; in hothouses ..... **15. L. elaiophylla**
5. Basidiocarps with white, or pinkish to orange-brown colours; in natural habitats
6. Basidiocarps white; annulus present; cheilocystidia absent; hairs of pileus covering made up of long clamped elements ..... **17. L. parvannulata**

6. Basidiocarps coloured; annulus only as woolly zone present; cheilocystidia present; hairs of pileus covering made up of non-septate elements
   7. Elements of pileus covering long (70-400 µm long); spores (5.5-)6.0-7.5(-8.0) × 3.0-4.0(-4.5) µm **14. L. subincarnata**
   7. Elements of pileus covering relatively short (60-110(-140) µm); spores (7.0-)7.5-9.0(-10) × (4.5)5.0-5.5 µm ..... **L. helveola** Bres., Fungi trident. 1: 15. 1882. Recorded from Italy, France, and Germany, but not yet known from the Netherlands
4. Pileus covering made up of long elements and short, clavate, narrowly clavate to cylindrical elements
   8. Lamellae with distinct yellow tinges
      9. Pileus covering made up of long elements, with short, clavate elements in between; cheilocystidia mostly narrowly lageniform to narrowly utriform; in woods ..... **11. L. xanthophylla**
      9. Pileus covering made up of long elements with occasionally short cylindrical elements in between; cheilocystidia clavate; in hothouses ..... **15. L. elaiophylla**
   8. Lamellae white to cream-coloured, occasionally pale grey with yellowish tinge; distinct yellow colours lacking in basidiocarps
      10. Basidiocarps with distinct olivaceous (brown) tinges ..... **10. L. forquignonii**
      10. Basidiocarps either very dark, almost black, or pink to brown coloured, lacking olivaceous tinges
         11. Annulus present, mostly as a distinct cuff around the stipe, with little squamulose patches on it
            12. Basidiocarp relatively big and sturdy (pileus 30-75 mm; stipe 20-60(-110) × (5-)8-10(-15) mm), growing in open sand on sanddunes; annulus thin; spores 9.0-11(-13) × 5.0-6.0 µm **L. brunneolilacea** Bon & Boiff. in Bull. trimest. Soc. mycol. Fr. 88: 18.1972. Recorded from the Atlantic and Mediterranean coasts growing on white dunes amid *Ammophila arenaria*, from mid France southwards. To be expected in the dunes in the Netherlands.
            12. Basidiocarps medium (pileus 15-45 mm; stipe 20-60 × 2-9 mm), growing in woods and copses; annulus a distinct cuff set with little dark squamules; spores 6.0-10.0 × (3.5-)4.0-5.0 µm
               13. Pileus covering broken up in discrete, dark patches around the dark calotte, made up of long elements and a very dense layer of dark-pigmented clavate elements; repent coloured hyphae on pileus surface absent ..... **8. L. felina**
               13. Pileus covering squamulose, but lacking a distinct calotte and discrete squamules, varying in colours from dark brown to pinkish brown; pileus covering made up of long elements and a loose layer of narrowly clavate elements; repent coloured hyphae (mostly) present on pileus surface **9. L. pseudolilacea**
         11. Annulus absent; fugacious or woolly annular zone and bands of squamules on stipe might be present
            14. Basidiocarps robust, with a relatively thick (5-9 mm wide) stipe, set with bands of squamules on pinkish to brownish vinaceous background; cheilocystidia often septate; spores 7.0-10.0(-11.0) × 4.0-5.0(-6.0) µm, Qav = 1.7-1.9 ..... **3. L. brunneoincarnata**
            14. Basidiocarps slender, with a thin stipe (1-4 mm wide), with some incomplete bands or girdles of small squamules; cheilocystidia not or rarely septate; spores either 4.5-7.5 × 3.0-4.5 µm with Qav = 1.55-2.0 or 7.5-10.0 × 3.5-5.0 µm, Qav = 2.2
               15. Cheilocystidia (narrowly) lageniform to (narrowly) utriform ('mummy-shaped'); spores 4.5-6.5 × 3.0-4.0 µm; elements of pileus elements relatively long: 185-300 µm **12. L. echinella**
               15. All other combinations of characters: see discussion under *L. echinella*

Sect. **Lepiota**

Spores fusiform-amygdaliform with convex abaxial and convex adaxial sides, or with a straight abaxial side, in combination with a pileus covering made up of long cylindrical elements, often intermixed with short elements.
N.B. Spore length measured without hilar appendage.

1. Lepiota clypeolaria (Bull.: Fr.) Kumm., Führ. Pilzk.: 137. 1871. – Fig. 80.

Agaricus clypeolarius Bull., Herb. France: pl. 405. 1789; *Agaricus clypeolarius* Bull.: Fr., Syst. mycol. 1: 21. 1821. – *Agaricus colubrinus* Pers., Syn. meth. Fung.: 258. 1801; *Lepiota colubrina* (Pers.) S.F. Gray, Nat. Arr. Br. Pl. 1: 601. 1821. – *Lepiota ochraceo-sulfurescens* Locq. ex M. Bon in Doc. mycol. 16 (61): 46. 1985. – *Lepiota clypeolaria* var. *minor* J. Lange, Fl. agar. dan. 1: 28. 1935 (not valid).

EXCL. – *Agaricus clypeolarius* sensu Sow., Col. Ill. Engl. Fungi 1: pl. 14. 1796 (= *L. cristata*); sensu Sow., Col. Ill. Engl. Fungi 2: pl. 171. 1798 (= *Leucocoprinus brebissonii*); *Lepiota clypeolaria* sensu Brebinaud in Bull. trimest. Soc. mycol. Fr. 47: 90. 1931 (= *Lepiota* spec.); *Lepiota clypeolaria* sensu Rea, Brit. Basidiomyc.: 69. 1922 (= *L. magnispora*); *Lepiota clypeolaria* sensu Johnson & Vilgalys in Mycologia 90: 974-976. 1998 (= *L. magnispora*). – *Agaricus colubrinus* sensu Krombh., Naturg. Abb. Beschr. essb. schädl. verd. Schwämme: pl. 1, figs. 10 & 11. 1831 (= *Macrolepiota* spec.);

SEL. ICON. – Breitenb. & Kränzl., Pilze Schweiz 4: pl. 220. 1995; Candusso & Lanzoni, Lepiota: pl. 15. 1990; Dähncke & Dähncke, 700 Pilze: 313. 1979; J. Lange, Fl. agar. dan. 1: pl. 11D, 11E. 1935 (as *L. clypeolaria* and *L. clypeolaria* var. *minor* resp.).

SEL. DESCR. & FIGS. – Horak, Syn. Gen. Agar.: 336-337. 1968 (as *L. colubrina*); H.V. Smith in Lloydia 17: 314-315. 1954.

VERN. NAME – Bosparasolzwam.

Pileus 25-100 mm, when young campanulate, conical with small umbo, expanding to plano-convex with low broad umbo, at centre felted to glabrous and pale brown, pale orange-like brown (Mu. 10 YR 6/3-8), rarely more red (7.5 YR 5-7/6) or pale buff, around centre with concentrical zones of more or less uplifted, discrete squamules more or less woolly, and concolorous to paler ochraceous brown than disc, towards margin more fibrillose, on pale cream to white background, at margin without or more rarely with sulphur-yellow tinges, at outermost margin when young with whitish floccose velar remnants, sometimes radially sulcate at margin to 10 mm from margin. Lamellae, L = 50-60, l = 1-3, moderately to very crowded, or moderately distant, free, not or slightly remote from stipe, rarely anastomosing, subventricose or ventricose, 3-6 mm wide, white, cream or pale flesh-coloured cream, with concolorous or white finely flocculose edge. Stipe 47-100 × 3-10 mm, tapering upwards or cylindrical, with bulbous base, fistulose, white to pale cream-coloured, at apical part more or less glabrous or finely fibrillose-striate, without real annulus, but with annulus-like zone of lanate or fibrillose squamules, below with irregular bands of lanate squamules or with incomplete girdles; squamules beige to pale brownish; not or yellowing when scratched, with white mycelium cords at base. Context white or pale cream and dull in pileus, and white or yellow and shiny in stipe. Smell strong, like the rubber component of the smell of *L. cristata*, unpleasant, or like the leaves of *Geranium robertianum*, or indistinct. Taste mild, or like smell and unpleasant. Spore print 'white'.

Spores in side-view 11.0-18.5 × (4.0-)4.5-6.0(-6.5) µm, Q = 2.1-3.4, Qav = 2.4-2.8, in side-view more or less amygdaliform with convex sides, some with papilla-like apex, with or without suprahilar depression, in frontal view more or less fusiform, thick-walled, with

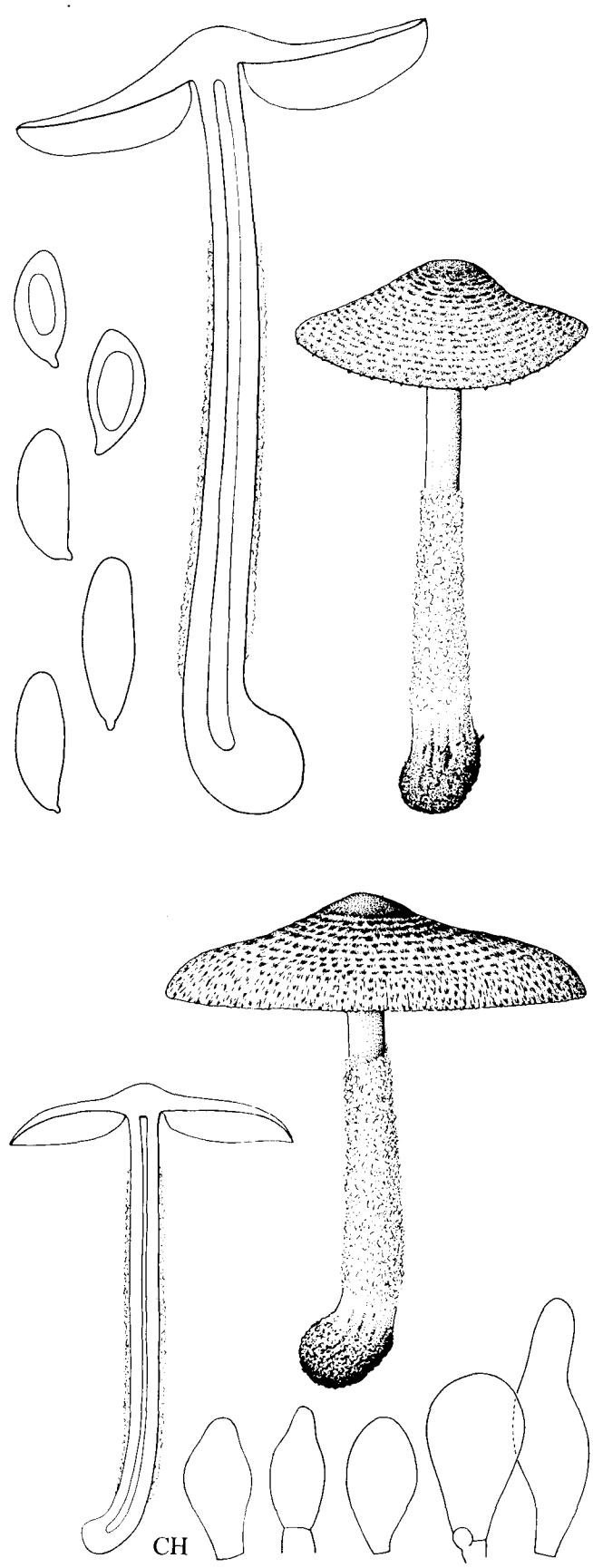

Fig. 80. *Lepiota clypeolaria*.

guttule or granular contents, dextrinoid, congophilous; not metachromatic in Cresyl Blue. Basidia 26-43 × 8.0-13 µm, clavate, 4-spored, rarely intermixed 4- and 2-spored. Lamella edge sterile. Cheilocystidia 12-33 × 5.0-15.5 µm, narrowly clavate, clavate, also cylindrical, broadly clavate or (sub)utriform, thin-walled and colourless. Pileus covering made up of erect elements, 150-c. 400 × 7.0-13 µm, mostly longer than 200 µm, with rounded apex, not or very rarely septate, slightly thick-walled, curved in lower part, with short elements in between, 15-60 × 6.0-10 µm; pigment pale brown and parietal. Stipitipellis a cutis made up of cylindrical, 4.0-15 µm wide hyphae, with yellow, sometimes encrusted, parietal pigment. Velum partiale made up of short, often c. 20 µm long, 4.0-8.0 µm wide, cylindrical, colourless hyphae, which are often curved. Below annular zone with squamules, similar to those on pileus. Clamp-connections present.

HABITAT & DISTR. – Solitary or in small groups, saprotrophic and terrestrial, mostly in beech-forests (*Fagus*) on rich, often calcareous soils. Rare in the Netherlands. Aug.-Oct., beginning of Nov. Widespread in Europe from the lowlands up into the montane zone, and occurring also in North America and Asia.

Lepiota clypeolaria is often confused with *L. magnispora* in the field. Spore shape is the decisive character to distinguish between the two: with a curved abaxial side in *L. clypeolaria*, and a straight abaxial side in *L. magnispora*.

Lepiota ochraceosulfurescens Locq. ex M. Bon (in Doc. mycol. 16 (61): 46. 1985) was described as a species in which the stipe discolours yellow when scratched, and in which stipe and pileus context are almost confluent. Both are qualitative and variable characters, which cannot be used on species level. In other characters the two species do not differ.

2. Lepiota magnispora Murrill in Mycologia 4: 237. 1912. – Fig. 81.

Lepiota fusispora C.H. Kauffm. in Papers Mich. Acad. Sci., Arts Letters 4: 330. 1924, non *Lepiota fusispora* P. Henn., 1897. – *Lepiota ventriosospora* D. Reid in Trans. Br. mycol. Soc. 41: 427. 1958. – *Lepiota clypeolaria* var. *pantherina* Gillet, Hyménomycètes: 62. 1874. – *Lepiota clypeolaria* var. *campanetta* Barla in Bull. Soc. mycol. Fr. 2: 116. 1886. – *Lepiota ventriosospora* var. *fulva* M. Bon in Bon & Chevassut in Doc. mycol. 4 (15): 27. 1974. – *Lepiota clypeolaria* f. *umbrinisquamosa* Hongo in Mem. Fac. Educ. Shiga Univ. Nat. Sci. 20: 51. 1970; *Lepiota clypeolaria* var. *umbrinosquamosa* (Hongo) M. Bon in Doc. mycol. 22 (88): 29. 1993. – *Lepiota ventriosospora* var. *umbrinorufescens* M. Bon in Doc. mycol. 22 (88): 46. 1993.

MISAPPL. – *Lepiota metulaespora* sensu Bres., Iconogr. mycol. 1: pl. 30. 1927; sensu Kühn. & Romagn., Fl. anal. Champ. sup.: 402. 1953. – *Lepiota clypeolaria* sensu Rea, Brit. Basidiomyc.: 69. 1922.

SEL. ICON. – Breitenb. & Kränzl., Pilze Schweiz 4: pl. 235. 1995; Dähncke & Dähncke, 700 Pilze: 315. 1979; R. Phillips, Paddest. Schimm.: 28. 1981; Ryman & Holmåsen, Svampar: 415. 1984; Vellinga & Huijser in Coolia 40: pl. 4. 1997.

SEL. DESCR. & FIGS. – Bon & Chevassut in Doc. mycol. 4 (15): 27. 1974 (as *L. ventriosospora* var. *fulva*); D. Reid in Trans. Br. mycol. Soc. 41: 427-429, fig. 9, pl. 24 fig. 3. 1958.

VERN. NAME – Geelbruine wolsteelparasolzwam.

Pileus 20-55 mm, hemispherical or conical with obtuse apex when young, expanding to broadly conical or plano-convex with broad high umbo, at centre felted and brown (Mu. 7.5 YR 4/8, 5/4, 7.5 – 10 YR 5/6), around centre with concentrical felted patches to fibrillose squamules; squamules concolorous with centre on pale ochraceous buff to pale pinkish ochraceous buff background; margin exceeding lamellae, when young with lanate-fibrillose yellow to white remnants of partial veil. Lamellae, L = 50-60, l = 1-3(-5), rather crowded to moderately distant, free, subventricose to ventricose, up to 6 mm broad, cream to pale brown-yellow (10 YR 7-8/6), with even, concolorous or slightly paler edge. Stipe 40-110 × 3-10 mm, tapering upwards, not or subbulbous at base, up to 10 mm wide, hollow, at apex white to cream-coloured and fibrillose (not pruinose), lower down with more or less distinct lanate annular zone, below this zone with yellowish to whitish

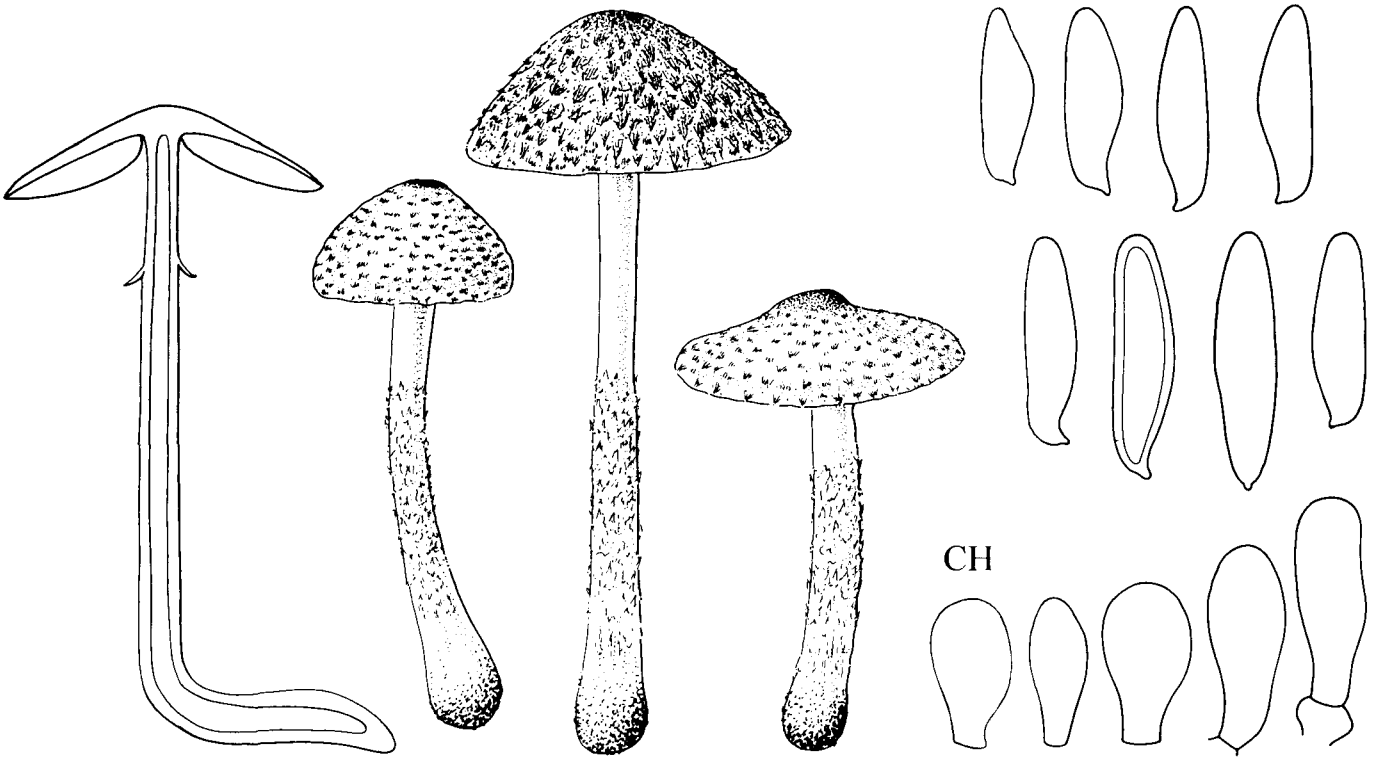

Fig. 81. *Lepiota magnispora*.

lanate floccules or rags, with girdles of brown squamules on this covering; background yellowish-brownish. Context white in pileus, cream-coloured with reddish flush to yellowish brown in stipe. Smell rather strong and unpleasant, like *L. cristata*. Taste as smell, rarely mild like *Boletus edulis*. Spore print white.

Spores in side-view (12.0-)13.5-25.0 × 4.0-6.0 µm, Q = (2.6-)2.7-4.8(-5.0), Qav = 3.0-4.2, with more or less straight abaxial side, usually strongly inflexed above hilar appendage ('penguin-shaped'), in frontal view fusiform to cylindrical, thick-walled, dextrinoid, congophilous; not metachromatic in Cresyl Blue. Basidia 20-42(-52) × 7.0-13.5 µm, 4-spored, very rarely some 2-spored. Lamella edge sterile. Cheilocystidia 11-40 × 7.0-16 µm, clavate, narrowly clavate and utriform, a few broadly clavate to spheropedunculate, thin-walled and colourless. Elements on pileus erect, (125-)170-400 × 9.0-16(-18) µm, rather thick-walled, not, or rarely septate, in between with short narrowly clavate to cylindrical elements, up to 35-80 µm long. Pigment brown, parietal in lower part of elements, also intracellular in upper part. Stipitipellis a cutis, made up of cylindrical, 4.0-8.0 µm wide elements with pale yellow-brown walls. Velum partiale made up of curved hyaline, cylindrical, 6.0-12 µm wide hyphae, some with encrusted walls. Clamp-connections present.

HABITAT & DISTR. – In small groups, saprotrophic and terrestrial, in coniferous (*Picea*), mixed or deciduous woods, on nutrient-rich often calcareous soils. In the Netherlands more or less evenly distributed over the country (dunes, province of Flevoland, southern Limburg), not common. End of Aug.-Oct. Widespread in Europe and North America, from the lowlands up into the montane and boreal zones.

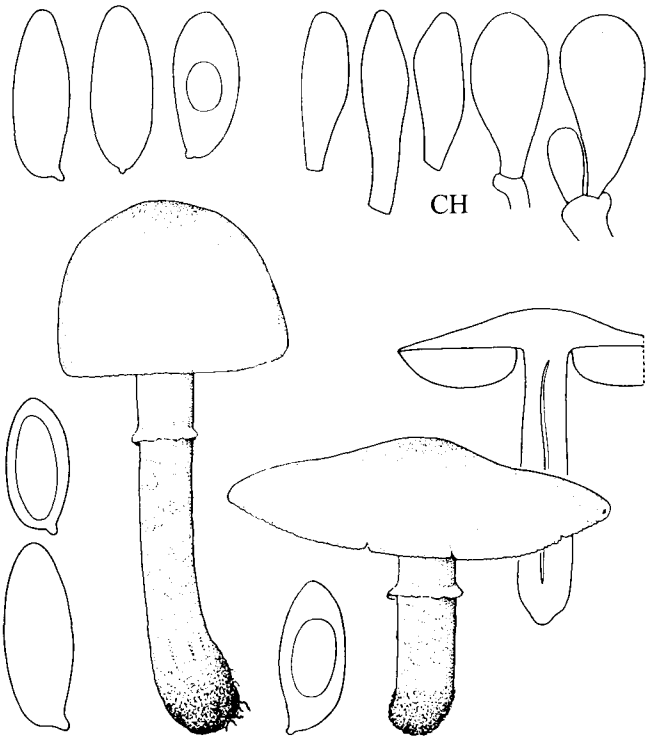

Fig. 82. *Lepiota erminea*.

This taxon was known as *L. metulaespora* in European literature, but Reid (in Trans. Br. mycol. Soc. 41: 427. 1958) showed that that was a different, tropical species, and described the European taxon as *L. ventriosospora* (in Trans. Br. mycol. Soc. 41: 427. 1958). However, Murrill described the species in 1912 from western North America as *L. magnispora*, a name which has hardly been in use since (see Vellinga in Mycotaxon 76: 430-431. 2000 on the synonymy).

Descriptions of *L. clypeolaria* from the 19th century often include *L. magnispora* (e.g. Fries, Monogr. Hymenomyc. Sueciae (*Lepiota*): 8-9. 1854). Popular mushroom guide books for the U.S.A. likewise do not make a distinction between the two species and use the name *L. clypeolaria* for *L. magnispora*. The two species are rather similar in the field, but in general *L. magnispora* has darker and intenser colours than *L. clypeolaria*. The difference in spore shape is the most reliable character to tell the species apart.

Bon (in Doc. mycol. 4 (15): 27. 1974) distinguished two varieties, viz. *L. ventriosospora* var. *ventriosospora* with yellow veil remnants, growing in *Picea*-forests, and var. *fulva*, more brown in appearance, lacking the yellow colour on the veil, with longer spores than var. *ventriosospora*, and growing in deciduous woods. But, as collections from deciduous woods often have a yellow veil, these two varieties are synonymized.

3. Lepiota erminea (Fr.: Fr.) Kumm., Führ. Pilzk.: 136. 1871. – Fig. 82.

Agaricus ermineus Fr.: Fr., Syst. mycol. 1: 22. 1821. – *Lepiota clypeolaria* var. *alba* Bres., Fungi trident. 1: 15. 1882; *Lepiota alba* (Bres.) Sacc., Syll. Fung. 5: 37. 1887, non *Lepiota alba* Beeli, 1932.

SEL. ICON. – Breitenb. & Kränzl., Pilze Schweiz 4: pl. 213. 1995 (as *L. alba*); Ryman & Holmåsen, Svampar: 414. 1984.

SEL. DESCR. & FIGS. – Høiland in Blyttia 35: 148. 1977 (as *L. alba*); Huijsman in Meded. Ned. mycol. Vereen. 28: 39-42. 1943; Kühner in Cryptog. Mycol. 4: 62-65. 1983 (as *L. alba*); Trimb. in Doc. mycol. 5 (20): 47-48. 1975 (as *L. alba*).

VERN. NAME – Duinparasolzwam.

Pileus 20-50(-85) mm, when young hemispherical, campanulate-conical with inflexed margin, expanding to plano-convex with (broad) umbo with deflexed margin, smooth at centre, slightly fibrillose-squamose around centre, at centre pale ochre or yellowish brown (Mu. 10 YR 8/6, 8/4), rarely darker (10 YR 6-7/6), at margin paler, pale cream to white, rarely very pale brown (10 YR 8/4). Lamellae, L = 38-50, l = 1-3, moderately distant to moderately crowded, free, ventricose, or subventricose, up to 8 mm broad, white to pale cream with concolorous even or finely flocculose edge. Stipe 15-60(-80) × 2-7 mm, cylindrical, slightly broadened at base, varying from thick and short to long and slender, hollow, above annulus or annular zone white and pruinose, lower down white to whitish (rarely brownish) or yellowish woolly-fibrillose, often glabrescent with age and rain, brownish at utmost base. Annulus often present, hanging, with brown or yellowish floccules. Context in pileus white, yellowish in stipe to brownish, very rarely discolouring yellow. Smell indistinct, indistinctly fungoid, slightly rancid or like *L. cristata*, rarely raphanoid. Taste mild, slightly unpleasant or rancid. Spore print white.

Spores in side-view 10.0-21.0(-23.0) × 5.0-7.0(-8.0) µm, avl × avw = 11.8-15.1 × 5.5-6.1 µm, Q = 1.75-3.5, Qav = 2.0-2.8, in side-view more or less amygdaliform, oblong to subcylindrical, with or without suprahilar depression, in frontal view fusiform to subcylindrical, dextrinoid and congophilous, not colouring in Cresyl Blue, thick-walled. Basidia 23-47.5 × 7.5-13.5 µm, 4-spored. Lamella edge sterile, but sometimes cheilocystidia very inconspicuous. Cheilocystidia 11-39 × 5.0-15(-27) µm, variable in shape from one collection to another, usually narrowly clavate, but also cylindrical, utriform, or clavate, thin-walled to slightly thick-walled and colourless. Pileus covering made up of more or less erect colourless or pale coloured aseptate hyphae, 40-400 × 5.0-12(-25) µm, mostly 200-300 × 6.0-12 µm; these elements straight, often twisted at base, with thickened walls. A very few short elements in between sometimes present. Stipitipellis a cutis, made up of cylindrical, 3.0-7.0 µm wide hyphae, with encrusted, cream walls. Velum partiale made up of non-encrusted, often rather short (20-

30 µm long), 3.0-5.0 µm wide, hyphae. Clamp-connections present in all tissues.

HABITAT & DISTR. – Solitary to gregarious in small groups, saprotrophic and terrestrial, in grassy vegetation types, very rarely in shrub vegetation. In the Netherlands almost completely restricted to the coastal dunes and to the sandy beach areas of the province of Flevoland, known from a very few localities inland (for a distribution map, see Arnolds et al., Overz. Paddest. Nederland: 288. 1995); rather common. (June-)Aug.-late Nov. In Europe widespread in grasslands on calcareous soils up into the subalpine zone, probably also in North America.

Two names existed in literature for a white species with fusiform spores: *Lepiota erminea* and *L. alba* and people have tried to fit the collections they found into one or the other, regarding *L. erminea* as a species with a raphanoid smell and long spores. Huijsman (in Meded. Ned. mycol. Vereen. 28: 39-42. 1943) described a collection from the Netherlands with long spores as *L. erminea*. However, the presence of numerous 2-spored basidia probably accounts for the extraordinary length of the spores in his collection. The differences he described between the two species do not warrant the distinction of two species and here they are considered one.

Specimens of *L. erminea* with rather brown pileus can be distinguished from *L. oreadiformis* by the wider spores (average width in *L. erminea* > 5.5 µm, in *L. oreadiformis* < 5.5 µm).

Lepiota ochraceodisca M. Bon (in Doc. mycol. 21 (81): 52. 1991) comes very close and might be identical, as it is characterized by an ochraceous-reddish disc and a more or less reddish woolly annulus. Recently it has been reduced to a forma of *L. alba* (Migliozzi & Coccia in Boll. Gruppo micol. G. Bres., n.S. 42: 107. 1999).

A variety with relatively small and narrow spores, i.e. measuring (8.5-)9.5-12(-13) × (3.0-)3.5-4.5 µm, was described as *L. alba* var. *angustispora* Bizzi & Migl. (in Migl. & Bizzi in Micol. ital. 23 (3): 29. 1994).

4. Lepiota oreadiformis Velen., Ceské Houby 2: 215. 1920. – Fig. 83.

Agaricus clypeolarius var. *pratensis* Fr., Epicrisis: 15. 1838; *Lepiota pratensis* (Fr.) Big. & Guill., Fl. Champ. sup. France: 58. 1909, non *Lepiota pratensis* Speg., 1898. – *Lepiota gracilis* var. *laevigata* J. Lange in Dansk bot. Ark. 2 (3): 24. 1915; *Lepiota laevigata* (J. Lange) J. Lange in Dansk bot. Ark. 4 (4): 47. 1923; *Lepiota oreadiformis* var. *laevigata* (J. Lange) M. Bon in Doc. mycol. 22 (88): 28. 1993.

SEL. ICON. – Kühner in Bull. trimest. Soc. mycol. Fr. 52: Atlas pl. 71, fig. 1. 1936 (as *L. laevigata*); Ryman & Holmåsen, Svampar: 415. 1984 (as *L. oreadiformis*).

SEL. DESCR. & FIGS. – Babos in Annls hist.-nat. Mus. natn. hung. 66: 70. 1974 (as Candusso & Lanzoni, Lepiota: 179-182, fig. 31. 1990; Kühner in Bull. trimest. Soc. mycol. Fr. 52: 231. 1936 (as *L. laevigata*).

VERN. NAME – Gladde wolsteelparasolzwam.

Pileus 20-65 mm, when young hemispherical to convex, later planoconvex or applanate with low, broad umbo, rather pale pinkish-ochraceous to dark yellow-brown at centre (Mu. 7.5 YR 7/6, 4/6-5/8), and paler around centre (7.5 YR 7/6, 8/4-6), and paler, up to almost white, at outermost margin, (very) finely plush-like, almost glabrous, to finely acute-squamulose at centre, adnate-fibrillose towards margin, with white woolly or cobwebby margin and adhering velum partiale in young specimens; margin exceeding lamellae. Lamellae, L = 40-60, l = 1-7, crowded to moderately distant, free, subventricose, up to 6 mm wide, greyish white when young, later more beige with pinkish sheen (10 YR 7/3), with white, subflocculose edge. Stipe 32-70(-90) × 3-6(-8) mm, cylindrical with slightly broadened base, rarely narrowed at base, fistulose with age, white, at apex lengthwise fibrillose, lower

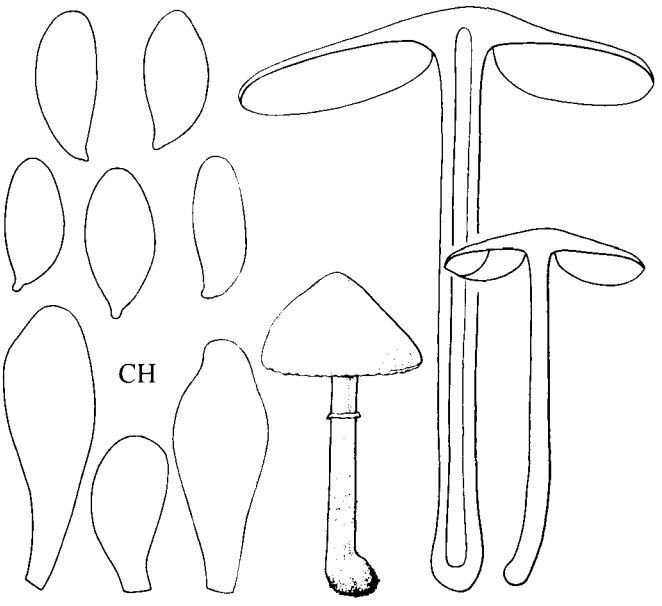

Fig. 83. *Lepiota oreadiformis*.

down (below ringlike zone) more lanate-floccose on fibrillose background and sometimes in basal part with some brownish squamules. Annulus rarely more developed than an arachnoid white zone, if developed, then hanging, white with pale brownish rim. Context in pileus dull, whitish to pale brownish, in stipe watery grey, cream, and (pinkish) brownish in lower part. Smell of undamaged and of cut basidiocarps fungoid, unpleasant of rubber, or sweetish and pleasant. Taste mild, fungoid, with slightly bitter aftertaste. Spore print 'white'.

Spores in side-view 10.0-16.5 × 4.5-6.5 µm, avl × avw = 11.5-14.4 × 4.8-5.5 µm, Q = (1.85-)1.95-3.1, Qav = (2.05-)2.25-2.7, in side-view fusiform to amygdaliform, with or without confluent hilar appendage and with or without suprahilar depression, in frontal view subcylindrical to narrowly ovoid, dextrinoid, congophilous, not metachromatic in Cresyl Blue, thick-walled. Basidia 17-40 × 6.5-12 µm, 4-spored. Lamella edge sterile. Cheilocystidia 11-39 × 5.0-13 µm, narrowly clavate, narrowly utriform or more cylindrical, hyaline and slightly thick-walled. Pleurocystidia not observed. Pileus covering made up of more or less erect elements, non-septate, 60-220(-360) × 6.0-14 µm, cylindrical and attenuated into pedicel, often with, but also found without, short, narrowly clavate to short-cylindrical elements, 18-60 × 10-13 µm; pale parietal brown pigment present in both short and long elements. Stipitipellis a cutis of 4.0-10 µm wide, cylindrical, cream-yellow hyphae. Velum partiale made up of cylindrical, often curved, hyaline hyphae, c. 6 µm wide. Clamp-connections present in all tissues.

HABITAT & DISTR. – Solitary or in small groups, saprotrophic and terrestrial on sandy to loamy soils (mainly sandy soils within the Netherlands), on road verges, in grasslands, also in deciduous woods. In the Netherlands very rare, scattered throughout the country, June-Sept. Rare and widespread in Europe.

Lepiota oreadiformis is taken in a broad sense, including *L. laevigata*, originally described as a rather big species, with brownish pileus and a slightly cottony-floccose stipe. *Lepiota oreadiformis* is generally considered a small, pale coloured rather smooth-stiped species. The present concept is the same as used by Candusso & Lanzoni (Lepiota: 178-182. 1990). It appears to be a variable taxon, both in macroscopical characters (size, development of an annulus) and in the presence of short narrowly clavate elements between the long elements of the pileus covering.

The name *L. pratensis* (Fr.) Big. & Guill. cannot be used for this taxon, as it is a later homonym of a different species, described by Spegazzini (in An. Mus. nac. Hist. nat. B. Aires, Ser. II, 6: 92. 1898), first as *L. platensis*, and subsequently, in the Index and Errata, as *L. pratensis*, since the name *L. platensis* was mistakenly used for two different species in the original publication.

Lepiota pallida Locq. ex M. Bon & Candusso (in Candusso & Lanzoni, Lepiota: 182. 1990) differs in having septate pileus covering elements.

Lepiota granulopunctata Locq. ex M. Bon (in Doc. mycol. 22 (88): 29. 1993) comes also very close. The main characteristic seems to be the almost glabrous stipe, but whether this warrants recognition at species level is unclear. Further study of this group of grassland species is badly needed.

Dark specimens of *L. erminea* differ from *L. oreadiformis* in the more yellow colours (in the range of Mu. 10 YR), whereas *L. pratensis* is characterized by more red in the pileus (in the range of Mu. 7.5 YR). The average width of the spores is an additional character to distinguish the two species: 4.8-5.5 µm in *L. oreadiformis* versus 5.5-6.1 µm in *L. erminea*. In both species the length (and also the length-width ratio) of the spores varies considerably.

Sometimes specimens of *L. oreadiformis* resemble young specimens of *L. clypeolaria*. Spore sizes and shapes of the two species are similar, but in *L. clypeolaria* the surface of the pileus splits up in a distinct central part and discrete squamules around centre, whereas the surface in *L. oreadiformis* is rather uniformly closed and uniformly splitting up into small patches, giving the surface an evenly coloured look.

5. Lepiota cortinarius J. Lange in Dansk bot. Ark. 2 (3): 25. 1915. – Fig. 84.

Lepiota audreae (D. Reid) M. Bon in Doc. mycol. 11 (43): 35. 1981. – *Lepiota dryadicola* Kühner in Cryptog. Mycol. 4: 65. 1983; *Lepiota audreae* var. *dryadicola* (Kühner) M. Bon, Fl. mycol. Eur. 3, Lépiotes: 51. 1993 (not valid); *Lepiota cortinarius* var. *dryadicola* (Kühner) M. Bon in Doc. mycol. 23 (92): 48. 1994.

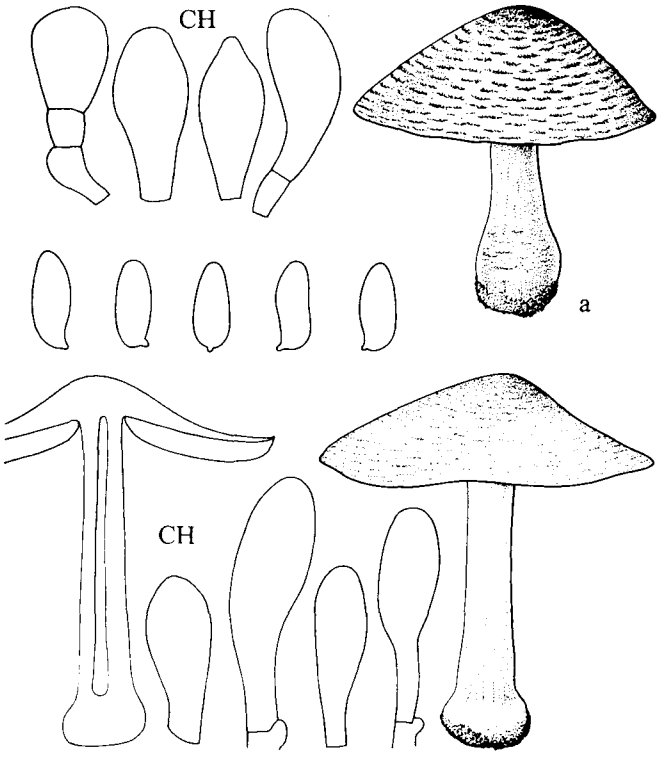

Fig. 84. *Lepiota cortinarius* (a: var. *audreae*).

VERN. NAME – Gordijnparasolzwam.

KEY TO THE VARIETIES

1. Basidiocarps with yellow colours, without pinkish brown or dark brown; pileus smooth, without distinct squamules or patches 5c. var. **flava**
1. Basidiocarps with pinkish brown to dark brown colours; pileus surface breaking up into squamules and patches
   2. Pileus with medium to pale brown colours (pinkish orange-brown, pale hazel-brown, reddish-ochraceous, isabella) 5a. var. **cortinarius**
   2. Pileus with dark brown colours ..... 5b. var. **audreae**

5a. var. **cortinarius**

SEL. ICON. – Candusso & Lanzoni, Lepiota: pl. 19a. 1990; Cetto, Funghi Vero 3, Ed. 3: pl. 863. 1982; J. Lange in Dansk bot. Ark. 2 (3): pl. 1b. 1915; J. Lange, Fl. agar. dan. 1: pl. 10B. 1935.

SEL. DESCR. & FIGS. – Huijsman in Persoonia 1: 325, figs. 1-3. 1960; J. Lange in Dansk bot. Ark. 2 (3): 25. 1915; Vellinga in Persoonia 14: 410-412, fig. 2. 1992; G.A. de Vries in Coolia 12: 48-52, figs. 1-5. 1966.

Pileus 40-80 mm, when young broadly and obtusely conical, rarely hemispherical, with inflexed margin, expanding to conico-convex, plano-convex or applanate, with broad, low or high umbo, often slightly undulating around centre, at centre tomentose, tomentose-felted, around centre breaking up into concentrical zones of patches or granulose to fibrillose-arachnoid squamules, at centre and when young in squamules pinkish orange-brown (Mu. 5 YR 4-3/4, 4/6), later around centre squamules paler, pale hazel-brown to pale isabella (5-7.5 YR YR 5/8 to 7.5 YR 7/6), on cream to pale pinkish background, when young with white lanate-floccose velar remnants at margin, and margin exceeding lamellae. Lamellae, L = c. 100, l = (1-)3, moderately crowded or crowded, free to remote from stipe, ventricose, subventricose or segmentiform, up to 6 mm broad, white to cream, with whitish, flocculose edge. Stipe 48-90 × 3.5-12 mm, broadened towards base to usually abrupt, up to 25 mm wide, bulb, hollow with age, whitish at apex, creamy-yellowish, glabrous or innately fibrillose lengthwise, lower down with lanate-floccose pinkish brown tomentum, which is appressed with age; sometimes squamules as on pileus present on bulb. Context thick, dull and white in pileus, white in stipe, with yellow-brown to golden-yellow tinges in bulb. Smell strong, fruity, sweetish, sometimes weak and reminiscent of *L. cristata*. Taste unpleasant. Spore print whitish to cream.

Spores (6.5-)7.0-9.0(-10.0) × (2.5-)3.0-3.5(-4.0) µm, Q = 2.1-2.9(-3.1), Qav = 2.3-2.7, in side-view cylindrical, often with slight suprahilar depression ('penguin-shaped'), in frontal view cylindrical to slightly ovoid, dextrinoid, congophilous, not metachromatic in Cresyl Blue. Basidia 18-29 × 5.5-9.0 µm, 4-spored, rarely also 2-spored. Lamella edge sterile. Cheilocystidia 15-50 × 6.0-13.5 µm, variable in shape and size: fusiform, broadly utriform, narrowly clavate or clavate, colourless, though rarely with yellowish refringent contents, slightly thick-walled. Pileus covering made up of long, adnate or ascending to erect, not or rarely septate, elements, (50-)150-400(-800) × 10-20 µm, with parietal brownish pigment, slightly thick-walled, occasionally with basal short, clavate elements, e.g. 30-35 × 14-18 µm. Stipitipellis a cutis of cylindrical, 3.0-10 µm wide hyphae, with loose, irregular, colourless, patent, cylindrical, c. 3.0 µm wide hyphae. Clamp-connections present in all tissues.

HABITAT & DISTR. – Solitary to gregarious, in fairy rings, sometimes fasciculate, saprotrophic and terrestrial on rather nutrient-rich, often

calcareous, sandy to clayey soils, in deciduous and mixed woods, city-parks, and on mine waste heaps. In the Netherlands rare, mainly in the new polders, scattered on loamy localities in the Pleistocene regions, and in southern Limburg. Sept.-Oct.(-Dec.). Widespread and rare in Europe, also known from the eastern part of the U.S.A.

5b. var. **audreae** D. Reid in Fung. rar. Ic. col. 3: 8. 1968.

Lepiota audreae var. *dryadicola* (Kühner) M. Bon, Fl. mycol. Eur. 3, Lépiotes: 51. 1993 (not valid); *Lepiota cortinarius* var. *dryadicola* (Kühner) M. Bon in Doc. mycol. 23 (92): 48. 1994.

SEL. ICON. – Candusso & Lanzoni, Lepiota: pl. 19b. 1990; D. Reid in Fung. rar. Ic. col. 3: pl. 19a. 1968.

SEL. DESCR. & FIGS. – W. Beyer in Z. Pilzk. 43: 193-196. 1977 and in Libri bot. 5: 211. 1992; Kelderman in Coolia 31: 16-17, fig. 3. 1988; D. Reid in Fung. rar. Ic. col. 3: 8-10. 1968.

CHARACTERISTICS – Pileus 35-45(-60) mm, dark brown and slightly squarrose-felted at centre, around centre breaking up into discrete, concentrical, hazel-brown patches or squamules; stipe 25-50 × 6-7 mm, also with rather dark brown squamules.

Microscopical characters as in the typical variety.

HABITAT & DISTR. – Gregarious, saprotrophic and terrestrial on nutrient-rich soils; in the Netherlands very rare, only known from mine waste heaps in southern Limburg (Brunssum). Sept.-Oct. Rare but widespread in Europe, possibly more thermophilic than var. *cortinarius*.

5c. var. **flava** Bas & Vellinga in Vellinga in Persoonia 14: 414. 1992.

SEL. DESCR. & FIGS. – Bas & Vellinga in Vellinga in Persoonia 14: 414, figs. 3d-h. 1992.

CHARACTERISTICS – Pileus ochraceous yellow, smooth and glabrous, but in outer half with granular dots, slightly darker than background; stipe pale straw-yellow.

Microscopical characters as in typical variety, but elements of pileus covering with yellow walls.

HABITAT & DISTR. – Gregarious, saprotrophic and terrestrial on clay in plantation of deciduous trees. In the Netherlands only known from one locality in the province of Flevoland (Dronten, Spijkbos), Oct. Not known outside the Netherlands.

6. Lepiota subgracilis Kühner in Bull. trimest. Soc. mycol. Fr. 52: 231. 1936. – Fig. 85.

Lepiota clypeolaria var. *gracilis* Quél. in C. r. Ass. franç. Av. Sci. (Besançon, 1893) 22: 485. 1894 (Champ. Jura Vosges Suppl. 19); *Lepiota gracilis* (Quél.) J. Lange in Dansk bot. Ark. 2 (3): 24. 1915, non *Lepiota gracilis* Peck, 1899; *Lepiota gracilis* (Quél.) Rea, Brit. Basidiomyc.: 70. 1922 (superfluous). – *Lepiota subgracilis* Wasser in Ukr. bot. Zh. 35: 518. 1978, non *Lepiota subgracilis* Kühner, 1936; *Lepiota wasseri* M. Bon in Doc. mycol. 22 (88): 29. 1993 (superfluous). – *Lepiota kuehneriana* Locq. in Friesia 5: 296. 1956.

SEL. ICON. – Breitenb. & Kränzl., Pilze Schweiz 4: pl. 230. 1995 (as *L. kuehneriana*); Candusso & Lanzoni, Lepiota: pl. 12. 1990 (as *L. kuehneriana*); Hardtke & Rödel in Mykol. Mittbl. 36: 5. 1993; J. Lange, Fl. agar. dan. 1: pl. 11F. 1935 (as *L. gracilis*).

SEL. DESCR. & FIGS. – Bizzi & Migl. in Micol. ital. 28 (2): 23-31. 1999; Candusso & Lanzoni, Lepiota: 159-162, fig. 25; 184-186, fig. 33. 1990 (as *L. kuehneriana* and *L. subgracilis* resp.); Enderle & Krieglst. in Z. Mykol. 55: 97-98. 1989; Hardtke & Rödel in Mykol. Mittbl. 36: 1-3. 1993; Kelderman, Parasolzw. Zuid-Limburg: 66-67. 1994; Svrcek in Ceská Mykol. 19: 47-49, fig. 5. 1965.

VERN. NAME – Slanke wolsteelparasolzwam.

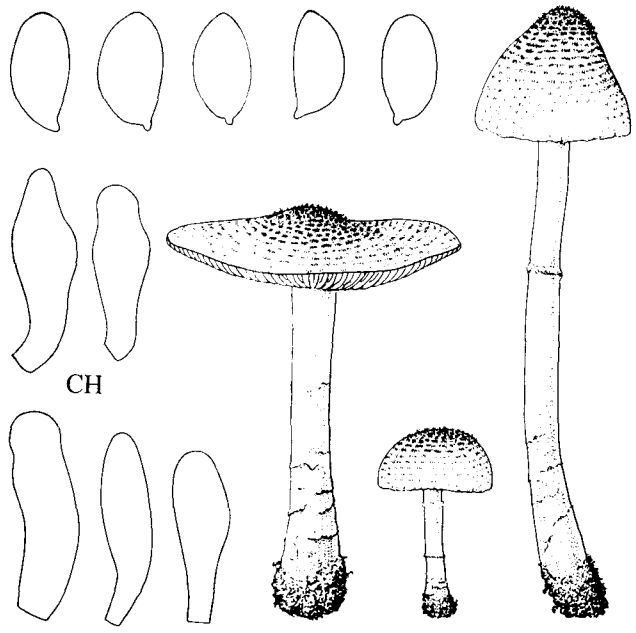

Fig. 85. *Lepiota subgracilus*.

Pileus 20-48 mm, campanulate, expanding to plano-convex, plano-concave, with broad low umbo, at centre dark red-brown, fulvous, greyish pinkish brown, paler towards margin, at centre densely set with small fibrillose or pyramidal squamules, not showing the underlying context, towards margin with fibrillose or more granular squamules, on white, ochraceous background, with or without vinaceous tinges, sometimes at margin with a zone of dark orange-brown squamules (Mu. 7.5 YR 6/6). Lamellae, L = 45, l = 1-3, moderately distant to crowded, free to narrowly adnexed, segmentiform to ventricose, up to 8 mm wide, creamy white, cream-coloured, very pale grey-brown with age, with finely serrate to almost even, white edge. Stipe 40-90 × 2-6.5 mm, cylindrical or slightly broadening at base, hollow, cream, pale brownish or pale ochraceous with lilacinous tinge, finely fibrillose, with in lower half or only at base, some girdles of squamules, concolorous with those on pileus. Annulus usually present as white woolly remnants of the partial veil, and also as a brown ring, remnants of the universal veil. Context white and dull in pileus, in stipe concolorous with surface and shiny. Smell and taste not distinct, when old reminiscent of *L. cristata*. Spore print probably white.

Spores 9.0-13.5 × 4.0-6.0(-6.5) µm, Q = 1.8-2.4(-2.6), Qav = 1.9-2.1, in side-view amygdaliform to oblong, with or without suprahilar depression, in frontal view oblong, broadly fusiform or slightly ovoid, uniguttulate, thick-walled, strongly dextrinoid, congophilous; inner wall not metachromatic in Cresyl Blue, while spore content colours blue. Basidia (18-)21-35 × 7.5-10 µm, 4-spored, with some 2- or even 1-spored ones intermixed. Lamella edge sterile, sometimes in places fertile. Cheilocystidia 15-43 × 6.5-11 µm, variable in shape, cylindrical and subcapitate to narrowly clavate, or lageniform to utriform, narrowly clavate, thin-walled and colourless. Pleurocystidia absent. Pileus covering made up of elongated elements, often united to squamules; elements 55-360 × 8.0-13 µm, cylindrical, slightly flexuous in lower part, non-septate, or with 1 septum, with slightly thickened, brown or grey-brown walls, sometimes also with intracellular pigment, with or without basal clavate elements, with dark brown parietal pigment. Stipitipellis a cutis, made up of cylindrical hyphae, 4.0-6.0 µm wide, with pale yellow walls; elements of squamules as those on pileus. Clamp-connections present in all tissues.

HABITAT & DISTR. – Solitary or in small groups, terrestrial and saprotrophic, on clayey soils, often rich in nutrients and/or calcium, in deciduous woods, in the Netherlands very rare, known from southern Limburg (Valkenburg, Schaelsberg; Cadier en Keer, Riesenberg) and from one locality in the river area (Barendrecht, Huys ten Donck). Sept.-Oct. Rare and scattered throughout Europe, but absent from alpine and arctic regions.

Lepiota subgracilis is a variable species, variable in colours of the pileus (from very dark brown to ochraceous brown), in presence of velar remnants on the stipe (as girdles, or as two ringzones, one of the partial veil, one of the universal veil), and in presence or absence of a hymeniform underlayer in the pileus covering. It seems that the hymeniform underlayer is present in young specimens, whereas the elements lengthen and do not persist as a separate layer in older specimens. The variation in colours and in presence of velar remnants was observed by Kelderman (Parasolzw. Zuid-Limburg: 67. 1994) in seven collections from one locality.

Lepiota kuehneriana Locq., *L. wasseri* M. Bon, and probably also *L. latispora* (Wasser) M. Bon, belong to this same variable taxon. Extensive descriptions of the latter taxon are lacking. Bon (in Doc. mycol. 11 (43): 30, 32. 1981; and Fl. mycol. Eur. 3, Lépiotes: 56-60. 1993) placed *L. latispora* and *L. kuehneriana* in subsect. *Latisporinae* M. Bon, characterized by spores with length-width ratio < 2.5, whereas *L. subgracilis* and *L. wasseri* were ranked in subsect. *Fusisporinae* (J. Lange) M. Bon, characterized by spores with a length-width ratio > 2.5. However, the spore sizes given by Bon scarcely differ for any of these taxa, and the length-width ratio is less than 2.5 in all cases.

7. Lepiota ignivolvata Bousset & Joss. in Joss. in Riv. Micol. 33: 123. 1990.

Lepiota ignivolvata Bousset & Joss. in Joss. in Bull. trimest. Soc. mycol. Fr. 64: 5. 1948 (not valid); *Lepiota ignivolvata* Bousset & Joss. in Joss. in Bull. mens. Soc. linn. Lyon 41: 5. 1972 (not valid); *Lepiota ignivolvata* Bousset & Joss. in Joss. in Bull. mens. Soc. linn. Lyon 58: 328. 1989 (not valid).

SEL. ICON. – Breitenb. & Kränzl., Pilze Schweiz 4: pl. 229. 1995; Candusso & Lanzoni, Lepiota: pl. 11. 1990; Courtec. & Duhem, Guide Champ. France Europe: pl. 668. 1994; Dähncke, 1200 Pilze: 513. 1993.

SEL. DESCR. & FIGS. – Joss. in Bull. trimest. Soc. mycol. Fr. 64: 7-8, fig. 1. 1948; Schwöbel in Z. Pilzk. 32: 2-4, figs. 2 & 3. 1966.

CHARACTERISTICS – Pileus 50-90 mm, with glabrous brown centre, around centre with adnate felted-tomentose, brownish squamules on pale background; lamellae cream-coloured; stipe 70-100 × 10-15 mm, with brown narrow annulus, and belts of floccules below annulus, whitish cream, in basal part discolouring orange when touched, with age or on drying; context white to creamy; smell strong, like the rubber smell of *L. cristata*; taste unpleasant, like rubber.

Spores 8.5-11.0(-12.5) × 5.0-6.0(-6.5) µm, Q = 1.75-1.9, Qav = 1.75-1.95, amygdaliform with rounded apex in side-view; cheilocystidia 17-37 × 9.0-17 mm, narrowly clavate to clavate; pileus covering made up of long (reaching over 500 µm) ascending to erect elements, with a rather regular layer of short elements; pigment brown and parietal in long and short elements; clamp-connections present.

HABITAT & DISTR. – Solitary or in small groups, saprotrophic and terrestrial, in beech-forests (*Fagus*) on calcareous soils. According to Josserand (in Bull. trimest. Soc. mycol. Fr. 64: 8. 1948) in *Picea*-forests. Known from Denmark, Switzerland, France, Luxembourg, and Germany. Sept.-Oct.

Sect. **Ovisporae** (J. Lange) Kühner

Spores ellipsoid to oblong; pileus covering made up of long, erect elements, with or without short clavate elements at the base of these long elements.

Subsect. **Felininae** M. Bon

Pileus covering made up of long, erect elements and short, clavate elements.

8. Lepiota felina (Pers.) P. Karst., Ryssl., Finl., Skand. Halføns Hattsv.: 10. 1879. – Fig. 86.

Agaricus felinus Pers., Syn. meth. Fung.: 261. 1801; *Lepiota clypeolaria* var. *felina* (Pers.) Gillet, Hyménomycètes: 62. 1874.

MISAPPL. – *Lepiota clypeolarioides* sensu Huijsman in Meded. Ned. mycol. Vereen. 28: 25-27. 1943.

SEL. ICON. – Dähncke, 1200 Pilze: 519. 1993; Papeti & Forti in Boll. Circ. micol. G. Carini 29-30: middle page. 1995.

SEL. DESCR. & FIGS. – Papeti & Forti in Boll. Circ. micol. G. Carini 29-30: middle page. 1995.

VERN. NAME – Panterparasolzwam.

Pileus 15-40 mm, hemispherical when young, expanding to plano-convex, applanate, a bit undulating, with or without umbo, at centre with uplifted, plush-like, very dark brown (Mu. 10 YR 4-3/2, 7.5 YR 3/2, 5 YR 3/3), little tufts in a distinct patch, very rarely more orange-brown (7.5 YR 3/4), around centre with concentrical zones of uplifted or flattened, discrete patches, concolorous with centre, on a cream background, towards margin the patches become more radially arranged, more cobwebby squamules; margin a bit ragged, rarely with annulus remnants attached, and exceeding lamellae. Lamellae, L = 30-45, l = 1-3, moderately distant to moderately crowded, free, some anastomosing, (sub)ventricose, up to 5 mm wide, cream-coloured, sometimes with pinkish sheen, with white to concolorous eroded or flocculose edge. Stipe 32-60 × 2-5 mm, gradually widening towards base, hollow, innately fibrillose lengthwise, whitish or pale brownish (7.5 YR 8/4) above annulus, below annulus pinkish-brownish (7.5 YR 6/4) or grey brownish, with, rarely without, in lower half some scattered girdles of squamules, paler than those on pileus, with white tomentum and some white mycelial cords at base. Annulus like a cuff around

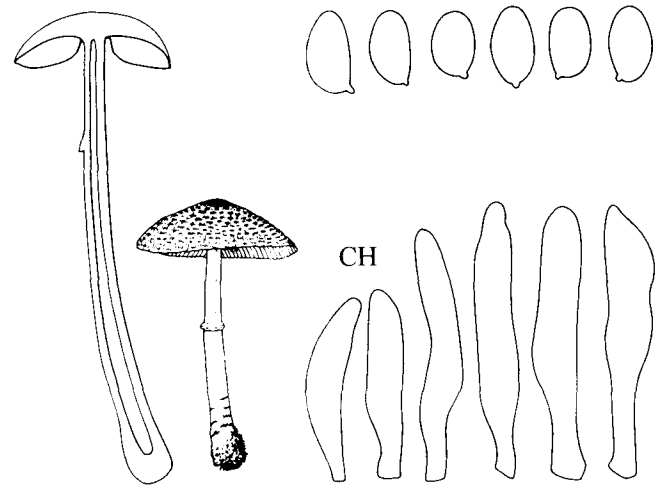

Fig. 86. *Lepiota felina*.

stipe, rarely only fibrillose-membranaceous, ragged at upper side, set with dark grey-brown squamular patches, disappearing with age. Context white in pileus, concolorous with surface in stipe. Smell suggestive of cedar wood, of cut basidiocarps like the rubber component of the smell of *L. cristata*: astringent and unpleasant. Taste not known, probably unpleasant. Spore print white.

Spores 6.0-8.5 × (3.5-)4.0-5.0 µm, Q = 1.45-1.95, Qav = 1.65-1.75, ellipsoid to oblong, some in side-view amygdaliform with blunt apex, with abrupt hilar appendage, thick-walled, dextrinoid, though not all spores reacting in the same strong way, congophilous, not metachromatic in Cresyl Blue. Basidia 21-35 × 6.5-9.0 µm, 4-spored, intermixed with a few 2-spored. Lamella edge sterile. Cheilocystidia 21-53 × 4.5-10 µm, most often cylindrical or slightly irregularly cylindrical, with acuminate apex, often with septum, rarely with capitate apex, sometimes fusiform, colourless, with slightly thickened wall. Pleurocystidia absent. Pileus covering made up of agglutinated long, non-septate, erect elements in tufts, 110-415 × 9.0-17 µm, with dark brown parietal pigment that decreases in quantity towards apex, without septa, with a very dense underlayer made up of narrowly clavate to clavate elements, up to 15 µm wide, with dark brown parietal and in lower parts sometimes encrusting dark brown pigment; encrusting dark brown pigment also present in lower hyphae. Stipitipellis below annulus, a cutis of cylindrical, irregular, colourless hyphae, with slightly encrusted walls, 3.5-6.0 µm wide, with some irregular brown-walled hyphae with narrowly clavate terminal elements, c. 9.0-10 µm wide, and squamules like those on pileus, with clavate and long elements. Clamp-connections present in all tissues.

HABITAT & DISTR. – In small groups and saprotrophic on nutrient-rich, often calcareous soil, in deciduous or coniferous woods, also on mine waste heaps. In the Netherlands rather rare, occurring in the southern part of Limburg, the province of Flevoland and in locally loam-rich places of the Pleistocene regions. Sept.-Oct. Widespread and not common throughout Europe; also recorded from North America.

Lepiota felina can be confused in the field with *L. pseudolilacea*, as both are characterized by the cuff-like annulus with little dark patches on it. *Lepiota pseudolilacea* can be distinguished on account of the structure of the pileus covering, which lacks the dense hymeniform underlayer of *L. felina*, and is provided with adnate coloured hyphae.

9. Lepiota pseudolilacea Huijsman in Bull. mens. Soc. linn. Lyon 16: 182. 1947. – Fig. 87.

Lepiotula pseudolilacea (Huijsman) Wasser in Nov. Sist. vyssh. nizsh. Rast. 1975: 191. ('1975') 1976. – *Lepiota pseudohelveola* Kühner in Bull. trimest. Soc. mycol. Fr. 52: 221-223. 1936 (not valid); *Lepiota pseudohelveola* Kühner ex Hora in Trans. Br. mycol. Soc. 43: 44. 1960. – *Lepiota pseudohelveola* var. *sabulosa* M. Bon in Doc. mycol. 17 (67): 8. 1987.

EXCL. – *Lepiota pseudohelveola* sensu J. Favre, Champ. sup. Zone alpine: 157-158. 1955 (= *L. favrei*).

SEL. ICON. – Candusso in Riv. Micol. 33: 17. 1990 (as var. *sabulosa*); Vellinga & Huijser in Coolia 40: pl. 5. 1997 (as *L. pseudohelveola*).

SEL. DESCR. & FIGS. – Derbsch & Schmitt, Atl. Pilze Saarlandes 2: 493. 1987; Kühner in Bull. trimest. Soc. mycol. Fr. 52: 221-223. 1936 (both as *L. pseudohelveola*).

VERN. NAME – Manchetparasolzwam, incl. Valse lila parasolzwam.

Pileus 13-45 mm, when young rounded-conical with inflexed margin, expanding to plano-convex, applanate or plano-concave with or without low umbo, almost completely felted, plush-like at centre, towards margin more radially fibrillose, and the tufts a bit uplifted, but discrete

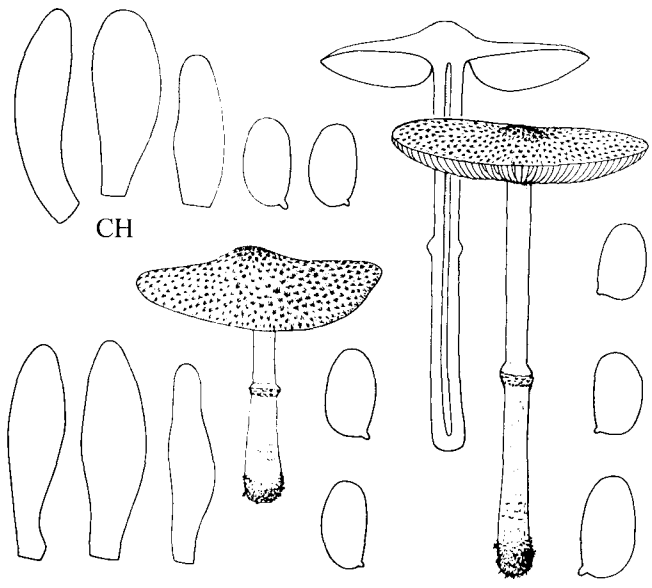

Fig. 87. *Lepiota pseudolilacea*.

squamules lacking, pinkish greyish brown to dark red-brown (Mu. 7.5 YR 4/3, 5/4; 5 YR 4/4, 5-7.5 YR 3/3), brown with some grey tinges (7.5 YR 5/4 plus 7.5 YR 4/6), brown (10 YR 4/5) or, especially when old, more orange-brown (7.5-10 YR 4-6/6), rarely with lilacinous tinges, near margin showing underlying whitish context, with margin exceeding lamellae, especially when young. Lamellae, L = 32-48, l = 1-3, moderately distant to crowded, free, but quite close to stipe, ventricose, subventricose, or segmentiform, up to 5 mm wide, cream with brownish tinge or with pinkish sheen (e.g. 10 YR 8/2-3), with white, fimbriate or flocculose (lens) edge. Stipe 23-55 × 2-9 mm, cylindrical, not or slightly broadened at base, hollow, with distinct annulus, and when young above this annulus a white fugacious annulus, lengthwise fibrillose, cream(ish) (7.5 YR 8/2) at apex, brownish-pinkish, pinkish-lilacinous (7.5 YR 6/4), to brownish at base, in lower part with some girdles of rather woolly squamules. Annulus like a cuff around stipe, white-cream and set with a band of squamules or patches concolorous to those on pileus, rarely with a dark zone only, sometimes with darker upper rim. Context white in pileus, glassy above lamellae, shiny in stipe and concolorous with surface. Smell of basidiocarps when cut, fungoid-astringent, fruity-aromatic, even sweet-aniseed-like, or like the rubber component of the smell of *L. cristata*. Taste indistinct or as smell. Spore print white.

Spores 6.0-10.0 × 4.0-5.0 µm, Q = 1.4-2.1, Qav = 1.6-1.8, in side-view ellipsoid, oblong, even subcylindrical, rarely with straight adaxial side or even with slight suprahilar depression, ellipsoid to oblong in frontal view, with inner wall orange-brown in Melzer's Reagent, congophilous, cyanophilous, not metachromatic in Cresyl Blue. Basidia 15-33 × 6.0-9.0 µm, 4-spored, rarely 2-spored. Lamella edge sterile. Cheilocystidia 17-43 × 5.0-12 µm, mostly (irregularly) cylindrical, but also narrowly utriform, clavate or narrowly clavate. Pleurocystidia absent. Pileus covering made up of more or less erect long elements in tufts, 100-370 × 8-16 µm, sometimes only up to 200 µm long, with short-clavate elements in between, 13-60 × 10-15 µm, and a layer of repent cylindrical coloured hyphae, 4.0-6.0 µm in diam. Pigment brown, intracellular and parietal, also encrusting in repent hyphae, and pigment especially present in the short elements. Stipitipellis a cutis of colourless, cylindrical hyphae, 4.0-10 µm in diam. Squamules on stipe as those on pileus. Clamp-connections present in all tissues.

HABITAT & DISTR. – Gregarious, rarely solitary, saprotrophic and terrestrial in dune grasslands, and in deciduous woods on calcareous soils, also on mine waste heaps. In the Netherlands rather rare, in southern Limburg and in the coastal dunes. Sept.-Nov. Widespread in Europe.

Lepiota pseudolilacea and *L. pseudohelveola* are considered synonymous, as the differences in spore shape and in size of the elements of the pileus covering of the two species are small and there is a range in spore shape and in size of the pileus elements. The better known name *L. pseudohelveola* was validly published on a later date than *L. pseudolilacea*.

Lepiota pseudohelveola var. *sabulosa* M. Bon (in Doc. mycol. 17 (67): 8. 1987) is identical in most characters, though macroscopically distinct because of its paler colours.

In several *Lepiota*-species a wide range of colours can be observed; microscopical characters and characters concerning presence and shape of a ring are considered to be more important than colour for species delimitation.

Lepiota pseudolilacea is a toxic species, containing amanitins (Gérault & Girre in C. r. hebd. Séanc. Acad. Sci., Paris 280, Sér. D: 2841-2843. 1966 (as *L. pseudohelveola*)).

Lepiota farinolens Bon & G. Riousset (in Doc. mycol. 22 (85): 65. 1992), described from grassy localities in southern France, has also an annulus, but this one is not set with dark squamules, and is distinguished on account of its pale pinkish colours, and the farinaceous smell, which is especially distinct after rubbing the basidiocarps. The spores of *L. farinolens* measure 7.5-9.5 × (4.0-)4.5-5.0 µm, Q = 1.6-2.0, and the elements of the pileus covering are relatively short: 100-160(-180) µm long, and a layer of short clavate elements is lacking, placing this species in the vicinity of *L. subincarnata* and *L. brunneoincarnata*.

10. Lepiota forquignonii Quél. in C. r. Ass. franç. Av. Sci. (Blois, 1884) 13: 277. 1885 (Champ. Jura Vosges Suppl. 13). – Fig. 88.

Lepiota forquignonii var. *coniferarum* M. Bon in Doc. mycol. 11 (43): 41. 1981. – *Lepiota olivaceobrunnea* P.D. Orton in Trans. Br. mycol. Soc. 91: 561. 1988; *Lepiota forquignonii* var. *olivaceobrunnea* (P.D. Orton) M. Bon in Doc. mycol. 22 (88): 29. 1993.

EXCL. – *Lepiota forquignonii* sensu Barbier in Bull. mens. Soc. linn. Lyon 3: 76-78. 1934 (= *L. grangei*).

SEL. ICON. – Candusso & Lanzoni, Lepiota: pl. 30. 1990; Papeti & Forti in Boll. Circ. micol. G. Carini 29-30: middle page. 1995; D. Reid in Fung. rar. Ic. col. 2: pl. 9c&d. 1967.

SEL. DESCR. & FIGS. – Huijsman in Meded. Ned. mycol. Vereen. 28: 23-25, fig. 4. 1943; Mal. & Bert., Fl. Champ. sup. Maroc 1: 128-129. 1970.

VERN. NAME – Olijfparasolzwam.

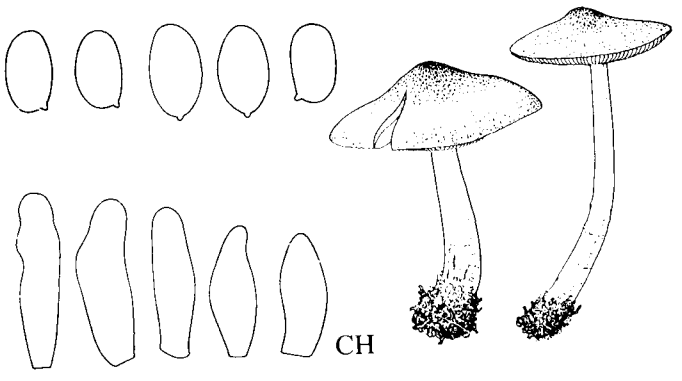

Fig. 88. *Lepiota forquignonii*.

Pileus 18-42 mm, at first hemispherical, rounded conical with inflexed margin, expanding via campanulate to plano-convex or applanate with umbo, when young grey-brown squamulose, later at umbo dark grey-brown with greenish or olive tinge (Mu. 10 YR 5/2, 5/3-4), velvety-plushy, with small tufts, around umbo with concentrical, small plush-like, grey-brown (10 YR 5/4 to 7/4) squamules on pale to white background, in marginal zone more radially fibrillose, when young with white overhanging margin exceeding lamellae. Lamellae, L = 40-60, l = 1-5, moderately crowded, free, ventricose or segmentiform, up to 6.5 mm wide, white at first, later cream-coloured, or greyish with yellowish tinge (2.5 Y 8/4), sometimes with pinkish flush when looked at from below, with white floccose to eroded edge. Stipe 23-58 × 3-6 mm, cylindrical or tapering towards apex, hollow, white, lengthwise innately creamy-fibrillose, in lower 1/2-2/3 set with woolly white velum girdles, in lower part just above base, with squamules, concolorous to those on pileus (10 YR 5-4/4), with white mycelial cords. Context white to cream in pileus and stipe. Smell of basidiocarps when cut indistinct, fungoid, unpleasant: a bit acid, or fishy-rubber-like, sometimes reminiscent of the smell of *L. cristata*. Taste not known. Spore print white.

Spores (5.5-)6.0-8.0 × 3.5-5.0 µm, Q = 1.6-1.95, Qav = 1.8-1.9, oblong in side-view, sometimes with the adaxial side flatter than the abaxial side, in frontal view oval-oblong, dextrinoid, congophilous, not metachromatic in Cresyl Blue. Basidia 16-23 × 6.0-8.0 µm, 4-spored, sometimes with some 2-spored basidia intermixed. Lamella edge sterile. Cheilocystidia 15-32 × 3.5-8.0 µm, variable in shape, almost cylindrical to very narrowly utriform, slightly fusiform, narrowly clavate etc., relatively small, and thin-walled. Pleurocystidia absent. Pileus covering made up of erect to adnate, non-septate elements, 60-370 × 5.0-10 µm, rarely septate in basal part, narrowed into base, with pale yellowish to greyish-brownish parietal pigment, with at base some narrowly clavate to cylindrical short elements, 22-55 × 8.0-14.5 µm, also with pale brownish parietal pigment. Stipitipellis a cutis of narrow, cylindrical hyphae, 3.0-5.0 µm wide; partial veil consisting of irregular, colourless hyphae, 3.0-5.0 µm wide, with encrusting colourless pigment; squamules on stipe made up of elements as on pileus, but with a relatively high number of relatively short, narrowly clavate elements, c. 50 × 8.0 µm. Clamp-connections present in all tissues.

HABITAT & DISTR. – In small groups, saprotrophic and terrestrial on more or less calcareous soils, in deciduous woods. In the Netherlands rare, only known from several localities in southern Limburg (e.g. Cadier en Keer, Riesenberg and Örenberg; Elsloo, Bunderbos), Sept.-Oct. Widespread, but apparently not common in the warmer regions of Europe (absent from Denmark and Norway, but present on the Swedish Island of Øland).

Lepiota olivaceobrunnea P.D. Orton lacks pinkish tinges and is less grey than typical *L. forquignonii*, but it is in all other characters identical to *L. forquignonii*; reason for Bon to change its status into a variety of *L. forquignonii*. Here it is subsumed in the synonymy of *L. forquignonii*.

Var. *coniferarum* differs from typical *L. forquignonii* in the slightly bigger spores (up to 8.0 µm) and the darker colours of the basidiocarps. Whether these differences warrant status on varietal level is questionable.

11. Lepiota xanthophylla P.D. Orton in Trans. Br. mycol. Soc. 43: 289. 1960, non *Lepiota xanthophylla* Sing., 1973. – Fig. 89.

EXCL. – *Lepiota xanthophylla* sensu Besl et al. in Z. Mykol. 50: 187-188. 1984; sensu Breitenb. & Kränzl., Pilze Schweiz 4: pl. 236. 1995; sensu Migl. et al. in Riv. Micol. 32: 105-107. 1989; sensu Migl. & Bizzi in Micol. ital. 26 (3): 57-58. 1997 (in all cases *L. elaiophylla*).

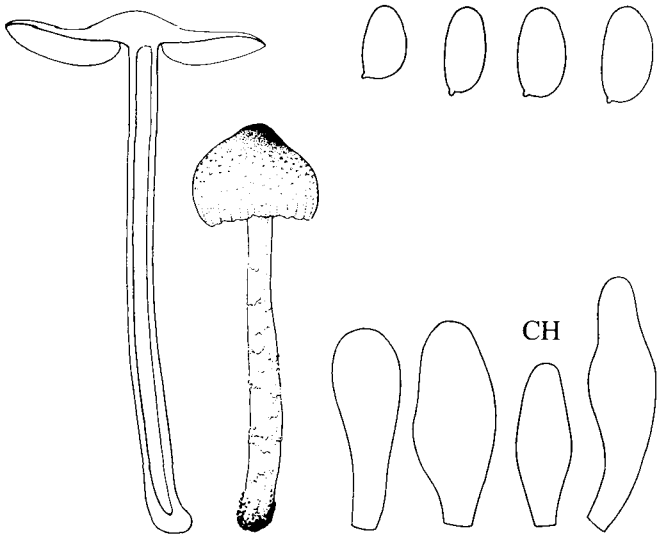

Fig. 89. *Lepiota xanthophylla*.

MISAPPL. – *Lepiota citrophylla* sensu Boud. in Bull. Soc. mycol. Fr. 9: pl. 2, fig. 1. 1893; sensu Rea, Brit. Basidiomyc.: 72. 1922.

SEL. ICON. – Imaz. & Hongo, Col. Ill. Mushr. Japan 1: pl. 41, fig. 280. 1987; Rald et al. in Svampe 26: 38. 1992; Tabarés in Bolets Catalunya 10: pl. 480. 1991; Vellinga & Huijser in Boll. Gruppo micol. G. Bres., n.S. 40 (2-3): fig. 1. ('1997') 1998.

SEL. DESCR. & FIGS. – Kelderman, Parasolzw. Zuid-Limburg: 124-125. 1994; P.D. Orton in Trans. Br. mycol. Soc. 43: 289-290. 1960; Rald et al. in Svampe 26: 38. 1992; D. Reid in Fung rar. Ic. col. 3: 10-12, fig. 6. 1968; Vellinga & Huijser in Boll. Gruppo micol. G. Bres., n.S. 40 (2-3): 458-460, fig. 2. ('1997') 1998.

VERN. NAME – Geelplaatparasolzwam.

Pileus 10-30(-40) mm, when young hemispherical, campanulate with inflexed margin, expanding to plano-convex with umbo and undulating limb, and deflexed margin, at centre brown (Mu. 10 YR 3/4) with pointed fibrillose squamules, around centre paler brown (10 YR 5/6) with more adnate fibrils, at outermost margin revealing the yellow context between them, when young with some yellowish velar remnants at margin. Lamellae, L = c. 60, l = 1-3, moderately crowded, distinctly free, subventricose to 5 mm broad, yellow (more green than 5 Y 8/6) with pale uneven edge. Stipe 35-60 × 3-5 mm, slightly broadening downwards, hollow, pale sulphur-yellow (slightly more greenish than 5 Y 8/6-8, resembling K. & W. 1A5), at apex slightly fibrillose, below irregularly woolly, in lower half or at base only with small, incomplete bands of brown squamules on heightened yellow woolly background, without real annulus, but with a low rim. Context yellowish cream in pileus, in stipe yellowish to distinctly yellow at base, whitish fibrillose around cavity. Smell of intact basidiocarps indistinct, slightly astringent, when basidiocarp cut strong, like *L. cristata*. Taste not known. Spore print white (when fresh).

Spores (6.0-)6.5-9.0(-10,0) × (3.5-)4.0-5.0 µm, Q = (1.4-)1.6-2.0, Qav = 1.7-1.9, oblong, often with less convex adaxial than abaxial side in side-view, giving the spores a slight amygdaliform appearance, oblong in frontal view, dextrinoid, congophilous, not metachromatic in Cresyl Blue. Basidia (17-)20-30 × (6.5-)7-9.5(-10.5) µm, mostly 4-spored, but often also some (3-)2(-1) spored basidia present. Lamella edge sterile. Cheilocystidia (15-)20-35(-40) × (5.0-)6.5-12(-14.5) µm, often clustered, narrowly lageniform, narrowly utriform, narrowly clavate to cylindrical, rarely clavate, hyaline with slightly thickened walls. Pleurocystidia absent. Pileus covering made up of more or less erect, long elements (more erect at pileus centre, more adnate towards margin), (120-)150-400(-490) × 5.0-15 µm, flexuous in lower part, with slightly thickened, yellow-brown walls, becoming thinner and paler towards apex, also with pigment soluble in ammonia, intermixed with pale coloured, narrowly clavate, clavate and spheropedunculate elements, 22-80(-105) × (7.5-)10-25 µm, sometimes encrusted in lower part; lower lying hyphae sometimes encrusted. Stipitipellis a cutis of colourless, cylindrical elements, 2.5-6.0 µm in diameter, with velar hyphae in lower part of stipe, cylindrical, irregular and flexuous, 2.5-10 µm in diameter, colourless, or with encrusting colourless pigments; squamules made up of elements similar to those of pileus covering, but shorter. Clamp-connections present in all tissues.

HABITAT & DISTR. – Gregarious and saprotrophic, terrestrial on humus-rich, nutrient-rich, clayey, probably calcareous soils, in deciduous woods. In the Netherlands very rare, only known from some localities in southern Limburg (Valkenburg, Schaelsberg; Cadier en Keer, Riesenberg and Örenberg; Margraten, Eijsderbos; Elsloo, Bunderbos). Sept.-Oct. Scattered and rare in temperate Europe, from Denmark southwards, also known from Japan.

The name *Lepiota xanthophylla* has been erroneously used for *L. elaiophylla* Vellinga & Huijser, a toxic species growing in Europe in hothouses, with more olive tinges in the basidiocarps, and a different structure of the pileus covering.

12. Lepiota echinella Quél. & Bern. in Bull. Soc. mycol. Fr. 4: LI. 1888 (as *Lepoita echinellus*). – Fig. 90.

Lepiota minuta J. Lange in Dansk bot. Ark. 4 (4): 48. 1923, non *Lepiota minuta* Vogl., 1896; *Lepiota setulosa* J. Lange, Fl. agar. dan. 1: 34. 1935. – *Lepiota rhodorhiza* (Romagn. & Locq.) Locq. in Bull. mens. Soc. linn. Lyon 14: 98. 1945 (not valid); *Lepiota rhodorhiza* (Romagn. & Locq.) ex P.D. Orton in Trans. Br. mycol. Soc. 43: 285. 1960.

EXCL. – *Lepiota echinella* sensu Huijsman in Meded. Ned. mycol. Vereen. 28: 22. 1943 (= *Lepiota* spec.)

VERN. NAME – Piekhaarparasolzwam.

Although numerous species in the vicinity of *Lepiota echinella* have been described, it is still possible to make a collection which does not fit in any of them. After an overview of this species complex, two varieties of *L. echinella* are described.

There appears to be huge variation in the main characters used to distinguish species in the vicinity of *Lepiota echinella*: spore size, shape of the cheilocystidia and the length and structure of the elements of the pileus covering. Short characteristics of the existing species are given in the following overview, which is a compilation of literature on the existing names; the problems in interpretation of some names are outlined. Bon (Fl. mycol. Eur. 3, Lépiotes: 68-77. 1993) in his treatment of this group, emphasized colour of the basidiocarps, while here priority is given to microscopical characters.

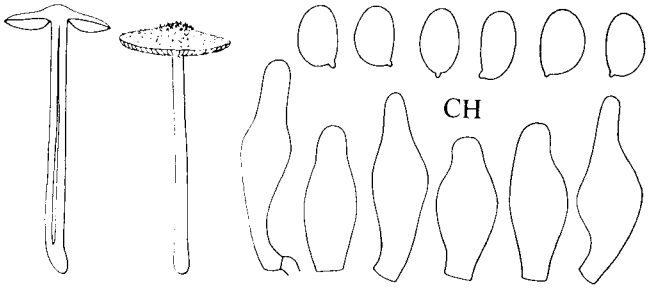

Fig. 90. *Lepiota echinella*.

Lepiota lepida Guinb. & Bodin (in Doc. mycol. 23 (92): 61. 1994) comes very close to *L. echinella*; the spores are slightly bigger (on average 6.6-7.0 × 3.8-4.3 µm), and the shape of the cheilocystidia is more varied than in *L. echinella*: not only lageniform but also more cylindrical cystidia occur; a septum might occur in the pileus covering elements, which are long and slender. *Lepiota bickhamensis* P.D. Orton (in Notes R. bot. Gdn Edinb. 41: 588. 1984) is probably identical with *L. lepida*, though it lacks septa in the pileus covering elements. Basidiocarps have been found, fitting *L. lepida* as regards pileus covering elements and spore size, but with cheilocystidia that are predominantly clavate, and only a few being widest in the middle.

Lepiota clypeolarioides Rea (Brit. Basidiomyc.: 69. 1922) is macroscopically different from all other species in this group, resembling *L. clypeolaria*, but with ellipsoid spores. A modern photograph of its var. *armillata* Bon et al. is provided by Migliozzi & Cherubini (in Boll. Ass. micol. ecol. Romana 17: 27. 1989). This species is subject to various interpretations. Kühner (in Bull. trimest. Soc. mycol. Fr. 52: 228-229. 1936) described specimens from Algeria. Huijsman (in Meded. Ned. mycol. Vereen. 28: 25-27. 1943) used the name *L. clypeolarioides* for an alcohol collection of *L. felina*, and named Kühner's collection *L. kuehneri*. As this was not a valid description of a new species, Hora (in Trans. Br. mycol. Soc. 43: 448. 1960) described *L. kuehneri* with a Latin diagnosis and designated a type collection, which got lost. Bon (in Doc. mycol. 26 (102): 21-23. 1996) designated Kühner's collection (actually made by Maire) as neotype. Unfortunately, Bon's measurements of the spores of this neotype ((4.5-)5-6(-7) × (3-)4-4.5(-5) µm) differ considerably from the present author's (6.0-7.5 × 3.5-4.0 µm, avl × avw = 6.6 × 3.8 µm). Kühner (and Hora for the British type) gave as spore sizes intermediate values: 5.5-7 × 3.2-4 µm. *Lepiota kuehneri* might well be conspecific with *L. lepida*, but perhaps is better considered a nomen dubium.

Lepiota coxheadii P.D. Orton (in Notes R. bot. Gdn Edinb. 41: 589. 1984 (as *L. coxheadi*)) is characterized by spores 6.0-7.5 × 3.5-4.0(-4.5) µm, Q = 1.6-1.9, Qav = 1.71, narrowly lageniform to cylindrical-clavate cheilocystidia, and in contrast to *L. echinella*, *L. lepida* and *L. bickhamensis*, relatively short elements in the pileus covering (80-135 × 10-14 µm). Specimens with short spores (5.5-6.5 × 3.0-4.0 µm, avl × avw = 6.0 × 3.4 µm), and relatively short elements in the pileus covering have been encountered in the Netherlands, but whether they belong to *L. coxheadii* is not clear, as colours and sizes of the basidiocarps do not fit with the concept of *L. coxheadii*.

Lepiota favrei Kühner ex M. Bon (in Doc. mycol. 22 (88): 29. 1993) is a pale, small species with spores 6-8.5 × 4-5 µm and 'mummy-shaped' cheilocystidia, described from alpine habitats on calcareous soil (for a full description see Favre, Champ. sup. Zone alpine: 157-158, fig. 143. 1955 (as *L. pseudohelveola*)).

Lepiota glareophylla Fillion (in Bull. Féd. mycol. Dauph. Savoie 144: 7. 1997) is a species with very small basidiocarps (pileus 8-12 mm), pale yellow-brown colours and darker brown squamules, big spores (11-12(-12.5) × 6.0-7.0(-7.5) µm) and a pileus covering made up of relatively short and wide elements of all lengths ((35-)50-120(-160) × 10-15(-20) µm).

Another small species with a rather irregular pileus covering is *L. locquinii* M. Bon (in Doc. mycol. 16 (61): 20. 1985); the pileus measures 1-2 cm, and the spores are smaller than in *L. glareophylla*: 6.5-8.0 × 3.5-4.5 µm; the layers of the pileus covering are not clearly separated causing the irregular look (the sketch given by Bon (Fl. mycol. Eur. 3, Lépiotes: 69. 1993) is misleading in this respect). Specimens with such an irregular pileus covering have been encountered in the Netherlands, but they were much bigger and darker brown or more pink coloured than *L. locquinii* in the original description, and the cheilocystidia were lageniform (instead of clavate to flexuous). Kelderman (Parasolzw. Zuid-Limburg: 115. 1994) gave a description of such a collection.

Lepiota speciosa (Trimb.) Trimb. & Augias (in Trimbach in Doc. mycol. 18 (72): 50. 1988), first described as a variety of *L. rhodorhiza* (Trimbach in Doc. mycol. 5 (20): 45. 1975), differs from *L. echinella* in the big basidiocarps (stipe up to 90 × 6 mm), with copious veil on the stipe, the big spores (6-7.5(-8) × 3-4.5 µm), and the clavate to lageniform cheilocystidia.

KEY TO THE VARIETIES

1. Stipe without any (red to vinaceous pink) strigae at base **12a. var. echinella**
1. Stipe red to vinaceous pink strigose at base . . . **12b. var. rhodorhiza**

12a. var. **echinella**

EXCL. – *Lepiota setulosa* sensu Kühner in Bull. trimest. Soc. mycol. Fr. 52: 224-226. 1936 (= var. *rhodorhiza*).

SEL. ICON. – Migl. & Coccia in Micol. ital. 19 (3): 9. 1990.

SEL. DESCR. & FIGS. – Migl. & Coccia in Micol. ital. 19 (3): 6-8, fig. 2. 1990.

Pileus 5-28 mm, convex to plano-convex, applanate with low umbo, sometimes slightly undulating around centre, at centre dark (red)brown (Mu. 7.5 YR 3/2, 4/4), and plush-like with little upright tufts, around centre gradually breaking up into small granular patches, or small squamulose floccules, concolorous with centre, or paler towards margin (e.g. 7.5 YR 5/4), on cream to pale pinkish background. Lamellae, L = 30-35, l = 1-3, moderately distant to crowded, free, segmentiform to ventricose, up to 2 mm wide, cream-coloured, rarely creamy white, with white or concolorous eroded to flocculose edge. Stipe 17-35 × 1-3 mm, cylindrical, sometimes slightly widening towards subbulbous base, fistulose, whitish fibrillose in upper part, lower down more irregularly woolly fibrillose and more pinkish brown, without real annulus, but at base sometimes with some bands of squamules, concolorous with pileus. Context white in pileus, in stipe concolorous with surface and reddish in lower part. Smell very variable, indistinct, fungoid, unpleasant or like the smell of *L. cristata*. Taste as smell. Spore print probably white.

Spores 4.5-6.5 × 3.0-4.0 µm, Q = 1.4-2.0, Qav = 1.55-1.8, ellipsoid to oblong in side-view, in maturity dextrinoid, congophilous, cyanophilous, and not metachromatic in Cresyl Blue. Basidia 15-23 × 6.0-8.0 µm, predominantly 4-spored. Lamella edge sterile. Cheilocystidia 15-33 × 6-12 µm, with 2.0-5.5(-6.5) µm wide neck, lageniform to utriform, with short to long neck, hyaline and slightly thick-walled. Pleurocystidia not observed. Pileus covering made up erect, long, cylindrical elements in tufts, 185-300 × 8-12.5 µm and short, narrowly clavate to cylindrical elements, 15-46 × 8.0-10 at base; repent coloured hyphae absent. Pigment especially situated in lower part of long elements, and clavate elements, dark brown, parietal, encrusting sometimes in lower parts of long elements and underlying hyphae. Stipitipellis a cutis of narrow, 2-4 µm wide cylindrical hyphae, with in lower part loosely attached, irregular hyphae with brown parietal pigment. Clamp-connections present in all tissues.

HABITAT & DISTR. – Solitary, or in small groups, saprotrophic and terrestrial in deciduous woods, on humus-rich, nutrient-rich sandy to clayey soils. In the Netherlands relatively rare, occurring in the coastal dune area, southern Limburg and some scattered localities, Sept.-Oct. Scattered, rare and widespread in Europe.

Lepiota echinella var. *echinella* forms rather small basidiocarps, which often grow solitary. Thus, the chance of overlooking this taxon in the field is rather great.

12b. var. **rhodorhiza** (P.D. Orton) Hardtke & Rödel in Mykol. Mittbl. 35: 62. 1992.

Lepiota setulosa var. *rhodorhiza* Romagn. & Locq. in Locq. in Bull. trimest. Soc. mycol. Fr. 60: 38. 1944 (not valid).

MISAPPL. – *Lepiota setulosa* sensu Kühner in Bull. trimest. Soc. mycol. Fr. 52: 224-226. 1936.

SEL. ICON. – Lanzoni & Candusso in Boll. Gruppo micol. G. Bres. 26: 109. 1983.

SEL. DESCR. & FIGS. – Kühner in Bull. trimest. Soc. mycol. Fr. 52: 224-226. 1936 (as *L. setulosa*); Migl. & Coccia in Micol. ital. 19 (1): 13-15, figs. 1 & 2. 1990 (as *L. rhodorhiza*); P.D. Orton in Trans. Br. mycol. Soc. 43: 285-286. 1960.

CHARACTERISTICS – Differs from the typical variety in the sometimes more robust basidiocarps (pileus up to 40 mm, stipe up to 65 × 5 mm), and the presence of a vinaceous pink to red strigose tomentum at base of stipe.

Microscopical characters as in the typical variety.

HABITAT & DISTR. – Gregarious in small groups, saprotrophic and terrestrial on humus-rich, mostly sandy soils, in deciduous woods or avenues with deciduous trees. In the Netherlands very rare, known from a few localities (for instance Archem near Ommen, and Hollandse Rading), Sept.-Oct. In Europe rare, and widespread.

Subsect. **Helveolinae** Bon & Boiffard

Pileus covering made up of long, erect elements, lacking short, clavate elements.

13. Lepiota brunneoincarnata Chod. & Mart. in Bull. Soc. bot. Genève 5: 222. 1889. – Fig. 91.

SEL. ICON. – Kobler in Schweiz. Z. Pilzk. 66: opp. p. 6. 1988; J. Lange, Fl. agar. dan. 1: pl. 13F. 1935 (rather red-brown).

SEL. DESCR. & FIGS. – Derbsch & Schmitt, Atl. Pilze Saarlandes 2: 490. 1987; Kobler in Schweiz. Z. Pilzk. 66: 6. 1988; Schulz-Weddigen in Z. Mykol. 52: 91-100. 1986.

VERN. NAME – Gegordelde parasolzwam.

Pileus 25-55 mm, when young conico-convex, widely campanulate or broadly obtusely conical, expanding to plano-concave or applanate, with low broad umbo or plano-convex with umbo and deflexed margin, at centre dark greyish-brownish to nearly black or very dark to dark vinaceous red-brown, and around centre with concentrical zones of squamules, slightly paler or concolorous with centre (Mu. 7.5 YR 3/2-5/2, 2.5 YR 3/4-4/4, 3/6-4/6), rarely also with centre cracked into squamules, on whitish, cream to vinaceous pink or pinkish buff background; squamules and centre tomentose, often made up of small pyramids. Lamellae, L = 45-55, l = 1-3, rather to moderately crowded, free, ventricose up to 7 mm wide, white to cream, when old often with brownish red spots, with white, slightly eroded edge. Stipe 25-70 × 5-9 mm, cylindrical or slightly broadened or attenuate at base, fistulose, in apical half cream to pinkish cream to brownish-pinkish, lengthwise whitish fibrillose, in lower half with discrete squamules, forming incomplete girdles, concolorous with squamules on pileus on pinkish to brownish-vinaceous pink background, with white mycelium strands at base. Context white to whitish in pileus, yellowish to glassy red-brown in cortex of stipe, in inner part of stipe white and dull. Smell fruity-aromatic to more fungoid. Taste fungoid or unpleasant: rancid and astringent. Spore print 'white'.

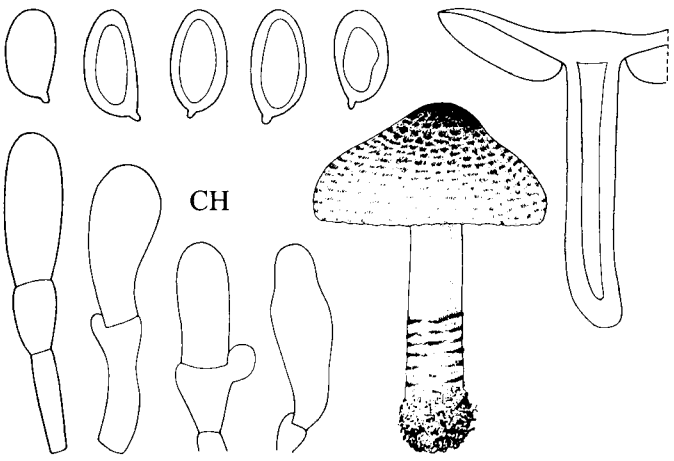

Fig. 91. *Lepiota brunneoincarnata*.

Spores in side-view 7.0-10.0(-11.0) × 4.0-5.0(-6.0) µm, Q = (1.5-)1.6-2.05(-2.15), Qav = 1.7-1.9, oblong, slightly amygdaliform with straight adaxial side, in frontal view oblong, thick-walled, strongly dextrinoid, congophilous; wall not colouring in Cresyl Blue. Basidia 24-42 × 6.5-10.0 µm, predominantly 4-spored, also intermixed 2- and 4-spored (hence longer spores). Lamella edge sterile. Cheilocystidia irregular, often septate, 14-37 × 4.0-10 µm, cylindrical, narrowly clavate, or narrowly utriform. Pleurocystidia not observed. Pileus covered with elements in squamules; elements 90-285 × 8.0-14 µm, not septate, sometimes with attenuate apex with thickened wall; with brown parietal pigment; underlayer of cylindrical twisting cylindrical hyphae with narrowly clavate terminal elements, with brown parietal pigment. Stipitipellis a cutis of cylindrical, non-coloured, 3.0-8.0 µm wide hyphae; elements of squamules like those on pileus. Clamp-connections present in all tissues.

HABITAT & DISTR. – Gregarious or more rarely solitary, terrestrial in mixed deciduous woods, mainly on soils rich in nutrients, which are rather clayey or loamy. In the Netherlands rare and scattered (for a distribution map, see Arnolds et al., Overz. Paddest. Nederland: 288. 1995); June-Oct., but mostly recorded in the summer months. Widespread in Europe, but everywhere rare, absent from the boreal, (sub)alpine and arctic regions.

Lepiota brunneoincarnata is a very toxic species, causing, just as *Amanita phalloides*, severe damage to the liver, which can result in death (e.g. Furia et al. in Micol. ital. 11 (3): 29-33. 1982; Hermann in Mykol. Mittbl. 30: 73-76. 1987, and Schulz-Weddigen in Z. Mykol. 52: 91-100. 1986).

14. Lepiota subincarnata J. Lange, Fl. agar. dan. 5: V. 1940. – Fig. 92.

Lepiota josserandii Bon & Boiff. in Bull. trimest. Soc. mycol. Fr. 90: 289. ('1974') 1975; *Leucoagaricus josserandii* (Bon & Boiff.) Raithelhuber in Metrodiana 17: 75. 1989; *Lepiota subincarnata* var. *josserandii* (Bon & Boiff.) Gminder in Beitr. Kenntn. Pilze Mitteleur. 12: 69. 1999. – *Lepiota josserandii* var. *rosabrunnea* Raithelhuber in Metrodiana 16: 42. 1988.

EXCL. – *Lepiota subincarnata* sensu Johnson & Vilgalys in Mycologia 90: 974-976. 1998 (= *Lepiota* spec.).

MISAPPL. – *Lepiota helveola* sensu Joss. in Bull. trimest. Soc. mycol. Fr. 47: 65-66. 1931.

SEL. ICON. – J. Lange, Fl. agar. dan. 1: pl. 13I. 1935; R. Phillips, Paddest. Schimm.: 29. 1981; Rald et al. in Svampe 26: 39. 1992.

SEL. DESCR. & FIGS. – M. Bon in Doc. mycol. 20 (78): 48, figs. 2I-L. 1990; Derbsch & Schmitt, Atl. Pilze Saarlandes 2: 492. 1987; Enderle & Krieglst. in Z. Mykol. 55: 94-96. 1989; Esteve-Rav. & Altés in Bol. Soc. micol. Madrid 14: 162-163, figs. 1-3. 1990 (as *L.*

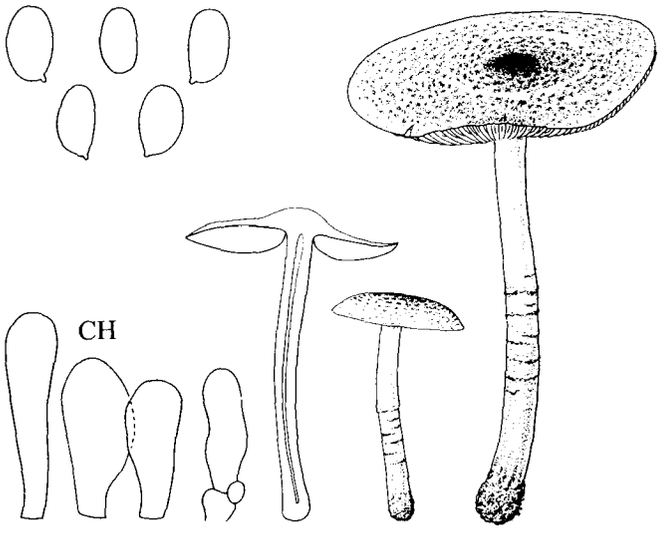

Fig. 92. *Lepiota subincarnata*.

josserandii); Gminder in Beitr. Kenntn. Pilze Mitteleur. 12: 68-70, figs. 6-10. 1999 (as *L. subincarnata* and *L. subincarnata* var. *josserandii* resp.) Kelderman, Parasolzw. Zuid-Limburg: 104-105. 1994; Kühner in Bull. trimest. Soc. mycol. Fr. 52: 223-224. 1936.

VERN. NAME – Vaalroze parasolzwam.

Pileus 17-42(-60) mm, when young hemispherical with inflexed margin, expanding to plano-convex or even plano-concave with broad low umbo and straight margin, at centre vinaceous pink, pinkish red, reddish brown or grey-brown to pink-brown (Mu. 2.5 YR 4/4, 5 - 7.5 YR 4/4, 5/5, 5/4 or 7/4), paler towards margin (7.5 YR 8-7/4, 7/6; 5 YR 8/3-4, 7/6), flocculose or flocculose-squamulose at centre, towards margin either completely tomentose or split up in small, appressed floccose, concentrically or more irregularly arranged, patches or squamules on a cream or pale pinkish cream background, when young with white velar remnants at margin. Lamellae, L = 40-80, l = 0-3, moderately distant to crowded, free, ventricose or subventricose, up to 7 mm broad, white to cream with age, with concolorous to white, entire or finely granular edge. Stipe 15-55 × 1.5-7(-14) mm, cylindrical or slightly broadened at base, fistulose with age, in upper half lengthwise innately striate, pale, cream or pinkish (5 YR 8/3), more or less halfway with girdle of annulus, concolorous with pileus and lower down provided with more girdles or incomplete bands, made up of floccules on a cream, fibrillose background, with white mycelium cords at base. Context in pileus white, slightly pink coloured under surface at centre, dull, in stipe shiny and beige, beige-pink or brownish in cortex, in inner part white and cottony. Smell always with a fruity component and a fungoid or farinaceous component. Taste unpleasant, rather astringent at back of throat. Spore print white.

Spores in side-view (5.5-)6.0-7.5(-8.0) × 3.0-4.0(-4.5) µm, Q = (1.45-)1.5-2.0(-2.3), Qav = 1.65-1.85, oblong or cylindrical with rather straight sides, sometimes uniguttulate, dextrinoid, congophilous, strongly cyanophilous, not metachromatic in Cresyl Blue; hilar appendage inconspicuous. Basidia 17.5-30 × 5.0-8.5 µm, 4-spored, rarely 4- and 2-spored intermixed. Lamella edge sterile. Cheilocystidia usually abundant, rarely inconspicuous and not easily found, 11-37 × 5.0-10 µm, cylindrical, narrowly clavate, clavate, some septate, thin- or slightly thick-walled, colourless. Pleurocystidia absent. Pileus covered with erect elements, 70-400 × 6.0-16 µm, sometimes not surpassing 200 µm; elements cylindrical without attenuate apex or more fusiform with attenuate apex, narrower in basal part, straight, or twisted in lower part, with parietal pigment. The longer elements present at centre of pileus, the smaller ones towards margin. Underlayer well-developed, made up of twisted, cylindrical, repent elements, 4.0-5.0 µm wide, with parietal, brown pigment. Stipitipellis a cutis of cylindrical elements, 3.0-6.0 µm in diam., with encrusting pale pigments; squamules made up of elements as on pileus, but slightly shorter and wider. Clamp-connections present in all tissues.

HABITAT & DISTR. – Gregarious in small groups, saprotrophic and terrestrial on humus- or nutrient-rich sandy to clayey soils, in city-parks, gardens, copses, deciduous or mixed woods and also on mine waste heaps, rather common in the Netherlands, Aug.-Nov. Widespread in Europe, also recorded from North America.

Lepiota subincarnata is, like *L. brunneoincarnata* and *L. elaiophylla*, very toxic (Gérault & Girre in C. r. hebd. Séanc. Acad. Sci., Paris, Sér. D, 280: 2842. 1966), because of the presence of amanitins; it also contains amatoxins.

15. Lepiota elaiophylla Vellinga & Huijser in Boll. Gruppo micol. G. Bres., n.S. 40 (2-3): 462. ('1997') 1998.

MISAPPL. – *Lepiota xanthophylla* sensu Besl et al. in Z. Mykol. 50: 187-188. 1984; sensu Breitenb. & Kränzl., Pilze Schweiz 4: pl. 236. 1995; sensu Migl. et al. in Riv. Micol. 32: 105-107. 1989; sensu Migl. & Bizzi in Micol. ital. 26 (3): 57-58. 1997.

SEL. ICON. – Breitenb. & Kränzl., Pilze Schweiz 4: pl. 236. 1995; Migl. et al. in Riv. Micol. 32: 106. 1989; Migl. & Bizzi in Micol. ital. 26 (3): pl. 3. 1997 (all as *L. xanthophylla*); Vellinga & Huijser in Boll. Gruppo micol. G. Bres., n.S. 40 (2-3): fig. 3. ('1997') 1998.

SEL. DESCR. & FIGS. – Vellinga & Huijser in Boll. Gruppo micol. G. Bres., n.S. 40 (2-3): 462-463, fig. 4. ('1997') 1998.

VERN. NAME – Olijfplaatparasolzwam.

CHARACTERISTICS – Pileus 14-33 mm, with age expanding to plano-convex with or without low umbo, with central velutinous to subtomentose dark orange-brown (Mu. 10 YR 3/4) or reddish-ochraceous brown patch, around the patch breaking up into concentrical, small, arachnoid-subtomentose squamules slightly paler than at centre, on pale olivaceous yellow to pale sulphur-yellow background; lamellae, L = c. 50, l = 1-3, moderately distant to crowded, free, ventricose, olive-yellow, greyish-olivaceous yellow (5 Y 6/4; K. & W. 3A4-3B4, later 3C5-4C5), less grey towards edge; edge yellow and slightly eroded; stipe 32-40 × 2.5-3 mm, cylindrical, hollow, in upper part subglabrous to lanate-fibrillose and olive-yellow, with a brown ring-like zone, and below this zone with bands of small brownish squamules, as on pileus, on more lanate covering; context pale sulphur-yellow to olive-yellow brownish in pileus (paler than 5 Y 8/4), darker olive-yellow (5 Y 6/4) in stipe; smell unpleasantly fungoid; spore print yellow-cream (Breitenbach & Kränzlin, Pilze Schweiz: pl. 236. 1995).

Spores 6.5-9.5 × 3.5-4.5 µm, Q = 1.75-2.25(-2.4), Qav = 1.9-2.2, oblong, subcylindrical in side-view, dextrinoid, congophilous, not metachromatic in Cresyl Blue; basidia 18-35 × 6.0-9.5 µm, 4-spored; cheilocystidia 15-40(-48) × 5.0-12 µm, narrowly clavate to clavate, disappearing with age; pileus covering made up of more or less erect elements, 60-265 × 6.5-18 µm, with brownish parietal and intracellular pigments, lacking a layer of clavate, short elements; clamp-connections present in all tissues.

HABITAT & DISTR. – In small groups, saprotrophic and terrestrial, until now only known from greenhouses in Europe together with cultivated plants; in the Netherlands known from pots with *Spathiphyllum* in a commercial greenhouse (Uithoorn), and from a hothouse in a botanical garden (Leiden). Aug.-Oct.

European authors called this taxon *Lepiota xanthophylla* (or *L. citrophylla*), but the former is a species with browner pileus, more yellow lamellae, and with a layer of clavate elements in the pileus covering (see Vellinga & Huijser in Boll. Gruppo micol. G. Bres., n.S. 40 (2-3): 460-462. ('1997') 1998. for a discussion on this species), and *L. citrophylla* has spurred spores (Pegler, Agaric Fl. Sri Lanka: 305. 1986).

Lepiota elaiophylla is highly toxic, and contains α-amanitin and β-amanitin (Besl et al. in Z. Mykol. 50: 190. 1984).

16. Lepiota rubella Bres. in P. Henn. in Verh. bot. Ver. Prov. Brandenb. 31: 149. 1890.

Lepiota bettinae Dörfelt in Z. Mykol. 48: 246. 1982; *Echinoderma bettinae* (Dörfelt) M. Bon in Doc. mycol. 22 (88): 28. 1993.

EXCL. – *Lepiota rubella* sensu M. Bon, Fl. mycol. Eur. 3, Lépiotes: 81. 1993 (= *Lepiota* spec.).

SEL. ICON. – Breitenb. & Kränzl., Pilze Schweiz 4: pl. 215. 1995 (as *L.* aff. *bettinae*); Migl. & Coccia in Boll. Ass. micol. ecol. Romana 18: 7. 1990 (as *L. bettinae*).

SEL. DESCR. & FIGS. – Babos in Agarica 6 (12): 204-205. 1985; Contu in Micol. ital. 15 (3): 52-53. 1986; Dörfelt in Z. Mykol. 48: 245-251. 1982; Migl. & Coccia in Boll. Ass. micol. ecol. Romana 18: 5-11. 1990 (all as *L. bettinae*); Vellinga et al. in Sydowia 50: 272-277. 1998.

VERN. NAME – Rode dwergparasolzwam.

CHARACTERISTICS – Pileus 6-10 mm, rounded conical when young, expanding to plano-concave, often with small umbo, set with hairy lilacinous-purplish squamules, densely set at centre, more scattered near margin, on whitish background, with fimbriate margin; lamellae, L = 23-27, l = 3(-7), rather crowded, free, ivory white and becoming yellowish, with whitish edge; stipe 8-14 × 0.7-1 mm, tapering towards apex, whitish at apex, pinkish-lilacinous to slightly brownish at base, entirely pubescent, rarely with floccose dark purplish annular zone, in lower part with scattered minute purplish brown flocculi; context whitish in pileus, brownish-lilacinous in stipe; smell of bruised basidiocarps acid spermatic.

Spores 3.5-5.0 × 2.5-3.0 µm, Q = 1.6-1.8(-2.0), Qav = 1.7, oblong in side-view and in frontal view; basidia 11-14 × 4.5-6.5 µm, 4-spored; lamella edge sterile; cheilocystidia 15-22 × 5.0-6.5 µm, narrowly clavate; pleurocystidia absent; pileus covering made up of very thick-walled, brown hyphae, 5-7 µm wide, with walls up to 2 µm thick, with terminal elements hardly widened to distinctly clavate, up to 17 µm wide; clamp-connections present in all tissues.

HABITAT & DISTR. – Gregarious in big groups, saprotrophic and terrestrial, in hothouses. Known from several (botanical) gardens in Europe, and there the whole year through. The natural distribution area is tropical America.

For an elaborate discussion on the synonymy of *Lepiota rubella* and *L. bettinae*, see Vellinga et al. (in Sydowia 50: 272-278. 1998).

17. Lepiota parvannulata (Lasch: Fr.) Gillet, Hyménomycètes: 66. 1874. – Fig. 93.

Agaricus parvannulatus Lasch in Linnaea 3: 156. 1828; *Agaricus parvannulatus* Lasch: Fr., Syst. mycol., Ind. gen.: 34. 1832.

Fig. 93. *Lepiota parvannulata* (habit del. P. Kelderman).

SEL. ICON. – Candusso & Lanzoni, Lepiota: pl. 25b. 1990.

SEL. DESCR. & FIGS. – Kelderman in Coolia 34: 52-53, fig. 2. 1991; Kühner in Bull. trimest. Soc. mycol. Fr. 52: 218-219. 1936.

VERN. NAME – Witte dwergparasolzwam.

Pileus 5-25 mm, convex with low umbo, ochraceous with reddish tinge at centre, cream-coloured to white at margin, completely covered in woolly-tomentose fibrils, with some toothed velum remnants at margin. Lamellae, L = 20-28, l = 1-3, crowded, free, subventricose, white to slightly cream-coloured, with even concolorous edge. Stipe 11-25 × 0.7-3 mm, cylindrical or slightly broadened at base, fistulose, white, with annulus, below annulus with some ochraceous fibrils on white to cream background. Annulus ascending, white, fragile and membranaceous. Context white, in basal part of stipe becoming brownish with age.

Spores 3.5-4.5 × 2.0-3.0 µm, Qav = 1.7, non-dextrinoid, not congophilous, not metachromatic in Cresyl Blue, uninucleate. Basidia 14-20 × 5.0-6.6 µm, 4-spored. Lamella edge fertile. Cheilocystidia absent. Pleurocystidia absent. Pileus covering made up of repent to ascending hyphae with terminal elements non- or up to 2-septate (without clamp-connections at the septa), 170-300 × 5-6.5 µm, without pigment. Clamp-connections present in all tissues.

HABITAT & DISTR. – Solitary to gregarious, saprotrophic and terrestrial in a nutrient-rich, relatively warm part of a wooded slope. In the Netherlands very rare, recorded only once from one locality in southern Limburg (Valkenburg, Schaelsberg), Sept. Known from only a very few finds throughout central and mediterranean Europe.

The above description has been based on the selected descriptions cited.

The spores of this taxon are uninucleate, while most *Lepiota*-species have binucleate spores. The absence of chemical reaction of the spore wall in Melzer's Reagent and Congo Red is also a striking character of this species.

Lepiota nigrescentipes G. Riousset (in Bon & G. Riousset in Doc. mycol. 22 (85): 67-68. 1992) comes very close to *L. parvannulata*, has also uninucleate spores with the same kind of chemical reactions, but differs in the stipe which blackens with age.

Lepiota parvannulata resembles white *Leucoagaricus*-species like *L. serenus* (Fr.) Bon & Boiffard and *L. sericifer* (Locq.) Vellinga, but the presence of numerous clamp-connections makes it unlikely that this taxon belongs to that genus. Spores of *Leucoagaricus*-species are binucleate.

Sect. **Fuscovinaceae** Bon & Candusso

Clamp-connections absent; elements of pileus covering articulate and cylindrical, repent to ascending.

18. Lepiota fuscovinacea Møller & J. Lange in J. Lange, Fl. agar. dan. 5: V. 1940. – Fig. 94.

Lepiota fuscovinacea Møller & J. Lange in J. Lange, Fl. agar. dan. 1: 33. 1935 (not valid).

SEL. ICON. – Breitenb. & Kränzl., Pilze Schweiz 4: pl. 224. 1995; Enderle & Krieglst. in Z. Mykol. 55: between p. 64 and p. 65. 1989; J. Lange, Fl. agar. dan. 1: pl. 13H. 1935; D. Reid in Fung. rar. Ic. col. 2: pl. 10a. 1967.

SEL. DESCR. & FIGS. – Kühner in Bull. trimest. Soc. mycol. Fr. 52: 220-221. 1936; D. Reid in Fung. rar. Ic. col. 2: 8-9. 1967.

VERN. NAME – Purperbruine parasolzwam.

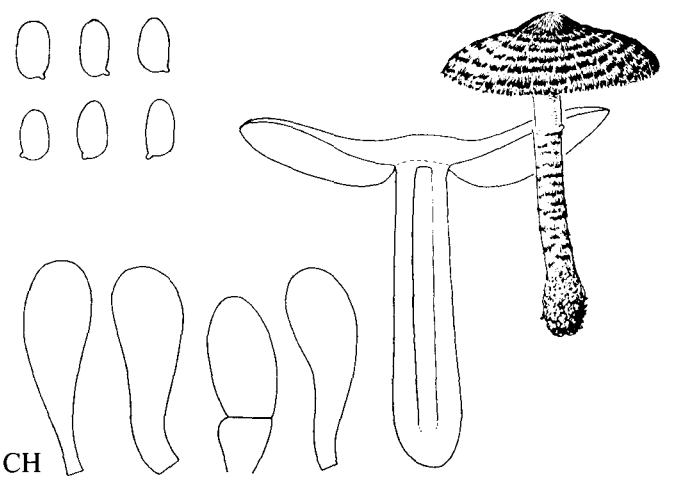

Fig. 94. *Lepiota fuscovinacea*.

Pileus 17-42 mm, when young bluntly conical, expanding to more or less applanate or plano-convex with broad prominent, wide umbo to plano-concave with low umbo and undulating margin, with fibrillose-lanate tomentose covering, in centre with uplifted squamules, towards margin more appressed fibrillose, showing the background, sordid grey-pink to dark purplish, purplish grey or dark reddish brown porphyraceous (Mu. 7.5 - 10 YR 3/2; K. & W. 6E5-4) nearly blackish with age at centre, towards margin slightly paler on pale pinkish background (10 YR 7/3 - 6/4, 7B4), when young with velar remnants at margin. Lamellae, L = 50-80, l = 1-3, very crowded, free, subventricose or with straight edge, up to 4 mm broad, white-cream to cream-coloured, with age brown spotted or sordid pale yellow-brown (10 YR 8-7/4), with white fimbriate edge. Stipe 20-55(-95) × 3-11 mm, cylindrical or slightly broadened towards straight or subbulbous base, hollow with age, in apical part pale pinkish cream to pale pinkish or sordid cream (10 YR 8/4 - 7/3, 5A2) and innately fibrillose, rather glabrous, lower down with or without distinct annular zone and in lower half or 3/4 with zones and bands of tomentose squamules, concolorous with covering of pileus on cream-coloured background, with basal white tomentum, and white rhizoids. Context in pileus white to off-white or with pinkish tinge, in stipe at first also cream, discolouring in cortex to grey-brown. Smell fruity or sweetish fungoid, or earth-like and unpleasant, slightly like the smell of *L. cristata*. Taste indistinct. Spore print white to cream.

Spores (3.5-)4.0-6.5(-7.0) × 2.0-3.3(-3.5) µm in side-view, Q = (1.5-)1.75-2.3(-2.75), Q = 1.9-2.15, oblong to cylindrical, a very few slightly allantoid, dextrinoid, congophilous, not metachromatic in Cresyl Blue, often in tetrads, uninucleate. Basidia (12.5-)13.5-22 × 4.0-7.0 µm, 4-spored. Cheilocystidia 13-45 × 6-15 µm, abundant, cylindrical, narrowly clavate or clavate, often uniseptate. Pleurocystidia not observed. Pileus covering made up of radial, loosely arranged, appressed to ascending, inflated to cylindrical, septate hyphae, 5.0-20 µm in diam., slightly thick-walled, with terminal elements with rounded or acute apex; pigment brown, soluble in ammonia. Stipitipellis a cutis made up of cylindrical, colourless to yellowish, 4.0-6.0 µm wide hyphae, with in lower part of stipe a covering with elements like those of pileus covering. Clamp-connections absent.

HABITAT & DISTR. – Solitary or in small groups, saprotrophic and terrestrial on loamy to clayey soils, rich in nutrients and humus, in deciduous and coniferous woods and plantations, also found on mine waste heaps. In the Netherlands rare and mostly in the western clayey-peat regions, the river area and southern Limburg, very rare elsewhere (for a distribution map, see Arnolds et al., Overz. Paddest. Nederland: 288. 1995). Aug.-Oct. Not common in the rest of Europe.

Lepiota fuscovinacea is unique within the genus on account of the combination of the following characters: absence of clamp-connections, uninucleate spores, and a pileus covering made up of repent hyphae.

Sect. **Stenosporae** (J. Lange) Kühner

Spores cylindrical with a straight or rounded bottom, which in most cases is elongated into a distinct spur; pileus covering not hymeniform, but made up of adnate, ascending or erect long and slender elements; clamp-connections present.

N.B. Spore width measured in middle of spores.

19. Lepiota castanea Quél. in C. r. Ass. franç. Av. Sci. (Reims, 1880) 9: 661. 1881 (Champ. Jura Vosges Suppl. 10). – Fig. 95.

Lepiota ignicolor Bres., Fungi trident. 2: 3. 1892; *Lepiota ignipes* Locq. in Bull. mens. Soc. linn. Lyon 14: 59. 1945 (not valid); *Lepiota ignipes* Locq. ex M. Bon in Doc. mycol. 8 (30-31): 70. 1978.

EXCL. – *Lepiota castanea* sensu Pilát in Acta Mus. natn. Prag. 11B (2): 3-5. 1955 (= probably *L. boudieri*).

MISAPPL. – *Lepiota fulvella* sensu Alessio in Micol. ital. 21 (3): 16-20. 1992.

SEL. ICON. – M. Bon in Fung. rar. Ic. col. 11: pl. 84, fig. 2. 1979 (as *L. ignicolor*); Breitenb. & Kränzl., Pilze Schweiz 4: pl. 219, 228. 1995 (as *L. castanea* and *L. ignicolor* resp.); Candusso & Lanzoni, Lepiota: pl. 18. 1990; Kühner in Bull. trimest. Soc. mycol. Fr. 53: Atlas pl. 74-2. 1937; Lanzoni & Candusso in Boll. Gruppo micol. G. Bres. 26: 101. 1983; R. Phillips, Paddest. Schimm.: 29. 1981; Rald et al. in Svampe 26: 39. 1992; D. Reid in Fung. rar. Ic. col. 6: pl. 43b. 1972.

SEL. DESCR. & FIGS. – Enderle & Krieglst. in Z. Mykol. 55: 53-55, and 73-75 (as *L. ignicolor*). 1989; Horak in Boll. Gruppo micol. G. Bres. 26: 90-92. 1983 (as *L. ignicolor*); Kelderman, Parasolzw. Zuid-Limburg: 78-79, 88-89, and 90-91. 1994 (resp. as *L. castanea*, *L. ignicolor*, and *L. ignipes*); Mal. & Bert., Fl. Champ. sup. Maroc 1: 130. 1970 (as *L. ignipes*); Migl. & Clericuzio in Micol. Veget. medit. 4: 36, 38. 1989 (as *L. ignicolor*); D. Reid in Fung. rar. Ic. col. 6: 11-14. 1972.

VERN. NAME – Kastanjeparasolzwam, incl. Vuurparasolzwam.

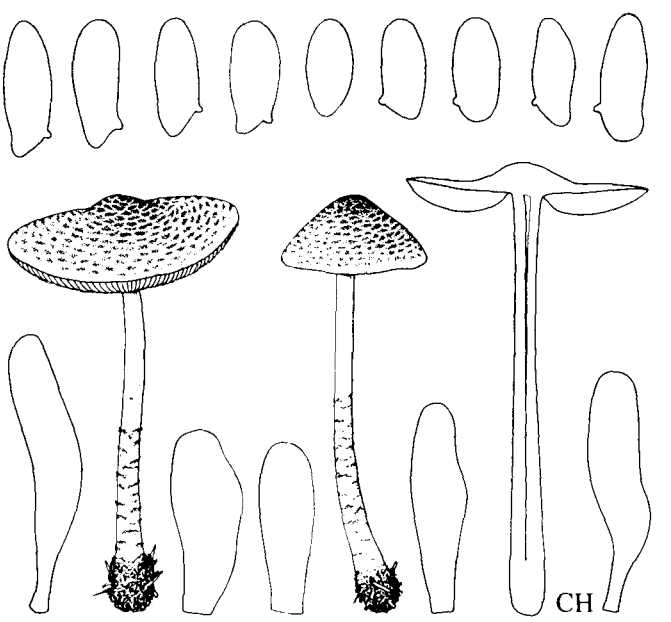

Fig. 95. *Lepiota castanea*.

Pileus 6-40 mm, campanulate or paraboloid when young, expanding to plano-convex, often with (broad) umbo, when young equally dark red-brown, red-brown, orange-brown (e.g. Mu. 5 YR 2.5/2, 5-7.5 YR 3/4, 5 YR 4/6, c. 5 YR 5-6/8 at centre and when young, later and towards margin 5 YR 4/6, 7.5 YR 4-5/6) and velvety-tomentose with uplifted squamules, with age breaking up in smaller patches or squamules, often in concentrical zones and towards margin more radially fibrillose, pallescent towards margin, on predominantly white or pale background (7.5 YR 7/8-8/6, 5 YR 7/8), or not or hardly showing the underlying context at all, with age often orange discolouring, sometimes with some white velar remnants at margin, and margin exceeding lamellae, especially when young. Lamellae, L = 25-40, l = 1-5, moderately distant to moderately crowded, free, ventricose, up to 6 mm wide, white at first, later cream, often with orange sheen (e.g. 10 YR 8/5) and with age orange-spotted, with white fine-flocculose edge. Stipe 22-65 × 1-6 mm, cylindrical, subbulbous at base, often curved in basal part, narrowly fistulose, at apex (1/4 to 1/3 of length) cream or pale pinkish cream-coloured and lengthwise adnate-fibrillose, without, rarely with, annulus, below this zone with fibrillose to squamulose covering, concolorous with squamules on pileus on shiningly white to slightly paler or yellowish-reddish, pinkish orange, pale red-brown or orange-brown (5 YR 5/6, 6-5/8) background, often staining orange when touched, sometimes orange-brown strigose at base, often with white mycelial cords at base. Annulus rarely present, small and woolly. Context whitish cream in pileus and in stipe apex, lower down in stipe concolorous with surface and often becoming vivid orange with age. Smell fruity, like the sweet component of the *L. cristata* smell. Taste mild, fungoid. Spore print white.

Spores in side-view 7.0-14.0(-15.5) × 3.0-5.5 µm, Q = (1.85-)2.0-3.0(-3.3), Qav = 2.15-2.9, more or less cylindrical, with especially in the longer spores a distinct sac-like spur, which protrudes from abaxial side, rarely with suprahilar depression, with patent hilar appendage, in frontal view, (sub)cylindrical, thick-walled, uniguttulate or not, strongly dextrinoid, congophilous, not metachromatic in Cresyl Blue. Basidia 19-32 × 6-10 µm, 4-spored, rarely intermixed 2-spored. Lamella edge sterile. Cheilocystidia 19-41 × 5-10 µm, fusiform, narrowly utriform, narrowly clavate, or cylindrical with subcylindrical apex, colourless, rarely thick-walled. Pleurocystidia absent. Pileus covering made up of erect cylindrical elements, 55-330 × 7-22 µm, without or with up to 3 septa, with parietal brown pigment and additionally some pigment soluble in ammonia, with a layer of adnate, cylindrical, flexuous hyphae, 2.0-5.0 µm wide, with narrowly clavate to subcapitate, terminal elements and brown thickened walls. Stipitipellis a cutis, made up of colourless, cylindrical elements, 2.0-4.0 µm wide; elements in squamules shorter, more irregular, more flexuous and more often non-septate than those on pileus; underlayer of irregular, flexuous cylindrical hyphae present. Clamp-connections present in all tissues.

HABITAT & DISTR. – Solitary to gregarious, saprotrophic and terrestrial in deciduous, mixed or coniferous woods, in mossy dune scrub, also on mine waste heaps, on sandy to clayey soils, often rich in humus. In the Netherlands rather common throughout the country, but less common in districts characterized by nutrient-poor sand; Aug.-mid Nov. Widespread in Europe and temperate parts of Asia, also in North America.

Lepiota castanea in the present sense is a variable species, both in macroscopical characters and in microscopical characters like spore size and pileus covering. Some specimens show a more intense orange discoloration when touched or with age than others. The aspect of the pileus, completely brown or showing white context, differs greatly, and depends on the development of the felted underlayer; if this layer is well developed the pileus surface is totally covered; in specimens with a poorly developed underlayer the underlying context shows more clearly. Variants occurring in the dune area are strikingly slender and have a brilliant-white stipe; they also show more white on the pileus than the more sturdy inland types. This dune variant is probably Bon's *L. ignipes*.

The spore sizes differ greatly between collections, from 7.0-9.0 µm in one to 12-14 µm in others. But the range of the spore sizes is a continuum, without separable units. The small-spored collections tend to have less-septate elements in the pileus covering. The number of septa in these pileus elements differs, not only between collections, but also during the growth of the pileus (the number increases with growth) and the number of septa is greater at the pileus centre than at the margin of the pileus. The pigment is situated inside the walls of these elements, and in the walls of the underlying elements, but in addition to this parietal pigment there is often some pigment that is soluble in ammonia.

Horak (in Boll. Gruppo micol. G. Bres. 26: 90-92. 1983) characterized *L. ignicolor* by its small spores, non-septate elements and vacuolar pigment. Unfortunately this combination is not as straightforward as it seems. Specimens with small spores and up to 2 septa in their pileus elements do occur, and so do basidiocarps with big spores, and soluble pigment or with spores over 10 µm long with non-septate elements in the pileus covering.

Migliozzi & Zecchin (in Micol. ital. 26 (2): 11-22. 1997) distinguished three species in this complex: *L. castanea* Quél. sensu stricto, *L. castanea* sensu auct., and *L. ignicolor* Bres., differing in colour, structure of the pileus covering and spore size. In view of the transitions in spore size, the variability in the number of septa and the length of the pileus covering elements, their ideas are not followed here, and *L. castanea* is given in a broad sense.

Lepiota cingulum is closely related to *L. castanea* and is often confused with the latter in the field; for differences see under *L. cingulum*.

Lepiota andegavensis Mornand (in Doc. mycol. 12 (48): 43. ('1982') 1983) comes very close, but that species is characterized by very dark colours on the pileus. Judging from Bon's description (Fl. mycol. Eur. 3, Lépiotes: 54. 1993) the pileus covering resembles that of *L. boudieri*, but that is not the case; the elements are septate and bear only a basal clamp-connection.

Lepiota castanea contains a lower amount of amanitins than the species in *Lepiota* sect. *Ovisporae* subsect. *Helveolinae* (Gérault & Girre in C. r. hebd. Séanc. Acad. Sci., Paris, Sér. D, 280: 2842. 1966).

20. Lepiota cingulum Kelderman in Persoonia 15: 537. 1994. – Fig. 96.

MISAPPL. – probably *Lepiota fulvella* sensu M. Bon in Doc. mycol. 11 (43): 35-36. 1981; sensu M. Bon, Fl. mycol. Eur. 3, Lépiotes: 51. 1993.

SEL. ICON. – Heilmann-Clausen in Svampe 34: 33. 1996.

SEL. DESCR. & FIGS. – Kelderman in Coolia 31: 89-91, fig. 1. 1988 (as *Lepiota* spec.); Kelderman in Persoonia 15: 537-539, fig. 1. 1994; Kelderman in Parasolzw. Zuid-Limburg: 80-81. 1994.

VERN. NAME – Gordelsteelparasolzwam.

Pileus 31-55(-80) mm, when young hemispherical, expanding via broadly campanulate to plano-convex, applanate, with, rarely without, low to prominent, umbo, sometimes a bit undulating around centre, at centre dark brown (Mu. 5 YR 3/4, 5-7.5 YR 3/3, 7.5 YR 4/6, 10 YR 4-3/4), sometimes more pinkish brown (5 YR 4-3/2), felted-tomentose with small uplifted tufts, a bit plush-like (lens); around centre surface splitting up into concentrical zones of adnate to slightly uplifted patches to squamules, those becoming more adnate and radially arranged towards margin, and becoming paler brown than centre on cream, occasionally pinkish cream, background; margin exceeding lamellae. Lamellae, L = 45-60, l = 1-3, moderately crowded to moderately distant, free, rarely almost free and narrowly adnate, ventricose, up to 6.5

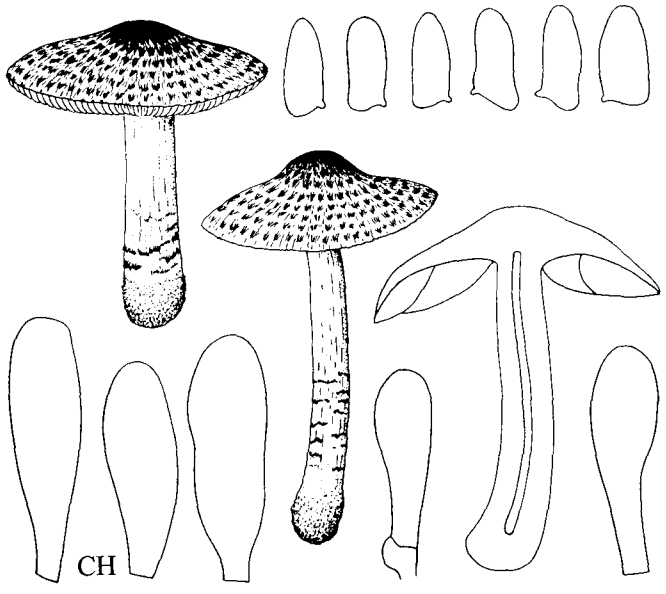

Fig. 96. *Lepiota cingulum*.

mm wide, cream (2.5 Y 8/2) with concolorous or white, finely flocculose (lens) to distinctly floccose edge. Stipe 28-58 × 4-10 mm, slightly broadening towards base, lengthwise innately fibrillose, hollow, at apex whitish to cream with pinkish sheen to pale pink at base, in lower half to 1/3 with distinct girdles of squamules, concolorous with those on pileus. Context whitish to creamy and dull in pileus, in stipe shiny cream in young specimens, later pinkish-brownish to red-brown or brown. Smell indistinct to strong, unpleasant fungoid. Taste fungoid. Spore print white.

Spores (7.5-)8.5-11 × 3.5-4.5(-5.0) µm, Q = 2.0-3.0, Qav = 2.3-2.55(-2.75), with straight or outgrown spur, cylindrical to oblong, with rounded or more acute apex, in frontal view oval, cylindrical, strongly dextrinoid, congophilous, not metachromatic in Cresyl Blue. Basidia 21-39 × 6.0-10 µm, 4-spored, occasionally 2-spored. Lamella edge sterile. Cheilocystidia abundant, 17.5-56 × 7.0-17 µm, rarely much bigger: 48-90 × 10.5-24 µm, narrowly clavate, more rarely clavate, cylindrical or narrowly utriform, slightly thick-walled and colourless. Pleurocystidia absent. Pileus covering made up of erect to ascending, sometimes very twisted, elements, 100-260 × 12-16 µm, up to 400 µm long, with attenuate apex and narrowing into pedicel, without septa, or, more rarely, with up to 2 septa in lower part, with dull brown parietal pigment; underlayer of cylindrical brown-walled, flexuous hyphae present, with narrowly clavate terminal elements. Stipitipellis a cutis, made up of cylindrical, 3.0-10 µm wide hyphae with colourless encrusting pigment; elements of squamules as those on pileus. Clamp-connections present in all tissues.

HABITAT & DISTR. – Solitary or in small to large groups, saprotrophic and terrestrial, on clayey soils, in deciduous and coniferous woods in the western part of the Netherlands and in southern Limburg, also on mine waste heaps, very rare. Aug.-Oct. Rare in Europe, recorded from the Netherlands, France, Denmark, and Great Britain.

Lepiota cingulum resembles *L. brunneoincarnata* in habitus. Both species have relatively sturdy basidiocarps with distinct concentrical zones of squamules on pileus and girdles on the stipe. Young specimens of *L. cingulum* may have a purplish hue. The shape of the spores is the differentiating character: spurred in *L. cingulum*, and ellipsoid in *L. brunneoincarnata*.

Differences with *L. castanea* are to be found in the colours of the basidiocarps: more subdued brown in *L. cingulum* and more vivid orange-brown in *L. castanea*.

21. Lepiota boudieri Bres., Fungi trident. 1: 43. 1884, non *Lepiota boudieri* Guéguen, ('1908') 1909. – Fig. 97.

Lepiota fulvella Rea in Trans. Br. mycol. Soc. 6: 61. ('1917') 1918. – *Lepiota castaneopallida* Damblon & Lambinon in Damblon et al. in Lejeunia 21: 90. ('1957') 1959. – *Lepiota fulvella* f. *gracilis* J. Lange, Fl. agar. dan. 1: 32. 1935 (not valid).

EXCL. – *Lepiota fulvella* sensu M. Bon in Doc. mycol. 11 (43): 35-36. 1981; M. Bon, Fl. mycol. Eur. 3, Lépiotes: 51. 1993 (see note); sensu Alessio in Micol. ital. 21 (3): 16-20. 1992 (= *L. castanea*).

MISAPPL. – *Lepiota acerina* sensu M. Bon in Doc. mycol. 11 (43): 36. 1981; sensu M. Bon, Fl mycol. Eur. 3, Lépiotes: 52. 1993; probably *Lepiota castanea* sensu Pilát in Acta Mus. natn. Prag. 11B (2): 3-5. 1955.

SEL. ICON. – Breitenb. & Kränzl., Pilze Schweiz 4: pl. 216. 1995; Chiari & Forti in Boll. Circ. micol. G. Carini 29-30: centre of issue. 1995; J. Lange, Fl. agar. dan. 1: pl. 12D, 12F. 1935 (as *L. fulvella*); Krieglst. in Z. Mykol. 51: opp. p. 132. 1985 (as *L. fulvella*); Kühner in Bull. trimest. Soc. mycol. Fr. 53: Atlas pl. 74-I. 1937 (as *L. fulvella*); Patanè in Schweiz. Z. Pilzk. 68: 223. 1990 (as *L. fulvella*); R. Phillips, Paddest. Schimm.: 29. 1981 (as *L. fulvella*).

SEL. DESCR. & FIGS. – Chiari & Forti in Boll. Circ. micol. G. Carini 29-30: 33-35. 1995; Kelderman in Coolia 31: 40-41, fig. 1. 1988; Kühner in Bull. trimest. Soc. mycol. Fr. 52: 234-236. 1936 (as *L. fulvella*); Patanè in Schweiz. Z. Pilzk. 68: 222-224. 1990 (as *L. fulvella*); Vellinga & Huijser in Persoonia 15: 237-239, fig. 6. 1993.

VERN. NAME – Oranjebruine parasolzwam.

Pileus 20-65 mm, when young hemispherical or (conico-)campanulate with inflexed margin, expanding to convex, plano-convex, applanate,

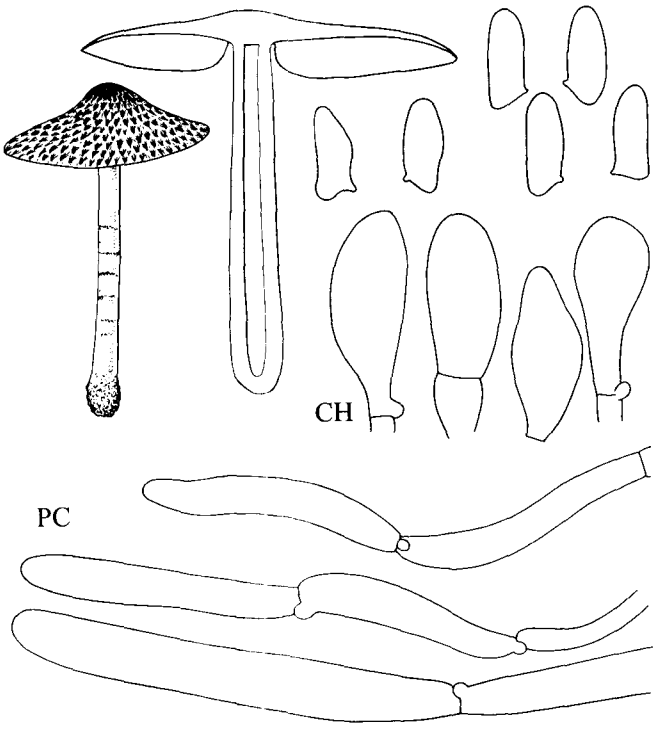

Fig. 97. *Lepiota boudieri*.

with deflexed margin, or plano-concave, and often with broad umbo, finely tomentose-squamulose at centre, orange-brown, dark red-brown or deep rusty brown (Mu. 7.5 YR 4/6, 5 YR 4/6), towards margin adnately, radially fibrillose-squamose, paler and more yellow than at centre (7.5 YR 5-6/6, 7/8) not or hardly showing the underlying pale cream, pale pinkish-ochraceous buff background (10 YR 5-7/8, 7-8/6), at margin, especially when young, with white velar remnants. Lamellae, L = 40-60, l = 1-5, crowded, moderately crowded, free, straight to ventricose, up to 6 mm broad, white to pale cream, often with reddish spots with age, with concolorous or slightly darker, flocculose edge. Stipe 30-70 × 3-8 mm, cylindrical and often gradually broadened towards base, or with slightly bulbous base, hollow with age, at apex whitish to pinkish, lengthwise adnately fibrillose, when young with white flocculose annulus, disappearing with age, or with orange-brown annular zone, which can be quite low on stipe, below this zone with adnate to slightly squarrose orange-brown or concolorous with pileus, fibrillose squamules on brownish flesh-pink, or pink arachnoid-lanate background. Context white and dull in pileus, shiny in stipe, cream and more or less concolorous with surface at apex, to red-brown below and white at base. Smell varying from fungoid-earthy to sweetish-fruity, nutty etc. Taste mild, fungoid or like smell. Spore print white.

Spores in side-view 7.0-10.0(-11.0) × 3.0-4.0(-4.5) µm, Q = (1.9-)2.1-2.9(-3.1), Qav = (2.2-)2.35-2.7, with truncate to spurred base, cylindrical, narrowly triangular or with curved abaxial side, in frontal view cylindrical, thick-walled, with or without one guttule, with patent hilar appendage, dextrinoid (orange-brown), congophilous, not metachromatic in Cresyl Blue. Basidia (15-)16-27.5 × 6.0-8.0 µm, usually 4-spored, rarely intermixed with some 2-spored basidia. Lamella edge sterile. Cheilocystidia 13-38 × 5.0-12 µm, subutriform, clavate, narrowly clavate to ovoid and pedicellate, colourless and not thick-walled. Pleurocystidia absent. Pileus covering made up of hyphae in adnate to ascending bundles, made up of 2-5 articulate and clamped elements, provided with pigment; terminal elements 40-215 × 8.0-24 µm, more or less cylindrical with rounded apex, rarely inflated, with prominent vacuolar, brown pigment, dissolving in ammonia and with some parietal pigment. Stipitipellis a cutis of non or slightly coloured, cylindrical, 3.0-14 µm wide hyphae, with in lower half of stipe the same kind of elements as on pileus. Clamp-connections present in all tissues.

HABITAT & DISTR. – In small groups, gregarious, saprotrophic and terrestrial on humus-rich, often nutrient-rich, loamy-clayey, rarely sandy, soils, in mixed or deciduous woods, copses or city-parks, also on mine waste heaps, rather rare in the Netherlands, Aug.-Oct.(beginning of Nov.). Widespread in the temperate regions of Europe, probably also in North America.

Occasionally totally white basidiocarps are encountered. Very dark specimens, blackish brown with lilacinous tinges, are also rarely noted. As the microscopical characters of those two colour variants do not deviate from those of normal *Lepiota boudieri*, (except for the absence of pigments in the former), no formal status is given to those variants.

For a discussion of the synonymy of *L. boudieri* and *L. fulvella* Rea, see Vellinga & Huijser (in Persoonia 15: 237-239. 1993).

Lepiota castaneopallida Damblon & Lambinon, a species described from Belgium, is characterized by multiseptate hyphae on the pileus. Because of this it is considered a synonym of *L. boudieri*. The presence or absence of clamp-connections is not mentioned.

Lepiota acerina Peck (in Rep. N.Y. St. Mus. nat. Hist. 51: 283. 1898) is probably another synonym. However, Smith (in Lloydia 17: 317. 1954) stated that clamp-connections are absent. Bon's interpretation of this taxon is a more purplish variant than typical *L. boudieri*, especially his variety *subpurpurata* M. Bon (in Bon & G. Riousset in Doc. mycol. 22 (85): 63. 1992). These colour variants fit well into the present concept of *L. boudieri*. American collections of *L. acerina*, present in the Leiden herbarium, proved to be *L. boudieri*.

Lepiota fulvella in the sense of Alessio (in Micol. ital. 21 (3): 16-20. 1992) probably belongs to the complex of *Lepiota castanea*, because of the slender basidiocarps, the spore size (spores 10.5-12 µm long) and the type of elements on the pileus (non-articulate, non-septate).

Lepiota fulvella in the sense of Bon (in Doc. mycol. 11 (43): 35-36. 1981 and Fl. mycol. Eur. 3, Lépiotes: 51. 1993) is probably *Lepiota cingulum*. However, material from Bon's herbarium filed as *L. fulvella* proved to belong to several species.

The colours of *Lepiota boudieri* are in general a little bit more yellowish than those of *L. castanea*.

22. Lepiota subalba Kühner ex P.D. Orton in Trans. Br. mycol. Soc. 43: 287. 1960. – Fig. 98.

Lepiota subalba Kühner in Bull. trimest. Soc. mycol. Fr. 52: 233. 1936 (not valid).

MISAPPL. – *Lepiota albosericea* sensu J. Lange, Fl. agar. dan. 1: 32. 1935; *Lepiota naucina* sensu Mos., Röhrlinge, Blätter-Bauchpilze, 2. Aufl.: 135. 1955.

SEL. ICON. – J. Lange, Fl. agar. dan. 1: pl. 12B. 1935 (as *L. albosericea*).

SEL. DESCR. & FIGS. – Enderle & Krieglst. in Z. Mykol. 55: 93-94. 1989; Kelderman, Parasolzw. Zuid-Limburg: 96-97. 1994; Kühner in Bull. trimest. Soc. mycol. Fr. 52: 233-234. 1936; P.D. Orton in Trans. Br. mycol. Soc. 43: 287-288. 1960; A. Pears. in Trans. Br. mycol. Soc. 35: 98. 1952.

VERN. NAME – Bleke parasolzwam.

Pileus 10-35 mm, when young hemispherical, campanulate or conical with inflexed margin, expanding to plano-convex, applanate or even plano-concave and then undulating, with or without broad (low) umbo, at centre pale yellowish, pale ochraceous or creamy (Mu. 10 YR 8/3,

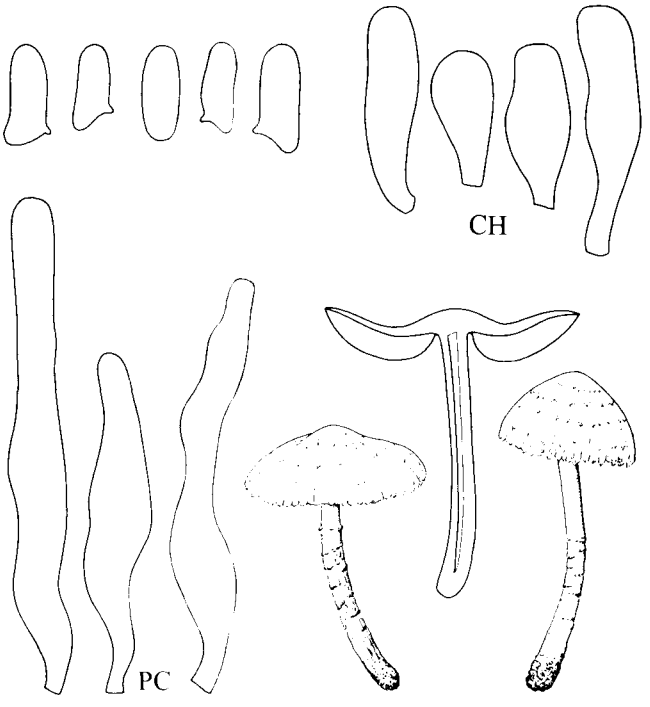

Fig. 98. *Lepiota subalba*.

8/4), towards margin cream to white, at centre felted, not broken up into squamules, towards margin with patches of felted-floccose covering on a white background, towards margin more squamulose-fibrillose, or completely sericeous-felted, when young with velar remnants at margin (as covering), with margin exceeding lamellae. Lamellae, L = 30-40, l = 1-3, rather distant to moderately crowded, free, sometimes some furcate, ventricose, subventricose or segmentiform, up to 3.5 mm broad, white, cream to brownish cream with age, with white finely floccose edge (lens). Stipe 18-60 × 1.5-4.5 mm, cylindrical or slightly broadened at base, or more rarely, tapering towards base, fistulose with age, cream, whitish at apex, and there lengthwise innately fibrillose or glabrous, lower down more pinkish brown or pink coloured, with ring-like zone of whitish lanate-floccose material, more below with floccose or lanate girdles; squamules or flocci with yellowish-ochraceous or yellow brownish tinges, vanishing with age and rain; white mycelium strands at base. Context in pileus whitish and dull, in stipe at apex white to pale pink, or pale pinkish brown to rather dark reddish brown at base. Smell sweetish, like the sweet component of the smell of *L. cristata*, fungoid, faintly or strongly like the smell of *L. cristata*, or fishy-fruity. Taste bitterish. Spore print probably white.

Spores in side-view (6.5-)7.5-10.0(-10.5) × 2.5-3.5(-4.0) µm, Q = (2.05-)2.15-3.0(-3.3), Qav = 2.35-2.85, with spurred, or truncate base, rarely with confluent base, in frontal view cylindrical, uniguttulate, often in groups (tetrads), dextrinoid, congophilous; wall not colouring in Cresyl Blue. Basidia 15-34 × 5.0-8.5 µm, 4-spored. Lamella edge sterile. Cheilocystidia 15-42 × 6.0-10 µm, usually cylindrical, with subcapitate apex or slightly swollen at centre, rarely narrowly clavate, not coloured, with slightly thickened wall. Pleurocystidia absent. Pileus covering made up of erect, irregular, narrowly fusiform to cylindrical elements, 30-210 × 6.0-21 µm, with rounded apex, narrowed into pedicel, slightly thick-walled, colourless, with basal clamp-connection. Basal layer of short elements not present. Stipitipellis a cutis of cylindrical elements 3.0-8.0 µm wide; elements of squamules as those on pileus, but usually shorter (e.g. 36-115 × 12-20 µm) and cylindrical to narrowly fusiform. Clamp-connections present in all tissues.

HABITAT & DISTR. – Solitary to gregarious in small groups, saprotrophic and terrestrial in deciduous woods, scrub etc., rarely in coniferous forests, on sandy to loamy soils rich in humus, widespread in the Netherlands, often on the inner coastal dunes. End of July-Oct. Known from the temperate zones of Europe; distribution outside Europe unknown.

23. Lepiota tomentella J. Lange in Dansk bot. Ark. 4 (4): 48. 1923. – Fig. 99.

EXCL. – *Lepiota tomentella* sensu Candusso & Lanzoni, Lepiota: 226-228. 1990; sensu M. Bon in Doc. mycol. 11 (43): 36-37. 1981; sensu Kelderman in Coolia 31: 43-44. 1988 (= in all cases *L. pilodes*); sensu Pegl. & Legon in Mycologist 12: 37. 1998 (= *L. cingulum*).

SEL. ICON. – J. Lange in Dansk bot. Ark. 4 (4): pl. 1d. 1923; J. Lange, Fl. agar. dan. 1: pl. 14D. 1935; Zecchin & Migl. in Micol. ital. 25 (2): pl. 1 & 2. 1996.

SEL. DESCR. & FIGS. – M. Bon in Bull. trimest. Soc. mycol. Fr. 92: 324-326, fig. 6. 1976; P.D. Orton in Trans. Br. mycol. Soc. 91: 562. 1988; Vellinga & Huijser in Persoonia 15: 224-226, fig. 1. 1993; Zecchin & Migl. in Micol. ital. 25 (2): 35-37, figs. 1 & 2. 1996.

VERN. NAME – Viltparasolzwam.

Pileus 10-28(-34) mm, when young paraboloid to campanulate with inflexed margin, expanding to convex, plano-convex or slightly plano-concave with low broad umbo, at centre dark grey-brown, ochre brownish or grey-brown with pinkish tinge (Mu. 7.5 YR 3/4, 5 YR 3-5/3-4, K. & W. 7-8E4, 7F6-5, 5-6D6), paler towards margin (7.5 YR 5-7/4), felted at centre, around centre flocculose-felted or broken up in more or less distinct appressed or slightly uplifted felted squamules; margin with some white velar remnants when young. Lamellae, L = 28-44, l = 1-3, rather crowded or crowded, free, (sub)ventricose, up to 5 mm broad, whitish at first, later cream or pale beige with slight pinkish reflex, with whitish finely flocculose edge. Stipe 15-50 × 2-4.5(-6.5) mm, cylindrical and usually with broadened base, subfistulose, when young whitish, cream-brown, finely fibrillose, later from base upwards reddish brown, pale brown rusty, in lower 1/2 to 2/3 with scattered squamules and girdles, like covering on pileus, without distinct annulus, when young sometimes with a white fugacious ring-zone, with white mycelium cords at base. Context in pileus whitish cream, in stipe white at first, later brownish or pale brown. Smell indistinct to slightly sweetish. Taste slightly bitter. Spore print white.

Spores in side-view (6.5-)7.0-9.5(-10.5) × 3.0-4.0(-4.5) µm, Q = 1.7-2.7, Qav = 2.1-2.4, with straight or outgrown broad spur, sometimes allantoid or phaseoliform, usually rather cylindrical, some attenuate towards base, in frontal view subcylindrical, dextrinoid (pale brown or orange-brown), congophilous; wall not coloured in Cresyl Blue. Basidia (16.5-)20-32 × 6.0-9.5 µm, 4-spored, rarely (3-)2-spored. Lamella edge sterile. Cheilocystidia (17-)20-40(-48) × 5.0-12 µm, cylindrical, narrowly clavate, or rarely narrowly utriform, slightly thick-walled, not coloured. Pleurocystidia absent. Pileus covering made up of cylindrical erect elements, (35-)45-320(-440) × 6.0-19 µm, usually narrowed into a pedicel, without or with up to 2(-3) clampless septa, with brownish, slightly thickened walls, clamped at base. Stipitipellis a cutis of cylindrical hyphae, 2.0-8.0 µm in diam., with some patent colourless hyphae; squamules on stipe made up of brown-walled elements, as on pileus, but shorter, up to 160 µm long. Clamp-connections present in all tissues.

HABITAT & DISTR. – Gregarious or more rarely solitary, saprotrophic and terrestrial in deciduous woods on rich loamy-sandy soils, often rich in lime, in the Netherlands very rare, only in southern Limburg (Cadier en Keer, Örenberg and Riesenberg; Valkenburg, Schaelsberg and St. Jansbosch). End of Aug.-Oct. Known from Belgium, France, Denmark, Germany, and England, everywhere rare except in England.

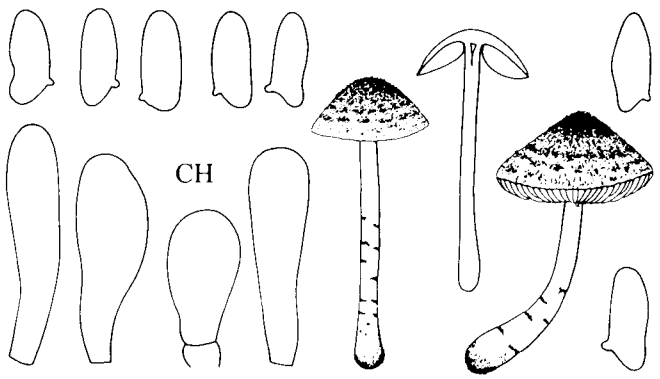

Fig. 99. *Lepiota tomentella*.

24. Lepiota pilodes Vellinga & Huijser in Persoonia 15: 226. 1993. – Fig. 100.

MISAPPL. – *Lepiota tomentella* sensu Candusso & Lanzoni, Lepiota: 226-228. 1990; sensu M. Bon in Doc. mycol. 11 (43): 36-37. 1981; sensu Kelderman in Coolia 31: 43-44. 1988.

SEL. ICON. – Zecchin & Migl. in Micol. ital. 25 (2): pl. 3. 1996.

SEL. DESCR. & FIGS. – Candusso & Lanzoni, Lepiota: 226-228, fig. 42. 1990 (as *L. tomentella*); Vellinga & Huijser in Persoonia 15: 226-

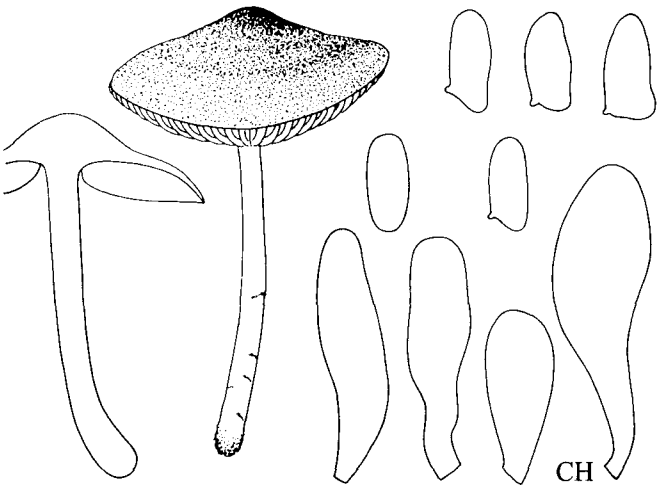

Fig. 100. *Lepiota pilodes*.

229, fig. 2. 1993; Zecchin & Migl. in Micol. ital. 25 (2): 37-41, figs. 3 & 4. 1996.

VERN. NAME – Valse viltparasolzwam.

Pileus 13-34 mm, expanding from campanulate to convex or planoconvex, with or without broad umbo, when young with margin exceeding lamellae, at centre dull orange brown, dark brown or ochraceous brown (Mu. 2.5 YR 4/4, 10 YR 3-4/4), towards margin fading to pale brown-beige (e.g. 10 YR 7/6), at first at outermost margin very pale, when very young and undamaged with dark fuligineous colours sometimes with a hue of green or olive, discolouring orange when touched and with age, completely covered with a relatively thin covering of small plush-like squamules, at centre closed and velutinous-tomentose, towards margin more fibrillose to arachnoid with context showing in between squamules. Lamellae, L = 31-35, l = 1-3, moderately distant to rather crowded, free, not or slightly cream-coloured, with age more orange brownish tinged or with orange-brown spots, with whitish or white, even to flocculose edge. Stipe 15-50 × 2-4 mm, cylindrical with broadened to bulbous base, fistulose, cream to pale pinkish cream at base, discolouring orange to reddish brown especially at base, lengthwise innately fibrillose, in upper half more or less pruinose, lower with faint girdles and scattered squamules (rarely without), concolorous with pileus, with white mycelium cords at base. Context in pileus white and dull, in stipe creamy, especially in cortex discolouring orange, with age in lower part reddish brown (5 YR 4/4). Smell faint, sweetish, fruity-fungoid or farinaceous, not like *L. cristata*. Taste not known. Spore print white.

Spores in side-view 7.0-10.0(-11.5) × 3.0-4.0(-4.5) µm, Q = 1.9-2.8(-3.0), Qav = 2.2-2.6, cylindrical, subcylindrical, with rounded apex or tapering towards apex, without or with lateral spur, with rounded or spur-like base, in frontal view subcylindrical or ovoid, with distinct patent hilar appendage, dextrinoid, congophilous; wall not colouring in Cresyl Blue. Basidia (19-)22-34(-38) × 6.5-9.5 µm, 4-spored, also some 2-spored. Lamella edge sterile. Cheilocystidia (16-)20-45(-50) × 5.0-15(-18) µm, narrowly clavate, clavate, narrowly utriform to more or less cylindrical, not coloured. Pleurocystidia absent. Covering of pileus made up of erect cylindrical to slightly fusiform elements, 60-280(-330) × (6.5-)8.0-21 µm, narrowed into pedicel, without (very rarely with one) clampless septa, with some basal clavate elements in between, with parietal and intracellular brown pigment, when fresh also with grey intracellular pigment. Stipitipellis a cutis of narrow 2.0-6.5 µm wide cylindrical hyphae; squamules on stipe made up of elements as those on pileus but 25-160 × 8.0-23 µm. Clamp-connections present in all tissues.

HABITAT & DISTR. – Gregarious in small groups, often together with *L. tomentella* and other *Lepiota*-species, terrestrial and saprotrophic in deciduous woods on rich loamy soils, also on mine waste heaps. In the Netherlands only known from some localities in southern Limburg; Sept.-Oct. Known from France, Germany and Italy.

This species comes very close to *Lepiota tomentella* and was not distinguished from it in the past. Characteristics of this species are the orange to ochraceous discoloration of the pileus surface, the broad cheilocystidia and the non-septate elements of the pileus covering.

25. Lepiota griseovirens Maire in Bull. trimest. Soc. mycol. Fr. 44: 37. 1928. – Fig. 101.

Lepiota griseovirens ssp. *obscura* Locq. in Bull. mens. Soc. linn. Lyon 14: 61-62. 1945 (not valid); *Lepiota griseovirens* var. *obscura* M. Bon in Doc. mycol. 6 (24): 44. 1976; *Lepiota obscura* (Locq.) Babos in Annls hist.-nat. Mus. natn. hung. 50: 89. 1958 (not valid); *Lepiota obscura* (M. Bon) M. Bon in Doc. mycol. 23 (91): 33. 1993. – *Lepiota grangei* f. *brunneoolivacea* Pilát in Acta Mus. natn. Prag. 11B (2): 9. 1955.

EXCL. – *Lepiota griseovirens* sensu D. Reid in Fung. rar. Ic. col. 6: 14-16. 1972; sensu M. Bon, Fl. mycol. Eur. 3, Lépiotes: 55. 1993; *Lepiota griseovirens* var. *griseovirens* sensu M. Bon in Doc. mycol. 11 (43): 38. 1981 (in all cases *L. poliochloodes*).

MISAPPL. – *Lepiota pseudofelina* in the sense of many authors, e.g. M. Bon, Fl. mycol. Eur. 3, Lépiotes: 55. 1993; Candusso & Lanzoni, Lepiota: 222-225, 22b. 1990; Kelderman, Parasolzw. Zuid-LimburgL 94-95. 1994; Chr. Lange in Svampe 31: 42. 1995; Migl. & Coccia in Boll. Ass. micol. ecol. Romana 19: 20. 1990.

SEL. ICON. – Breitenb. & Kränzl., Pilze Schweiz 4: pl. 226. 1995; Candusso & Lanzoni, Lepiota: pl. 22a, 22b. 1990 (as *L. griseovirens* and *L. pseudofelina* resp.); Chr. Lange in Svampe 31: 42. 1995 (as *L. pseudofelina*); Lanzoni & Candusso in Boll. Gruppo micol. G. Bres. 26: 104. 1983; Migl. & Coccia in Boll. Ass. micol. ecol. Romana 19: 20. 1990 (as *L. pseudofelina*); Rald et al. in Svampe 26: 38. 1992.

SEL. DESCR. & FIGS. – F.A. v.d. Bergh in Coolia 23: 54-56. 1980 (as *L. grangei*); Candusso & Lanzoni, Lepiota: 218-220, 223-225, figs. 40 & 41. 1990 (as *L. griseovirens* var. *griseovirens* and *L. pseudofelina* resp.); Courtecuisse in Bull. semest. Soc. mycol. Nord 42: 8-9, figs. 12-14. 1988; Kelderman, Parasolzw. Zuid-Limburg: 94-95. 1994 (as *L. pseudofelina*); Kühner in Bull. trimest. Soc. mycol. Fr. 52: 236-237.

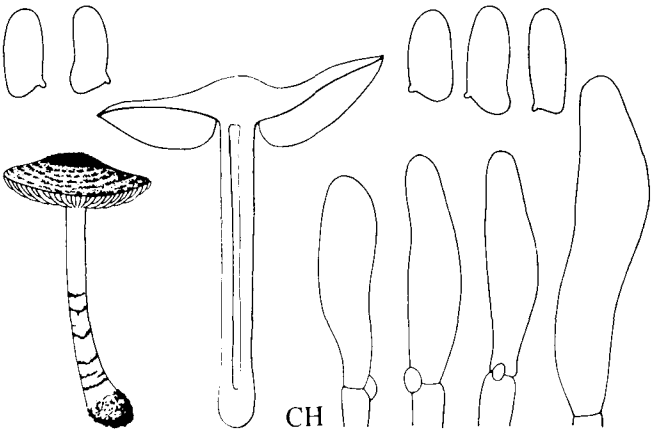

Fig. 101. *Lepiota griseovirens*.

1936 (as *L. pseudofelina*); Lanzoni & Candusso in Boll. Gruppo micol. G. Bres. 26: 103-107, fig. 2. 1983; Migl. & Coccia in Boll. Ass. micol. ecol. Romana 19: 17-19. 1990 (as *L. pseudofelina*); A. Pears. in Trans. Br. mycol. Soc. 29: 192. 1946 (as *L. pseudofelina*); Romagn. & Locq. in Bull. trimest. Soc. mycol. Fr. 60: 54-55. 1944; Vellinga & Huijser in Persoonia 15: 231-234, fig. 4. 1993.

VERN. NAME – Grijsgroene parasolzwam.

Pileus 12-32 mm, at first conico-campanulate, expanding to plano-convex or slightly plano-concave with broad umbo, when young with whitish margin exceeding lamellae, at centre with a closed velvety-tomentose covering with small tufts (plush-like), dark grey to black or greyish olive-brown, sometimes with a hue of green, blue or violet, towards margin cracked into small wart-like squamules, paler than at centre to pale olive-beige brownish or grey-brown (Mu. 2.5 YR 3/2, 5 Y 2.5/1 to 2.5 Y 7/6, 2.5 Y 6/2, 10 YR 6/4) on a pale cream to isabella background, slightly pallescent and more brownish with age and sometimes discolouring yellow-brown, orange-brown or salmon-brown at margin. Lamellae, L = 36-41, l = 1-5, crowded, free, subventricose or ventricose and rounded near stipe, 2-4 mm broad, white to cream (10 YR 8/2), when young sometimes with greyish tinge, turning orange brownish or with orange-brown spots when old, with white finely flocculose edge. Stipe 20-60 × 2-5 mm, cylindrical and slightly broadened at base, fistulose, in upper half pale, whitish to greyish, lengthwise fibrillose, without real annulus, but especially when young with an annular zone, in the lower half covered with bands or many scattered grey-black to grey-brown squamules as on pileus; background turning orange brownish at base; with white mycelium cords. Context in pileus white, with glassy line above lamellae, in stipe cortex pale yellow or brownish, at base of stipe turning orange-brown with age, inner part of stipe white cottony. Smell in young and undamaged specimens fruity, when damaged or with age more like *L. cristata*, lacking the rubber component, astringent. Taste rather strong, unpleasant, resembling smell. Spore print white.

Spores in side-view (6.0-)6.5-9.5(-11.0) × (3.0-)3.5-4.5 µm, Q = 1.6-2.5(-2.7), Qav = 1.8-2.4, oblong to cylindrical, with truncate base, the bigger the more distinctly spurred, in frontal view ± cylindrical, with thickened wall and patent hilar appendage, strongly dextrinoid, congophilous; wall in Cresyl Blue not colouring. Basidia 17-31 × 5.5-9.0 µm, 4-spored, often also 2-spored. Lamella edge sterile with tufts of cheilocystidia. Cheilocystidia (16-)20-42(-50) × 5.0-10.5 µm, usually narrowly utriform, also obovoid to narrowly clavate to nearly cylindrical. Pleurocystidia absent. Pileus covering made up of tightly packed, erect rather straight elements, (55-)85-320(-400) × 6.5-20(-24) µm, cylindrical or fusiform, often with attenuate apex, rarely furcate, with greyish-brownish parietal and in basal hyphae encrusting pigment, also with some vague coloured granules in H_2O, sometimes in lower part with 1(-2) clampless septa. Stipitipellis a cutis of cylindrical, not coloured hyphae 2.5-8 µm in diameter; elements of squamules like those on pileus but slightly shorter 35-240 × 6.5-22 µm. Clamp-connections present in all tissues.

HABITAT & DISTR. – Gregarious in small groups, terrestrial and saprotrophic in deciduous woods on sandy to loamy soils rich in humus and nutrients; known in the Netherlands from several localities in the inner coastal dunes, the river area and the western clay-areas, and from southern Limburg. In the Netherlands the most common species of the dark, greenish taxa. End of Aug.-Nov. Rare in Europe.

Most European authors called this species *Lepiota pseudofelina* J. Lange. However, Lange's description and figure (Fl. agar. dan. 1: pl. 12C. 1935) depict a slender specimen with a rapidly discolouring pileus, long spores, and with intracellular pigment in the pileus covering elements, indicating that this is most probably a young *L. grangei*.

The name *L. griseovirens* has been interpreted by some authors in the same way as is presented here; others regard it as the grey-green species with small spores, and short elements in the pileus covering. For an extensive discussion on the history of the name, see Vellinga & Huijser (in Persoonia 15: 234. 1993). Bon (Fl. mycol. Eur. 3, Lépiotes: 55. 1993) used *L. griseovirens* for *L. poliochloodes*, and both *L. pseudofelina* and *L. obscura* for *L. griseovirens* in the interpretation given here.

26. Lepiota poliochloodes Vellinga & Huijser in Persoonia 15: 229. 1993. – Fig. 102.

MISAPPL. – *Lepiota griseovirens* sensu M. Bon, Fl. mycol. Eur. 3, Lépiotes: 55. 1993; sensu D. Reid in Fung. rar. Ic. col. 6: 14-16. 1972; *Lepiota griseovirens* var. *griseovirens* sensu M. Bon in Doc. mycol. 11 (43): 38. 1981.

SEL. ICON. – Knudsen & Vesterholt, Truede Storsvampe Danmark: 33. 1990 (as *L. griseovirens*); D. Reid in Fung. rar. Ic. col. 6: pl. 43c & d, 1972 (as *L. griseovirens*).

SEL. DESCR. & FIGS. – D. Reid in Fung. rar. Ic. col. 6: 14-16. 1972 (as *L. griseovirens*).

VERN. NAME – Grauwgroene parasolzwam.

Pileus 10-31 mm, when young spherical to ellipsoid, expanding to convex, campanulate, finally applanate with low obtuse umbo, at first with a closed relatively thin covering, green-grey, grey-olive, grey-brown, light olive-brown (Mu. 5Y 6-5/3-4, 10YR 5-2/3, 2.5YR 6-5/2-4), towards margin splitting up into very small fibrillose squamules with age; underlying context discolouring, pink-yellow to light orange-brown (10YR 8-7/6-8, 2.5Y 8-7/6-8); margin when young fringed by velar remnants, exceeding lamellae. Lamellae, L = 36-42, l = 1-3(-7), moderately crowded, free, (sub)ventricose, up to 4 mm broad, rounded near stipe, cream-coloured, with white somewhat flocculose edge, discolouring light orange-brown on handling and with age. Stipe 20-55 × 2-4 mm, slightly broadening towards base, when young white and lengthwise fibrillose, with scattered squamules and girdles like covering on pileus, at base discolouring orange when touched and with age. Context in pileus white, in stipe white at first, in lower parts later on, mainly in the cortex, brown-orange to red-brown. Smell faint, slightly sweetish or unpleasant, not like *L. cristata*. Taste unknown. Spore print white.

Spores in side-view 6.0-8.0(-9.0) × (3.0-)3.5-4.5 µm, Q = 1.4-2.3, Qav = 1.7-2.0, usually oblong to cylindrical, with rounded or truncate base, more rarely with distinct spur, showing lateral hilar appendage, in frontal view more ellipsoid, dextrinoid, congophilous; wall not coloured in Cresyl Blue. Basidia 20-32 × 6.0-9.0 µm, 4-spored, some (3-)2-spored. Lamella edge sterile. Cheilocystidia (12-)16-35(-40) × 4.0-10(-11) µm, variable in shape, long and slender, ± cylindrical, short

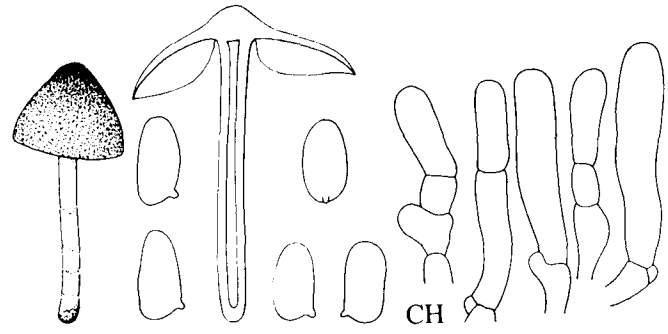

Fig. 102. *Lepiota poliochloodes*.

clavate, narrowly utriform, often with basal broad element, colourless with fine granular contents when fresh. Pleurocystidia not observed. Covering on pileus rather irregular and made up of elements (45-)70-180(-200) × 6.5-20(-26) µm, often broadened at middle and narrowed into pedicel, with 0-1(-2) clampless septa, with short clavate elements in between; pigment brown, parietal, in lower parts also intracellular, in basal parts of terminal elements encrusting. Stipitipellis a cutis of narrow hyphae, 1.5-6.5 µm broad; elements of squamules and girdles as those on pileus or shorter 25-120(-180) × 9.0-25(-33) µm. Clamp-connections present in all tissues. In fresh material all elements are full of little granules or oil drops; sometimes these granules are also visible in exsiccata.

HABITAT & DISTR. – Gregarious in small groups, terrestrial and saprotrophic in deciduous woods on nutrient-rich soils, loamy or sandy, but also on mine waste heaps; very rare in the Netherlands, only known from Valkenburg (Schaelsberg) and Kerkrade (former mine Laura-Julia); Oct. Known from Denmark, France and Great Britain, apparently very rare.

This species is known in European literature as *Lepiota griseovirens* sensu D. Reid (in Fung. rar. Ic. col. 6: 14-16. 1972). But the name *L. griseovirens* is best applied to the species formerly known under the name *L. pseudofelina* J. Lange. See notes on *L. griseovirens* and for an elaborate discussion see Vellinga & Huijser (in Persoonia 15: 234. 1993).

Lepiota poliochloodes differs from *L. griseovirens* in the lighter colours of the basidiocarp, the smaller spores and the shorter elements of the pileus covering. It is much rarer than *L. griseovirens*.

27. Lepiota grangei (Eyre) Kühner in Bull. mens. Soc. linn. Lyon 3: 79. 1934. – Fig. 103.

Schulzeria grangei Eyre in A.L. Sm. & Rea in Trans. Br. mycol. Soc. 2: 37. 1903; *Hiatula grangei* (Eyre) W.G. Sm., Synopsis Brit. Basidiomyc.: 27. 1908; *Lepiotula grangei* (Eyre) Horak in N. Z. J. Bot. 18: 184. 1980. – *Lepiota ochraceocyanea* Kühner in Bull. mens. Soc. linn. Lyon 3: 43. 1934.

MISAPPL. – *Lepiota forquignonii* sensu Barbier in Bull. mens. Soc. linn. Lyon 3: 76-78. 1934.

EXCL. – *Lepiota grangei* sensu F.A. v.d. Bergh in Coolia 23: 54-56. 1980 (= *L. griseovirens*); sensu Horak in N. Z. J. Bot. 18: 184-185, fig. 2. 1980 (= *Lepiota* spec.).

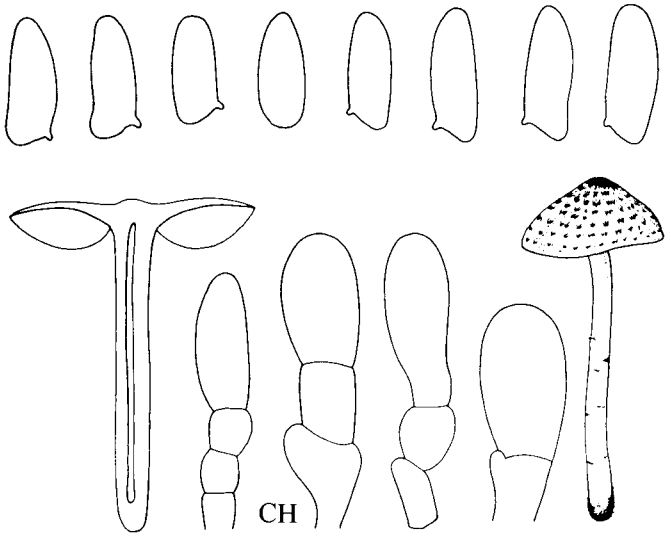

Fig. 103. *Lepiota grangei*.

SEL. ICON. – Breitenb. & Kränzl., Pilze Schweiz 4: pl. 225. 1995; Candusso & Lanzoni, Lepiota: pl. 21. 1990; Enderle in Z. Mykol. 51: between p. 16 and 17. 1985; J. Lange, Fl. agar. dan. 1: pl. 10A. 1935; Lanzoni in Boll. Gruppo micol. G. Bres. 29: 85. 1986; Locq. in Bull. trimest. Soc. mycol. Fr. 60: pl. 2, fig. 3. 1944; Rald et al. in Svampe 26: 38. 1992.

SEL. DESCR. & FIGS. – Candusso & Lanzoni, Lepiota: 213-216. 1990; Enderle in Z. Mykol. 51: 19-22. 1985; Herink in Ceská Mykol. 16: 228-234. 1962; Kelderman in Coolia 31: 91-92, fig. 2. 1988; Lanzoni in Boll. Gruppo micol. G. Bres. 29: 83-87, fig. 2. 1986; Locq. in Bull. trimest. Soc. mycol. Fr. 60: 41-42. 1944; Vellinga & Huijser in Persoonia 15: 235-237, fig. 5. 1993.

VERN. NAME – Groenschubbige parasolzwam.

Pileus 13-40 mm, when young campanulate or hemispherical with inflexed margin, expanding to plano-convex with umbo, at centre green-black, dark grey-green, grey-blue or blue-green, then green-brown or blue-brown to brown, velvety-tomentose with small erect squamules, around centre with concolorous or slightly paler small to very small uplifted or erect squamules on pale cream to pale brown background, with age often discolouring orange-brown, more glabrous and squamules less conspicuous; margin irregular and with some velar remnants especially when young. Lamellae, L = c. 30, l = 1-3, moderately to rather crowded, free, ventricose or broadly ventricose, up to 6 mm broad, when young whitish to cream, when old with orange-brown spots, with white finely floccose edge. Stipe 25-60 × 3-6 mm, cylindrical or slightly broadening towards base or with subbulbous base, fistulose with age, at apex glabrous and whitish or pale pinkish, lower down more orange (5 YR 5/8) or orange-brown, especially on handling, in lower half with some scattered girdles of squamules, as on pileus, blackish green-blue, blue-green or grey-green, without distinct annulus. Context in pileus white, in stipe concolorous with surface. Smell unpleasant, rubber-like, musty-stuffy or like *L. cristata*. Taste 'mild-aromatic'. Spore print white.

Spores in side-view (7.5-)8.0-13.0(-14.5) × 3.5-4.5(-5.0) µm, Q = 1.9-3.0(-3.2), Qav = 2.2-2.9, with truncate to distinctly spurred base, in frontal view cylindrical or subcylindrical, not or uniguttulate, slightly thick-walled, with distinct patent hilar appendage, immediately dextrinoid, congophilous; wall not coloured in Cresyl Blue. Basidia (20-)22-35 × 6.5-11.5 µm, 4-spored, rarely some 2-spored. Lamella edge sterile, made up of cheilocystidia, (16-)20-45(-55) × 5.0-13(-15) µm, ± cylindrical, narrowly utriform or narrowly clavate, colourless, often on broad basal element or septate in lower part. Pleurocystidia absent. Pileus covering made up of more or less erect elements, (30-)50-300(-400) × (6.5-)8.0-20(-24) µm, cylindrical with rounded apex, attenuate towards base, septate, with up to 5 clampless septa, rarely not septate, with thickened walls and with basal clamp-connection; pigment brownish parietal and intracellular, when fresh blue-green intracellular, in dried material in granules, visible in H_2O. Stipitipellis a cutis of narrow 2.0-7.0 µm wide, cylindrical, colourless hyphae; elements of squamules and girdles as those on pileus but less septate, 35-310 × 8.0-21 µm. Clamp-connections present in all tissues.

HABITAT & DISTR. – Gregarious, in small groups, terrestrial and saprotrophic in deciduous woods, especially in *Fagus*-woods on ± calcareous, loamy or sandy soils and soils rich in humus, but also on mine waste heaps under *Salix* and *Betula*. In the Netherlands very rare ('s-Graveland; Cadier en Keer, Riesenberg; Kerkrade, mine Laura-Julia; Valkenburg, Schaelsberg); more common in south-eastern Belgium, western Germany (Eifel) etc. End of Sept.-Oct. Known from Eurasia, and also recorded from Argentina and New Zealand, but these reports may concern closely related species.

Sect. **Lilaceae** M. Bon

Pileus covering a hymeniderm, made up tightly packed clavate, narrowly clavate to cylindrical elements; spores subglobose to ellipsoid or spurred.

28. Lepiota cristata (Bolt.: Fr.) Kumm., Führ. Pilzk.: 137. 1871. – Fig. 104.

Agaricus cristatus Bolt., Hist. Fung. Halifax 1: 7. 1788, non *Agaricus cristatus* Scop., 1774; *Agaricus cristatus* Bolt.: Fr., Syst. mycol. 1: 22. 1821; *Lepiotula cristata* (Bolt.: Fr.) Horak, Syn. Gen. Agar.: 338. 1968. – *Lepiota cristata* var. *felinoides* M. Bon in Doc. mycol. 11 (43): 34. 1981; *Lepiota felinoides* (M. Bon) P.D. Orton in Notes R. bot. Gdn Edinb. 41: 591. 1984, non *Lepiota felinoides* Peck, 1900; *Lepiota subfelinoides* Bon & Orton in P.D. Orton in Doc. mycol. 14 (56): 56. ('1984') 1985. – *Lepiota cristata* var. *exannulata* M. Bon in Doc. mycol. 11 (43): 34. 1981. – *Lepiota cristata* var. *pallidior* Boud. ex M. Bon in Doc. mycol. 11 (43): 34. 1981.

EXCL. – *Lepiota cristata* sensu Arora, Mushr. demyst., Ed. 2: 306. 1986 (= *L. casteneidisca*); sensu Sundb. in Mycotaxon 34: 240-242. 1989 (= *L. castaneidisca* and *L. cristata*).

SEL. ICON. – Arnolds & Veerkamp, Gids Paddest. Meetnet: 73. 1999; Breitenb. & Kränzl., Pilze Schweiz 4: pl. 221, 222. 1995 (as *L. cristata* and *L. cristata* var. *pallidior* resp.); Candusso & Lanzoni, Lepiota: pl. 20. 1990; Lanzoni & Candusso in Boll. Gruppo micol. Bresadola 26: 105. 1983; Lavorato in Schweiz. Z. Pilzk. 66: 127. 1988 (as *L. cristata* var. *felinoides*); R. Phillips, Paddest. Schimm.: 29. 1981; Ryman & Holmåsen, Svampar: 413. 1984.

SEL. DESCR. & FIGS. – Candusso & Lanzoni, Lepiota: 207-210, fig. 37. 1990; Horak, Syn. Gen. Agar.: 338-339. 1968 (as *Lepiotula cristata*); Kelderman, Parasolzw. Zuid-Limburg: 82-83. 1994.

VERN. NAME – Stinkparasolzwam.

Pileus 10-75 mm, when young campanulate, conico-campanulate, expanding to plano-convex or applanate with or without low umbo, at centre with a closed, smooth, covering, often called a 'calotte' and around this centre with rather broad concentrical squamules, sometimes with small, more granular, squamules; most typically the colour of the calotte and squamules is orange-brown to reddish brown (Mu. 7.5 YR 4-5/6), sometimes they are very dark brown, sometimes pale brownish buff; the colours fading with age and weather; background white to cream-coloured, radially adnate-fibrillose; remnants of annulus sometimes attached to the margin. Lamellae, L = 40-60, l = 1-3, moderately crowded to crowded, free, ventricose up to 4 mm broad, white to cream, rarely furcate, with white, even to finely flocculose edge. Stipe 15-80 × 2-8.5 mm, cylindrical or slightly broadened or even bulbous at base, fistulose with age, at apex whitish and at base pinkish or sordid brownish, innately silvery fibrillose, with or without annulus, at base often with clump of soil particles, or with white mycelium strands. Annulus loosely attached, straight or ascending, whitish on upper side, brownish or with small brown squamules on lower side. Context in pileus dull and white, in stipe concolorous with pinkish surface. Smell strong, sweet and with a rubber component, very rarely without any smell at all. Taste as smell, unpleasant. Spore print colour white to cream, but lemon-yellow according to Breitenbach & Kränzlin (Pilze Schweiz 4: 197. 1995).

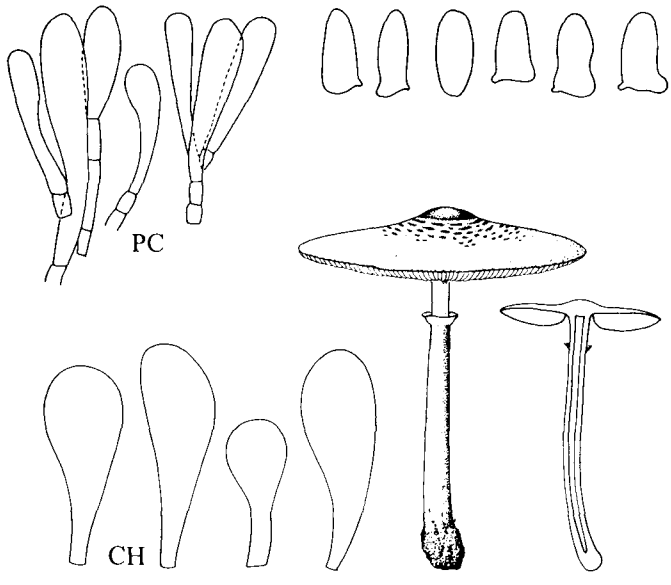

Fig. 104. *Lepiota cristata*.

Spores in side-view (5.0-)5.5-8.5(-10.0) × 2.5-3.5 µm, Q = 1.8-2.9, Qav = 2.0-2.5, truncate and narrowly triangular, rarely with distinct, saccate spur, cylindrical in frontal view, slightly thick-walled, dextrinoid, but not strongly so, congophilous, not metachromatic in Cresyl Blue. Basidia 14-28 × (4.0-)5.0-7.5 µm, 4-spored, rarely intermixed 4- and 2-spored. Lamella edge sterile. Cheilocystidia 17-55 × 7.0-18 µm, clavate, broadly clavate, spheropedunculate or narrowly clavate, slightly thick-walled, colourless. Pleurocystidia absent. Pileus covering a hymeniderm, made up of erect elements, 16-70 × 5.0-18 µm, cylindrical and often subcapitate to narrowly clavate, closely packed, slightly thick-walled and pigment brown and parietal. Stipitipellis a cutis made up of cylindrical, 4.0-12 µm wide, colourless hyphae. Clamp-connections present in all tissues.

HABITAT & DISTR. – Gregarious, sometimes in big groups, rarely solitary, saprotrophic and terrestrial, on humus-rich, often nutrient-rich soil, in a wide variety of habitats, from open road-sides to coniferous woods, often in ruderal and disturbed places; in all parts of the Netherlands common (for a distribution map, see Arnolds et al., Overz. Paddest. Nederland: 288. 1995); the most common *Lepiota*-species in the Netherlands. July-Nov. Widespread in all temperate and mediterranean parts of the Northern Hemisphere.

Lepiota saponella Bodin & Priou, from the west coast of France, comes very close, but differs macroscopically in the smaller squamules on the pileus, and the strong smell of soap; microscopically the broader, more triangular-shaped spores are a good differentiating character (Bodin & Priou in Bull. trimest. Soc. mycol. Fr. 110: 125-137. 1994).

Lepiota apatelia and *L. hymenoderma* resemble *L. cristata* closely, but can be easily distinguished on account of the ellipsoid spores.

Vellinga & Huijser (in Belg. J. Bot. 131: 198-199. ('1998') 1999) showed that *L. cristata* is more closely related to species with ellipsoid spores and a hymeniform pileus covering than to species with spurred spores and long elements in the pileus covering.

29. Lepiota apatelia Vellinga & Huijser in Belg. J. Bot. 131: 196. ('1998') 1999. – Fig. 105.

MISAPPL. – *Lepiota cristatoides* sensu Bizio et al. in Riv. Micol. 36: 226-227. 1993; sensu A. Hauskn. in Enderle & Krieglst. in Z. Mykol. 55: 63-64. 1989; sensu Huijser & Vellinga in Arnolds et al., Overz. Paddest. Nederland: 290-291. 1995; sensu Kelderman, Parasolzw. Zuid-Limburg: 132-133. 1994; sensu Vellinga & Huijser in Coolia 40: pl. 3. 1997.

SEL. ICON. – Bizio et al. in Riv. Micol. 36: 226. 1993 (as *L. cristatoides*); Vellinga & Huijser in Coolia 40: pl. 3. 1997 (as *L. cristatoides*).

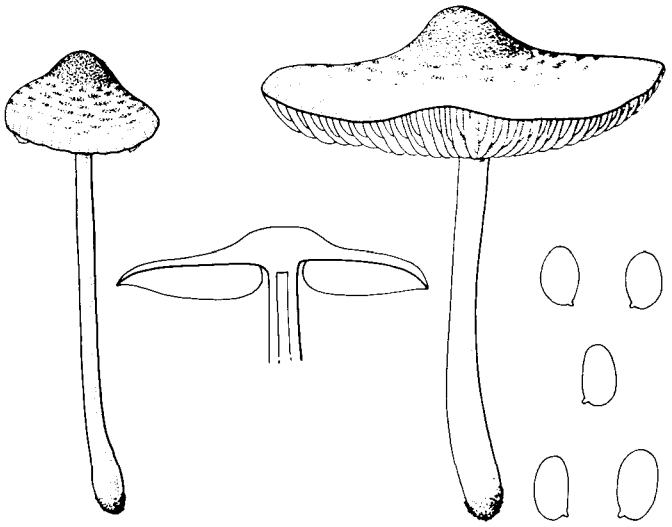

Fig. 105. *Lepiota apatelia*.

SEL. DESCR. & FIGS. – Bizio et al. in Riv. Micol. 36: 226-227. 1993 (as *L. cristatoides*); Kelderman, Parasolzw. Zuid-Limburg: 132-133. 1994 (as *L. cristatoides*).

VERN. NAME – Valse stinkparasolzwam.

Pileus 10-40(-60) mm, campanulate with inflexed margin when young, expanding to plano-convex, applanate, or widely conical with undulating limb, with or without blunt umbo, with uplifted margin in old specimens, orange-brown to yellow brownish (Mu. 7.5 YR 6/6-8, 5-6/6, 10 YR 7/8) and glabrous at centre, around centre breaking up into broad concentrically arranged, adnate patches, fading in colour towards margin, rarely breaking up in smaller, granular patches, paler than central part, on a pale cream to whitish, fibrillose-silky background, when young with white velar remnants at margin. Lamellae, L = 30-45, l = 1-3, rather crowded to moderately distant, sometimes anastomosing, free, ventricose or segmentiform, cream with pale cream-orange-pink tinge when looked into, with even or eroded concolorous edge. Stipe 25-60 × 2-5 mm, cylindrical and in some specimens widened at base, hollow, when young shiny cream-coloured, lengthwise adnately fibrillose, later from base upwards discolouring purple vinaceous red (c. 2.5 YR 3/4), with vanishing whitish bloom, with white basal tomentum, and white mycelial cords. Annulus white, membranaceous, often clinging to pileus margin, sometimes on stipe, easily removed. Context white to cream in pileus, brownish to reddish in stipe, concolorous with surface. Smell strong, sweet, also when basidiocarp crushed, rarely with the rubber component of the smell of *L. cristata*, sometimes a bit astringent. Taste like smell. Spore print white.

Spores 4.5-6.5 × 3.0-4.0 µm, Q = 1.4-1.8(-2.0), Qav = 1.4-1.65, ellipsoid to oblong in side-view, often with straight abaxial side, ellipsoid to oblong in frontal view, colouring orange-brown in Melzer's Reagent, but not strongly so, and often after 5-10 minutes, not or faintly metachromatic in Cresyl Blue. Basidia 15-27(-32) × 5.0-8.0 µm, 4-spored, rarely some 2-spored present. Lamella edge fertile; cheilocystidia absent. Pleurocystidia absent. Pileus covering a euhymeniderm with tendencies to a transition between a hymeniderm and an epithelium, made up of narrowly clavate to spheropedunculate terminal elements, 15-45(-60) × 10-20(-25) µm, with slightly thickened brown walls, some elements with brown intracellular pigment; underlying trama hyphae with colourless encrusting pigment. Stipitipellis a cutis of cylindrical, colourless hyphae, 3.5-4.5 µm in diameter. Clamp-connections present in all tissues.

HABITAT & DISTR. – Gregarious, often in big groups, saprotrophic and terrestrial, in deciduous woods, also on mine waste heaps. In the Netherlands very rare, known from two localities in southern Limburg (Brunssum, mine Hendrik; Margraten, Eysderbos), Sept.-Oct. Very rare in Europe, known also from Austria, Germany, and Italy.

Lepiota apatelia macroscopically resembles *L. cristata* very closely. The shape of the spores of course is the easiest character to separate the two species: spurred in *L. cristata* and ellipsoid in *L. apatelia*. Furthermore, the annulus in *L. apatelia* clings to the pileus margin, while in *L. cristata* it can often be found on the stipe, and the smell of *L. apatelia* lacks in general the rubber component, so characteristic of the smell of *L. cristata*.

Another closely related species is *L. cristatoides*, characterized by a smoother and pinker pileus, a ring that clings to the stipe, the smell of *L. cristata*, and the slightly smaller, non-dextrinoid spores.

30. Lepiota cristatoides Einh. in Ber. bayer. bot. Ges. 44: 31. 1973.– Fig. 106.

EXCL. – *Lepiota cristatoides* sensu Bizio et al. in Riv. Micol. 36: 226-227. 1993; sensu A. Hauskn. in Enderle & Krieglst. in Z. Mykol. 55: 63-64. 1989; sensu Kelderman, Parasolzw. Zuid-Limburg: 132-133. 1994; sensu Vellinga & Huijser in Coolia 40: pl. 3. 1997 (in all cases *L. apatelia*).

MISAPPL. – *Lepiota lilacea* var. *pallida* f. 'zonder cystiden' Kelderman, Parasolzw. Zuid-Limburg: 137. 1994. – *Lepiota rufipes* f. *phaeophylla* sensu Bizio et al. in Riv. Micol. 36: 240-241. 1993.

SEL. ICON. – Bizio et al. in Riv. Micol. 36: 240. 1993 (as *L. rufipes* f. *phaeophylla*); Bon & G. Riousset in Doc. mycol. 22 (85): 64-65, pl. 1B. 1992; Mos. & Jül., Farbatl. Basidiomyc. III Lepiota 9. 1990.

SEL. DESCR. & FIGS. – Einh. in Ber. bayer. bot. Ges. 44: 31-32. 1973; Kelderman in Coolia 35: 79-82, fig. 2. 1992 (as *L. lilacea* var. *pallida*); Kelderman, Parasolzw. Zuid-Limburg: 136-137. 1994 (as *L. lilacea* var. *pallida* f. 'zonder cystiden'); Laber et al. in Südwestd. Pilzrundschau 31 (1): 4-5. 1995.

VERN. NAME – Kleine stinkparasolzwam.

Pileus 9-30 mm, convex, plano-convex to applanate with low umbo, brown or pinkish orange (Mu. 7.5 YR 6-7/6; K. & W. 6B-C3-5) at centre, around centre breaking up into small concentrical patches, often only in marginal zone, making a fairly cream impression, glabrous at centre, not rugulose or micaceous. Lamellae, L = 30-40, l = 1, mod-

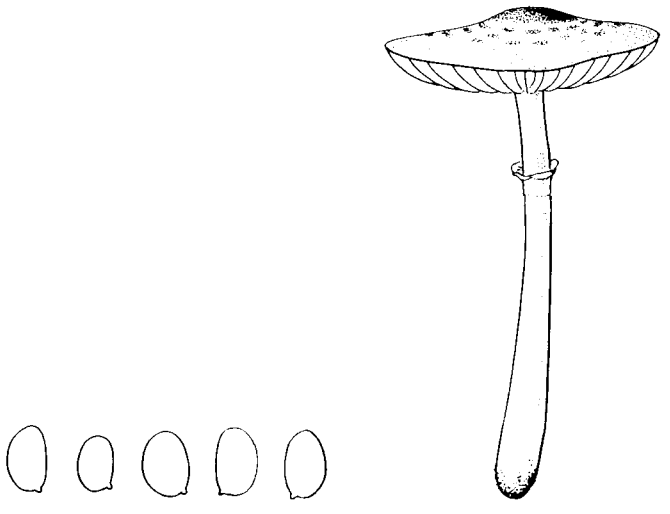

Fig. 106. *Lepiota cristatoides*.

erately crowded, free, ventricose up to 2 mm broad, cream-coloured (10 YR 8/3) with concolorous or white, even to eroded, edge. Stipe 15-50 × 1-3.0 mm, cylindrical, fistulose, whitish or cream, (sub)fibrillose and shiny at apex, more distinctly fibrillose in lower part on pinkish to vinaceous background (7.5 YR 8-7/6). Annulus fugacious and fibrillose-membranaceous, or distinct as a tube around stipe and membranaceous, rarely absent. Context whitish cream in pileus, in stipe with pinkish tinges, especially at base. Smell, especially of cut basidiocarps, like the rubber component of the smell of *L. cristata*, sometimes with spermatic component or like chlorine. Taste not known. Spore print off white.

Spores 3.5-5.0(-5.5) × 2.5-3.5 µm, Q = 1.3-1.7(-1.85), Qav = 1.4-1.65, ellipsoid to oblong, not dextrinoid, hardly colouring in Congo Red, metachromatic in Cresyl Blue, rather thin-walled. Basidia 16-25 × 4.0-7.0 µm, 4-spored, rarely intermixed with 2-spored. Lamella edge fertile; cheilocystidia absent. Pleurocystidia absent. Pileus covering a hymeniderm or irregular hymeniderm with several layers of elements; terminal elements clavate to almost ellipsoid-globose, (10-)15-50(-55) × 8-25(-35) µm, without or with yellowish parietal pigment, with scattered some narrow elements up to 5.0 µm wide with intracellular brown pigment; pigment encrusting in lower layers. Stipitipellis a cutis of cylindrical, colourless hyphae, 2.0-4.0 µm in diameter. Clamp-connections present in all tissues studied.

HABITAT & DISTR. – Gregarious, saprotrophic and terrestrial, especially in nutrient-rich places, for instance on the verge of sunken roads, or in the margins of woods. In the Netherlands very rare, known from several localities in southern Limburg. Sept.-Oct. Also recorded from other European countries (France, Germany and Italy).

Lepiota cristatoides differs from *L. rufipes* in the presence of an annulus, absence of cheilocystidia and the relatively longer spores (average length 4.3-4.8 µm, and Qav = 1.4).

Lepiota mediorosea Contu (in Bol. Soc. micol. Madrid 23: 44. 1998), described from Sardinia, comes very close, but differs in the smaller spores, viz. 3.0-4.2 × 2.0-2.8 µm.

See under *L. rufipes* and in Vellinga & Huijser (in Belg. J. Bot. 131: 199-201. ('1998') 1999) for more comments on this group of species.

31. Lepiota hymenoderma D. Reid in Fung. rar. Ic. col. 1: 24. 1966. – Fig. 107.

SEL. ICON. – Candusso & Lanzoni, Lepiota: pl. 35a. 1990; Migl. & Coccia in Micol. ital. 19 (1): pl. 55. 1990; D. Reid in Fung. rar. Ic. col. 1: pl. 6e. 1966; Winterhoff & Bon in Carolinea 52: pl. 1a. 1994.

SEL. DESCR. & FIGS. – Huijser & Kelderman in Coolia 34: 80-83, fig. 1. 1991; Kelderman, Parasolzw. Zuid-Limburg: 134-135. 1994; D. Reid in Fung. rar. Ic. col. 1: 24-25, figs. 6a-c. 1966; Winterhoff & Bon in Carolinea 52: 6-7, fig. 1. 1994.

VERN. NAME – Ringloze stinkparasolzwam.

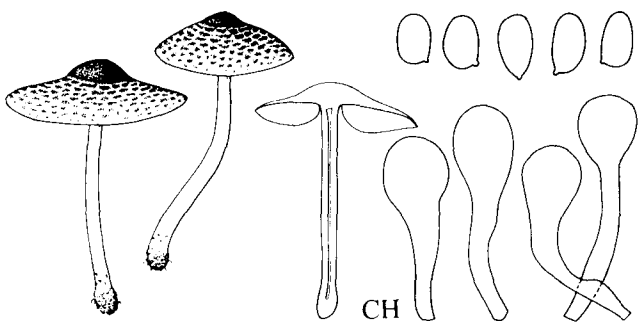

Fig. 107. *Lepiota hymenoderma*.

Pileus 5-32 mm, hemispherical when young, expanding to plano-convex or almost applanate, with or without (low) umbo, at centre on umbo smooth, chestnut-brown, dark brown (Mu. 10 YR 3/2-3, 5-7.5 YR 3/4), around umbo split up into small rather granulose, radially arranged patches, slightly paler than centre (10 YR 3/4, 4/3) towards margin fading to pale brown (7.5 YR 6/6; 10 YR 4/6 and paler), on cream-coloured radially fibrillose, silky background; margin not exceeding lamellae. Lamellae, L = 25-36, l = 1-3, rather distant to moderately crowded, free, slightly ventricose to ventricose, up to 6 mm wide, cream with greyish-brownish tinge (paler than 7.5 YR 7/4. 10 YR 7/3), with even, concolorous or whitish flocculose edge. Stipe 23-40 × 1.5-3 mm, cylindrical, narrowly fistulose, cream at apex, cream whitish at base, slightly discolouring orange-like at base, covered in adnate whitish fibrils, without annulus, in lower 1/3 of stipe length either with faint girdles or with scattered brown squamulose floccules. Context dull and whitish or cream in pileus, glassy or silky, white in stipe and faintly orange (7.5 YR 7/5) in base when old. Smell strong, with both the fruity and the rubber component of the smell of *L. cristata*. Taste unpleasant, like smell. Spore print probably white.

Spores in side-view 4.0-6.0(-7.0) × 2.5-3.5 µm, Q = 1.4-1.9(-2.0), Qav = 1.6-1.7, ellipsoid, oblong to cylindrical, slightly ovoid in frontal view, not or in some stages slightly colouring pale orange-red in Melzer's Reagent or Lugol, pale pink in Congo Red, metachromatic in Cresyl Blue. Basidia 13-24 × 5.5-7.0 µm, 4-spored, rarely 2-spored. Lamella edge sterile. Cheilocystidia 11.5-37 × 6.0-10.5 µm, clavate with rounded apex, slightly thick-walled, refractive, both in fresh and in dried material. Pleurocystidia absent. Pileus covering a hymeniderm, made up of narrowly clavate to cylindrical elements 12-63 × 8-13(-25) µm, with slightly thickened pale brown walls, interspersed with some narrow, up to 5 µm wide, cylindrical elements with intracellular pigment, covered by a hyaline or brown-coloured gelatinous layer, 10-12 µm thick; underlying elements with brown parietal to encrusting pigment. Stipitipellis a cutis, made up of cylindrical, colourless hyphae, 2.0-4.0 µm wide, with encrusting hyaline pigment. Elements in floccules as those on pileus. Clamp-connections present in all tissues.

HABITAT & DISTR. – Gregarious, saprotrophic and terrestrial, on clayey to loamy soil, rich in nutrients and often on calcareous bedrock, in deciduous and coniferous woods and plantations. Very rare in the Netherlands, only known from several localities in southern Limburg (e.g. Cadier en Keer, Örenberg; Elsloo, Bunderbos), Sept.-Oct. Widespread but rare in Europe; the localities in the Netherlands are probably the most northern in mainland Europe.

Reid (in Fung. rar. Ic. col. 1: 24. 1966) stated that the spores of *Lepiota hymenoderma* are dextrinoid. This is not confirmed by observations on the Netherlands' material. Here the spores do colour slightly in Melzer's Reagent, but only some spores, and the reaction is difficult to observe. Candusso & Lanzoni's (Lepiota: 306. 1990) observations agree with the present description in this respect, as these authors called the spores slightly dextrinoid.

Lepiota hymenoderma can be distinguished from small specimens of *L. cristata* in the field by the presence of some squamules in the lower part of the stipe and the absence of an annulus.

32. Lepiota lilacea Bres., Fungi trident. 2: 3. 1892. – Fig. 108.

Lepiotula lilacea (Bres.) Wasser in Nov. Sist. vyssh. nizsh. Rast. 1975: 191. ('1975') 1976. – *Lepiota lilacea* var. *pallida* M. Bon et al. in Doc. mycol. 19 (76): 71. 1989. – *Lepiota lilacea* f. *micropholoides* Migl. & Coccia in Micol. ital. 21 (2): 40. 1992.

SEL. ICON. – Àngel in Bolets Catalunya 14: pl. 681. 1995; Candusso & Lanzoni, Lepiota: pl. 36. 1990; Chrispijn, Champ. Jordaan: 69. 1999; Rald & Heilmann-Clausen in Svampe 28: 48. 1993.

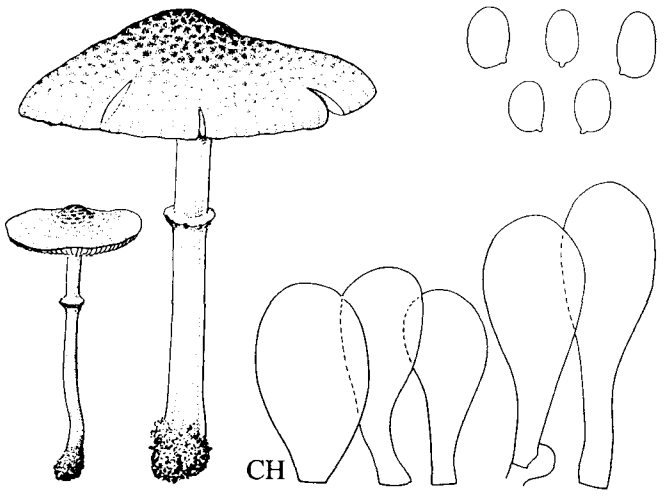

Fig. 108. *Lepiota lilacea*.

SEL. DESCR. & FIGS. – Candusso & Lanzoni, Lepiota: 309-310, fig. 63. 1990; Kühner in Bull. trimest. Soc. mycol. Fr. 52: 214-215. 1936; Rald & Heilmann-Clausen in Svampe 28: 50-52, fig. 6. 1993.

VERN. NAME – Lila parasolzwam.

Pileus 12-35 mm, when young campanulate-hemispherical, convex to applanate with umbo, with glabrous and closed umbo, surface around umbo splitting up into squarrose, concentrical squamules with uplifted tips, in small specimens with more adnate patches, very variable in colour, from very pale pink-brown, via pink-brown, brown to dark brown (K. & W. 8F6 at centre, 7D6 at squamules, 7F7, Mu. 7.5 YR 3/4, 7.5-10 YR 5/4), when young in most cases with distinctly lilacinous sheen, on an almost white background in pale specimens, to rose-tinged radially fibrillose background in medium-coloured specimens, with velar fringes at margin. Lamellae, L = c. 35, l = 0-1(-3), moderately crowded, free, ventricose, up to 4 mm wide, pale cream, with pinkish reflex, with white fine-flocculose edge. Stipe 16-55 × 1.5-3 mm, cylindrical or broadening at apex, fistulose, at apex white to isabella-buff, lower down more pinkish to pink or lilacinous, shiny lengthwise fibrillose. Annulus like a cuff around stipe, with underside squamulose and concolorous with pileus centre, with reflexed margin and upper side cream-coloured. Context white-cream in pileus, cream in stipe with pinkish streaks. Smell of cut specimens sweetish, like the sweet component of the smell of *L. cristata*, aromatic. Taste not known. Spore print colour not recorded.

Spores 4.0-6.0(-7.0) × 2.5-4.0 µm, Q = 1.3-1.7(-1.8), Qav = 1.4-1.55, ellipsoid, often uniguttulate, not distinctly thick-walled, hardly congophilous, non-dextrinoid, metachromatic in Cresyl Blue, with conspicuous hilar appendage in spores of 1- and 2-spored basidia. Basidia 18-26 × 5.5-7.5 µm, 4-spored; sometimes 1- and 2-spored basidia predominant. Lamella edge sterile. Cheilocystidia 17-41 × 7.0-14 µm, narrowly clavate, some clavate, a bit thick-walled and colourless. Pleurocystidia absent. Pileus covering a hymeniderm, made up of (15-)25-72(-85) × 8.5-21(-25) µm, cylindrical to narrowly clavate, rarely clavate to globose elements; pigment only present in some elements, and there intracellular and brown, in the very dark basidiocarps encrusting the lower parts of the terminal elements, in paler specimens only encrusting the hyphal walls in the underlying layer. Stipitipellis a cutis, made up of cylindrical elements, 2.0-4.0 µm in diameter, with finely encrusting colourless pigment. Clamp-connections abundant in all tissues.

HABITAT & DISTR. – Solitary or in small groups, saprotrophic and terrestrial on nutrient-rich soils, often in park-like situations, in the Netherlands rare, known from several localities in the western part of the country (province of Noord-Holland) and in southern Limburg; Sept.-Oct. Not a common species in Europe, but recorded from Denmark in the north to Italy in the south; also in North America.

The above macroscopical description is based on notes accompanying collections and the selected descriptions as cited above.

Lepiota lilacea is a variable species, concerning size and colours of the basidiocarps. It is characterized by its annulus, and microscopical characters (spores, cystidia and pileus covering). Dark variants resemble *L. felina* in structure of the annulus and the discrete central part and squamules of the pileus covering, but are easily distinguished on account of the structure of the pileus covering and spore size.

33. Lepiota ochraceofulva P.D. Orton in Trans. Br. mycol. Soc. 43: 284. 1960. – Fig. 109.

Lepiota cookei Hora in Trans. Br. mycol. Soc. 43: 446. 1960. – *Lepiota ochraceofulva* var. *huijsmanii* M. Bon in Doc. mycol. 22 (88): 30. 1993.

SEL. ICON. – Enderle & Krieglst. in Z. Mykol. 55: opp. p. 96. 1989; Rald & Heilmann-Clausen in Svampe 28: fig. 1. 1993; D. Reid in Fung. rar. Ic. col. 1: pl. 6b. 1966; Romagn. in Bull. trimest. Soc. mycol. Fr. 83: Atlas pl. 172. 1967.

SEL. DESCR. & FIGS. – Huijsman in Persoonia 2: 364, figs. 10-15. 1962; P.D. Orton in Trans. Br. mycol. Soc. 43: 284-285. 1960; Rald & Heilmann-Clausen in Svampe 28: 49-50, fig. 4. 1993; Romagn. in Bull. trimest. Soc. mycol. Fr. 83: Atlas pl. 172. 1967; Stridvall & A. Stridv. in Göteborgs Svampekl. Årsskr. 1981: 124-127. 1981.

VERN. NAME – Okerbruine parasolzwam.

Fig. 109. *Lepiota ochraceofulva*.

Pileus 28-70(-100) mm, hemispherical with inflexed margin, expanding to plano-convex or applanate, with or without umbo, with smooth umbo or centre and small, broad, adnate squamules in concentrical zones; centre and squamules orange-brown (Mu. 7.5(-5) YR 4/6) or paler leather-brown, on a whitish to cream or pale yellow-brown to pale orange radially fibrillose background (up to 7.5-10 YR 7/6), when young with margin inflexed and exceeding lamellae. Lamellae, L = c. 50-100, l = 3, crowded, free, separated from the stipe by a kind of collarium, segmentiform up to 10 mm broad, cream-coloured, pale yellow (10 YR 8/4) to pale orange-brown with age (10 YR 8-7/6), with white, even to flocculose edge. Stipe 50-70(-100) × 5-10 mm, enlarged at base up to 18 mm wide, cylindrical, hollow, whitish or pale yellow-brown, discolouring yellowish, orange or orange-brown when handled, with bands or girdles of orange-brown squamules on lower part of stipe or on bulbous base only, with vague annular zone, when young with distinct annulus made of partial veil, and with white mycelial cords at base. Context rather thick, whitish and dull in pileus, whitish and shiny in stipe. Smell when basidiocarps are cut unpleasant, vaguely suggestive of *L. cristata*, sweetish-soapy or perfumy. Taste mild, pleasant. Spore print probably white.

Spores in side-view 6.0-8.5(-10.0) × (3.5-)4.0-5.0 µm, Q = 1.5-1.9(-2.05), Qav = 1.65-1.8, oblong to cylindrical, some slightly ovoid; in frontal view slightly ovoid, dextrinoid, congophilous, not or slightly metachromatic in Cresyl Blue. Basidia 23-31 × 6.0-8.5 µm, 4-spored, rarely 1- or 2-spored. Lamella edge sterile. Cheilocystidia 15-36(-51) × 4.0-8.5 µm, cylindrical, narrowly clavate, narrowly utriform, sometimes with very long pedicel, in some basidiocarps for the main part slender: cylindrical to narrowly clavate, hyaline and slightly thick-walled. Pleurocystidia absent. Pileus covering a hymeniderm, made up of clavate, narrowly clavate or irregularly utriform elements, 23-50 × 8.0-11 µm, with brown parietal pigment. Lower cylindrical elements sometimes with encrusting, brown pigment. Stipitipellis a cutis, made up of cylindrical, colourless, 3.0-5.0 µm wide hyphae. Clamp-connections present in all tissues.

HABITAT & DISTR. – Solitary, in small groups to gregarious, saprotrophic and terrestrial on humus-rich and nutrient-rich loamy soil, on the edge of deciduous woods or in *Fagus*-woods, outside the Netherlands rather frequently encountered in *Juniperus*-vegetation. In the Netherlands known from two localities in southern Limburg (Elsloo, Bunderbos; Stokhem), from the province of Flevoland (Noordoostpolder, Urkerbos), and from Rijswijk (province of Zuid-Holland), Sept.-Oct. Rare, but widespread in Europe, known from Sweden southwards.

Bon (Fl. mycol. Eur. 3, Lépiotes: 77-78. 1993) placed *Lepiota ochraceofulva* in subsect. *Paralilaceae* of sect. *Felinae*, a subsection which is characterized by a dominant hymeniform underlayer and rare or barely emerging long elements. However, this type of element is absent in *L. ochraceofulva*.

Hora (in Trans. Br. mycol. Soc. 43: 446. 1960) described *L. cookei*, which is identical to *L. ochraceofulva*, described by Orton in the same issue of the same journal. Bon (Fl. mycol. Eur. 3, Lépiotes: 77-78. 1993) observed emerging elements in the pileus covering of *L. cookei*, and kept the species separate.

Lepiota ochraceofulva var. *huijsmanii* M. Bon was distinguished because of a fishy smell and the inconspicuous cheilocystidia. It appears that cheilocystidia are always abundant and quite obvious; a different smell is not considered to warrant distinction of a variety (see Huijsman in Persoonia 2: 364. 1962; Bon in Doc. mycol. 22 (88): 30. 1993; and Vellinga & Huijser in Belg. J. Bot. 131: 202-203. ('1998') 1999).

Lepiota ochraceofulva is a toxic species as it contains amanitins (Gérault & Girre in C. r. hebd. Séanc. Acad. Sci., Paris, Sér. D, 280: 2842. 1966).

34. Lepiota pyrochroa Malenç. in Mal. & Bert., Fl. Champ. sup. Maroc 1: 137. 1970. – Fig. 110.

SEL. ICON. – Bizio et al. in Riv. Micol. 36: 235. 1993; Mal. & Bert., Fl. Champ. sup. Maroc 1: pl. 5. 1970.

SEL. DESCR. & FIGS. – Bizio et al. in Riv. Micol. 36: 235-237. 1993; Bon & G. Riousset in Doc. mycol. 22 (85): 69. 1992; Mal. & Bert., Fl. Champ. sup. Maroc 1: 136-137, fig. 21. 1970; G. Riousset & Joss. in Bull. mens. Soc. linn. Lyon 45: 198-200, fig. 1. 1976.

VERN. NAME – Oranje parasolzwam.

Pileus 9-17 mm, plano-convex, applanate and undulating around centre, with low umbo, orange (Mu. 5 YR 5/6 at centre, 5 YR 6/6 around centre), when old brownish orange (7.5 YR 6/6 at centre, 7.5 YR 7/6 around centre), rugulose especially when old, and especially around centre, micaceous (lens). Lamellae, L = 20, l = 1-3, moderately crowded, free, not far remote from stipe, ventricose, up to 2.5 mm wide, pale pinkish-orangelike (10 YR 8/6), contrasting with pileus and stipe colours, when old more brownish, with even, concolorous edge, with age orange-spotted. Stipe 15-20 × 0.7-1,5 mm, cylindrical or slightly widened at apex, orange-red (2.5 R 4-5/6), shiny with some longitudinal innate fibrils in lower part, with narrow, white mycelial cords at base. Context orange and thin. Smell indistinct. Taste not known. Spore print probably white.

Spores 3.5-4.0(-4.5) × 2.5-3.0 µm, Q = 1.25-1.45, Qav = 1.35, ellipsoid in side-view and in frontal view, non-dextrinoid, not or hardly congophilous, metachromatic in Cresyl Blue, binucleate, seemingly rough in Melzer's Reagent, but smooth, when observed with Scanning Electron Microscope. Basidia 14-15 × 5.0-5.5 µm, 4-spored. Lamella edge fertile. Cheilocystidia not observed (but see comments). Pleurocystidia not observed. Pileus covering a hymeniderm, made up of clavate to sphero-pedunculate elements, 22-50 × 14-28 µm, with thickened, colourless walls; some elements with intracellular brown pigment. Stipitipellis a cutis of cylindrical, colourless hyphae, 3.0-6.0 µm in diameter. Clamp-connections present in all tissues.

HABITAT & DISTR. – Solitary or in small groups, saprotrophic and terrestrial on humus-rich and nutrient-rich soil, in deciduous wood on calcareous bedrock. In the Netherlands known from one locality in southern Limburg (Elsloo, Bunderbos). Sept. Originally described from Morocco and also recorded from *Cedrus*-woods in southern France, Sardinia, and from deciduous forests in Germany.

Cheilocystidia were absent in the Dutch material of *Lepiota pyrochroa*, though they have been reported for the Moroccan and French collections (see selected descriptions). The spores in the Dutch collection were considerably smaller than as given by Malençon (in Malençon & Bertault, Fl. Champ. sup. Maroc 1: 136-137. 1970).

Singer (Agar. mod. Taxon., Ed. 4: 494. 1986) mentions this species (erroneously called *L. polychroa*) as possibly belonging to the genus

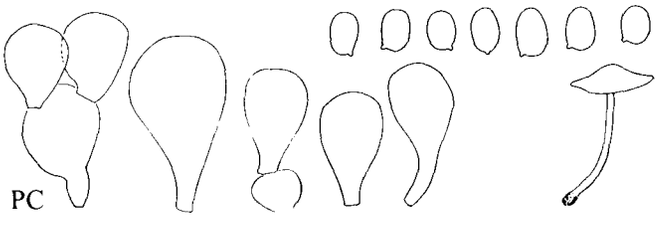

Fig. 110. *Lepiota pyrochroa*.

Smithiomyces, a genus characterized by a veil made up of very thin hyphae with embedded globose elements. However, all characters point to a close relationships with the species around *L. lilacea*.

35. Lepiota psalion Huijser & Vellinga in Vellinga & Huijser in Belg. J. Bot. 131: 203. ('1998') 1999.

MISAPPL. – *Lepiota rufipes* sensu Krieglst. in Beitr. Kenntn. Pilze Mitteleur. 7: 69-71. 1991.

SEL. ICON. – A. Hauskn. in Krieglst. in Beitr. Kenntn. Pilze Mitteleur. 7: opp. p. 64. 1991 (as *L. rufipes*).

SEL. DESCR. & FIGS. – Krieglst. in Beitr. Kenntn. Pilze Mitteleur. 7: 69-70, fig. 2. 1991 (as *L. rufipes*); Vellinga & Huijser in Belg. J. Bot. 131: 203-204, fig. 4. ('1998') 1999; Winterhoff & Bon in Carolinea 52: 8. 1994 (as *L. rufipes* f. *phaeophylla*).

CHARACTERISTICS – Pileus 7-22 mm at first, later expanding to applanate conical, with inconspicuous umbo, with inflexed margin when young with some adhering velar remnants, when young at centre pinkish to pale brown, sometimes almost white, paler towards margin, cream to pale flesh-coloured, smooth at centre, with age breaking open around centre into patches; lamellae free, crowded, relatively broad, when young creamy white, cream flesh-coloured, soon darker, with whitish, slightly eroded edge; stipe 12-22(-37) × 1-3 mm, at apex whitish, cream-white to slightly incarnate, towards base pinkish, pink-brown to vinaceous brown, almost smooth, slightly fibrillose, often with white, tomentose, ascending, often incomplete annulus, white-tomentose at base, often with white mycelial cords; context whitish in pileus, in lower part of stipe pink brownish to vinaceous brown; smell indistinct, like *L. cristata*.

Spores 3.0-4.5 × 2.5-3.5 µm, Q= 1.2-1.6, Qav = 1.25-1.45, broadly ellipsoid, ellipsoid, non-dextrinoid; basidia 15-22 × 4.0-6.0 µm, 4-spored, some 2-spored; cheilocystidia (13-)20-40 × 5.5-10.5 µm, narrowly clavate, or clavate; pileus covering a hymeniderm with transitions to an epithelium, with up to 3(-4) elements on top of each other; terminal element 18-55(-72) × 4-16(-20) µm, narrowly clavate, clavate, or obpyriform; clamp-connections present in all tissues.

HABITAT & DISTR. – Gregarious and terrestrial in humus-rich deciduous woods, June-Oct. Not with certainty recorded from the Netherlands, known from Austria, Germany, and Hungary.

This taxon has been confused with *L. rufipes*, but differs in the presence of an annulus, the fact that the pileus covering splits open in *L. psalion*, the uniformly narrowly clavate cheilocystidia and the binucleate spores.

36. Lepiota rufipes Morg. in J. Mycol. 12: 156. 1906. – Fig. 111.

Lepiota rufipes f. *phaeophylla* M. Bon in Bon & G. Riousset in Doc. mycol. 22 (85): 69. 1992.

EXCL. – *Lepiota rufipes* sensu Krieglst. in Beitr. Kenntn. Pilze Mitteleur. 7: 69-71. 1991 (= *L. psalion*). – *Lepiota rufipes* f. *phaeophylla* sensu Bizio et al. in Riv. Micol. 36: 240-241. 1993 (= *L. cristatoides*); *Lepiota rufipes* f. *phaeophylla* sensu Winterhoff & Bon in Carolinea 52: 8. 1994 (= *L. psalion*).

SEL. ICON. – Bizio et al. in Riv. Micol. 36: 239. 1993;

SEL. DESCR. & FIGS. – Bizio et al. in Riv. Micol. 36: 239-240. 1993; Joss. in Bull. trimest. Soc. mycol. Fr. 71: 65-67, fig. 1. 1955; Kelderman in Coolia 35: 76-79, fig. 1. 1992.

VERN. NAME – Kale parasolzwam.

Pileus 7.5-18 mm, when young conico-hemispherical with inflexed margin, expanding to plano-convex or applanate with, rarely without, umbo, when young whitish cream, later more ochre coloured, sometimes with pinkish tinge, especially at centre, (Mu. 10-7.5 YR 7/6, 7.5 YR 7-8/4 at centre, 10-7.5 YR 8/4, 8/2 around umbo), slightly micaceous (lens) or dull and glabrous, very slightly rugulose around umbo, sometimes with some white, arachnoid velum fibrils at margin. Lamellae, L = c. 25-40, l = 1-5, moderately crowded to crowded, slightly ventricose up to 4 mm wide, cream or creamy (2.5 Y-10 YR 8/4), darkening with age, with white eroded or fimbriate edge. Stipe 13-32 × 1-2 mm, cylindrical, narrowly fistulose or solid, pale cream in upper part, lower down with whitish bloom on vinaceous red background, often with white appressed fibrils in lower part, mostly without any trace of annulus, sometimes with adnate whitish remnants. Context pale or sordid cream and dull in pileus, shiny in stipe and especially in lower part reddish brown (7.5 YR 6/4-6). Smell indistinct or with faint smell like *L. cristata*. Taste not known. Spore print pale yellowish cream (c. 10 YR 8/4).

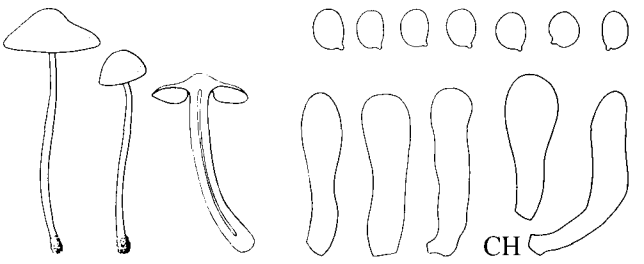

Fig. 111. *Lepiota rufipes*.

Spores 3.0-4.5 × 2.5-3.0(-3.5) µm, Q = 1.2-1.5(-1.6), Qav = 1.25-1.45, broadly ellipsoid to ellipsoid, uniguttulate, thin-walled, non-dextrinoid, seemingly rough in Melzer's Reagent, but smooth when observed with Scanning Electron Microscope, very pale pink in Congo Red, metachromatic in Cresyl Blue. Basidia 11-22 × 4.0-6.5 µm, 4-spored, rarely 2-spored. Lamella edge sterile. Cheilocystidia 14-34 × 3.5-11 µm, cylindrical and flexuous, often on top of each other, narrowly clavate, relatively thin-walled, colourless. Pleurocystidia absent. Pileus covering a hymeniderm, made up of tightly packed, narrowly clavate to broadly clavate elements, 15-48 × 8-24 µm; pigment brown, parietal in underlying hyphae. Stipitipellis a cutis of cylindrical, 2.0-4.0 µm wide hyphae, with brown walls (especially in lower part of stipe), with loose lying colourless, cylindrical velar hyphae. Clamp-connections present in all tissues.

HABITAT & DISTR. – Solitary or in small groups, saprotrophic and terrestrial on nutrient-rich, loamy or sandy, humus-rich soils, in deciduous woods and city-parks. In the Netherlands rare, occurring in southern Limburg, in the dune area and very rarely in clayey areas in the western part of the country, July-Oct. Rare in Europe, not recorded in the northern countries, probably reaching the northernmost limit of its distribution area in continental Europe in the Netherlands. Also known from North America.

The concept of *Lepiota rufipes*, as described above, is mostly based on the interpretation of Kühner & Maire (in Bull. Soc. Hist. nat. Afr. N. 28: 108-109. 1937) of *L. rufipes* Morg. Morgan's description (in J. Mycol. 12: 156. 1906) is rather vague, characterizing a small pale mushroom, without squamules, with a reddening stipe and an evanescent ring. *Lepiota rufipes* in the present sense lacks a ring, although some velar remnants may be present.

Lepiota rufipes f. *phaeophylla* M. Bon was described as a taxon with rather dark lamellae, and variable cheilocystidia. In later interpretations of this forma (e.g. Bizio et al. in Riv. Micol. 36: 240-241. 1993) the cheilocystidia are said to be rare to almost absent, and a ring to be present. The original description and material clearly depict *L.*

rufipes s.str., whereas the later interpretations agree either with *Lepiota cristatoides* or with *L. psalion*.

Several authors described *L. rufipes* as having a distinct annulus. This taxon differs from *L. rufipes* s.str. not only in the presence of this annulus, but also in the looser structure of the pileus covering, the presence of two nuclei in the spores (versus one in *L. rufipes* s.str.) and the absence of oil-like substances in the microscopical structures; furthermore the cheilocystidia are less variable in shape than in *L. rufipes*. This taxon has been described as *L. psalion* Huijser & Vellinga (in Vellinga & Huijser in Belg. J. Bot. 131: 203. ('1998') 1999).

Differences between *L. rufipes* and *L. cristatoides* are the presence in the former of cheilocystidia, the rounder spores, the absence of an annulus, and the non-squamulose pileus.

Lepiota neophana var. *europaea* Bizio & Migl. and its f. *papillata* Migl. & Perrone differ from *L. rufipes* in the absence of cheilocystidia, the scarcity of clamp-connections, and the longer spores (Bizio et al. in Riv. Micol. 36: 228-234. 1993; see also Vellinga & Huijser in Belg. J. Bot. 131: 205. ('1998') 1999).

Lepiota rufipes might be confused with specimens of *Cystolepiota seminuda* after heavy rain. The presence of cheilocystidia and the structure of the pileus covering are the best microscopical characters to distinguish *L. rufipes* from *C. seminuda*.

Sect. **Echinatae** Fay.

Pileus covered with acute squamules, made up of globose to ellipsoid (oblong) elements in agglutinated chains, transient to long coloured hyphae on pileus surface. Spores dextrinoid, rarely not reacting with Melzer's Reagent; clamp-connections present, rarely absent.

37. Lepiota aspera (Pers.: Fr.) Quél., Enchir. Fung.: 6. 1886. – Fig. 112.

Agaricus asper Pers. in Hoffm., Abb. Schwämme 3: pl. 21. 1793; *Amanita aspera* (Pers.) Pers., Observ. mycol. 2: 38. 1799; *Agaricus asper* (Pers.) Pers.: Fr., Syst. mycol. 1: 18. 1821; *Cystolepiota aspera* (Pers.: Fr.) Knudsen in Bot. Tidsskr. 73: 129. 1978; *Echinoderma asperum* (Pers.: Fr.) M. Bon in Doc. mycol. 21 (82): 62. 1991. – *Agaricus acutesquamosus* Weinm. in Hornsch., Syll. Pl. nov. Ratisb. 1: 70. 1822; *Lepiota acutesquamosa* (Weinm.) Kumm., Führ. Pilzk.: 136. 1871; *Cystolepiota acutesquamosa* (Weinm.) M. Bon in Doc. mycol. 7 (27-28): 11. 1977; *Echinoderma acutesquamosum* (Weinm.) M. Bon in Doc. mycol. 22 (88): 28. 1993; *Lepiota friesii* var. *acutesquamosa* (Weinm.) Quél. in Mém. Soc. Émul. Montbéliard, Sér. II, 5: 72. 1872 (Champ. Jura Vosges 1); *Lepiota aspera* var. *acutesquamosa* (Weinm.) Sing. in Persoonia 2: 9. 1961; *Agaricus friesii* Lasch in Linnaea 3: 155. 1828; *Agaricus friesii* Lasch: Fr., Syst. mycol., Ind. gen.: 21. 1832; *Lepiota friesii* (Lasch: Fr.) Quél. in Mém. Soc. Émul. Montbéliard, Sér. II, 5: 72. 1872 (Champ. Jura Vosges 1); *Cystolepiota friesii* (Lasch: Fr.) M. Bon in Doc. mycol. 7 (27-28): 12. 1977; *Echinoderma friesii* (Lasch: Fr.) M. Bon in Doc. mycol. 22 (88): 28. 1993. – *Lepiota acutesquamosa* var. *furcata* Kühner in Bull. trimest. Soc. mycol. Fr. 52: 210. 1936. – *Lepiota acutesquamosa* f. *gigantea* Pilát in Acta Mus. natn. Prag. 11B (2): 3. 1955; *Echinoderma acutesquamosum* f. *giganteum* (Pilát) M. Bon in Doc. mycol. 22 (88): 28. 1993.

EXCL. – *Lepiota acutesquamosa* var. *typica* Kühner in Bull. trimest. Soc. mycol. Fr. 52: 209. 1936; *Lepiota acutesquamosa* sensu Mos., Röhrlinge Blätterpilze, 4. Aufl.: 238. 1978 (in both cases *L. perplexa*).

SEL. ICON. – Breitenb. & Kränzl., Pilze Schweiz 4: pl. 214. 1995; Candusso & Lanzoni, Lepiota: pl. 7. 1990; Dähncke, 1200 Pilze: 514, 515. 1993; J. Lange, Fl. agar. dan. 1: pl. 10F. 1935 (as *L. acutesquamosa*); R. Phillips, Paddest. Schimm.: 27. 1981.

SEL. DESCR. & FIGS. – Candusso & Lanzoni, Lepiota: 127-128, fig. 17. 1990; Horak in Sydowia 33: 118-119. ('1980') 1981; Kelderman, Parasolzw. Zuid-Limburg: 44-45. 1994; Knudsen in Bot. Tidsskr. 75: 146-147, figs. 1L, 2A, 3I & 20. 1980; Kühner in Bull. trimest. Soc. mycol. Fr. 52: 210-211. 1936 (as *L. acutesquamosa* var. *furcata*).

VERN. NAME – Spitsschubbige parasolzwam.

Pileus 50-115(-150) mm, hemispherical with inflexed margin when young, expanding via broadly bluntly conical to applanate or slightly plano-concave with broad low umbo, when young completely covered with big pyramidal warts on a closed background, later at centre closely set with warts, towards margin with more repent spines with recurved tips, with radial fibrils around those spines or their place of attachment, easily removable, often, but not always, showing the underlying background in between; centre and spines brown, pinkish orange-brown, orange-brown, rarely pinkish yellowish brown (Mu. 7.5 YR 4-5/4-6, 7/6; 5 YR 5/6, 6/6), often spines darker than background and with dark tips, very rarely colourless (see notes); when young with white cobwebby velar remnants at margin. Lamellae, L = c. 200, number of lamellulae difficult to assess, very crowded, free, often furcate either near stipe or in outer part, segmentiform or slightly ventricose, up to 8.5 mm wide, usually rather narrow, creamy white, with age with orange spots, with white, flocculose edge. Stipe 50-120 × 9-22 mm, cylindrical often with bulbous or turnip-shaped base, hollow, annulate, above annulus cream-coloured, lengthwise fibrillose, below annulus brownish, or pinkish pale brown (c. 7.5 YR 7/4) fibrillose on white background, with in lower 1/3 to 1/4 girdles of brown floccose to acute, dark-tipped squamules as on pileus, with white mycelium cords at base. Annulus pendant, membranaceous, often disappearing as it is not properly attached to stipe, with white felted upper side confluent with upper part of stipe, and pale brownish underside beset with dark brown acute squamules, as on pileus. Context thick, white and dull in pileus, shiny and cream to pale yellowish-pinkish in stipe. Smell when cut and fresh very strong, like the rubber component of the *L. cristata*-odour, in some cases also with the sweet component of that smell. Taste as smell, slightly bitterish, unpleasant. Spore print white.

Spores 6.0-9.0(-9.5) × 2.5-3.5(-4.0) µm, Q = 1.9-3.3, Qav = 2.2-2.7, in side-view cylindrical, slightly triangular with widest part near hilar appendage, some with convex adaxial side, some with slight hilar depression in side-view ('penguin-shaped'), in frontal view cylindrical to slightly ovoid, dextrinoid, red, but sometimes hardly, in Congo Red, not metachromatic in Cresyl Blue. Basidia (12-)15-26 × 5.5-9.0 µm, 4-spored, very rarely 2-spored. Lamella edge sterile. Cheilocystidia abundant, 15.5-45 × 7.0-24 µm, clavate to spheropedunculate, rarely narrowly clavate, slightly thick-walled, hyaline, rarely yellowish. Pleurocystidia absent. Elements of pileus covering agglutinated into warts; terminal elements of chains 30-57 × 15-45 µm, globose to ellipsoid or clavate, with or without brown walls. Basal elements cylindrical to slightly inflated, 2.0-12 µm wide, brown-walled (not encrusted), with clamp-connections. Stipitipellis a cutis of cylindrical, 3.0-5.0 µm wide, hyphae, colourless, below annulus also brown hyphae present, with elements in spines and warts as those on pileus. Clamp-connections abundant in all tissues.

HABITAT & DISTR. – Gregarious, rarely solitary, saprotrophic and terrestrial on humus-rich and/or nutrient-rich sandy to clayey soils, often in slightly disturbed places like gardens and around badger dens, in deciduous, mixed, and coniferous woods, city-parks, and orchards. Also recorded from greenhouses. With *L. cristata* and *Cystolepiota seminuda* forming the trio of most common *Lepiota*-species in the Netherlands, occurring rather commonly throughout the country. Aug.-Nov. Widespread in Europe and the rest of the temperate parts of the

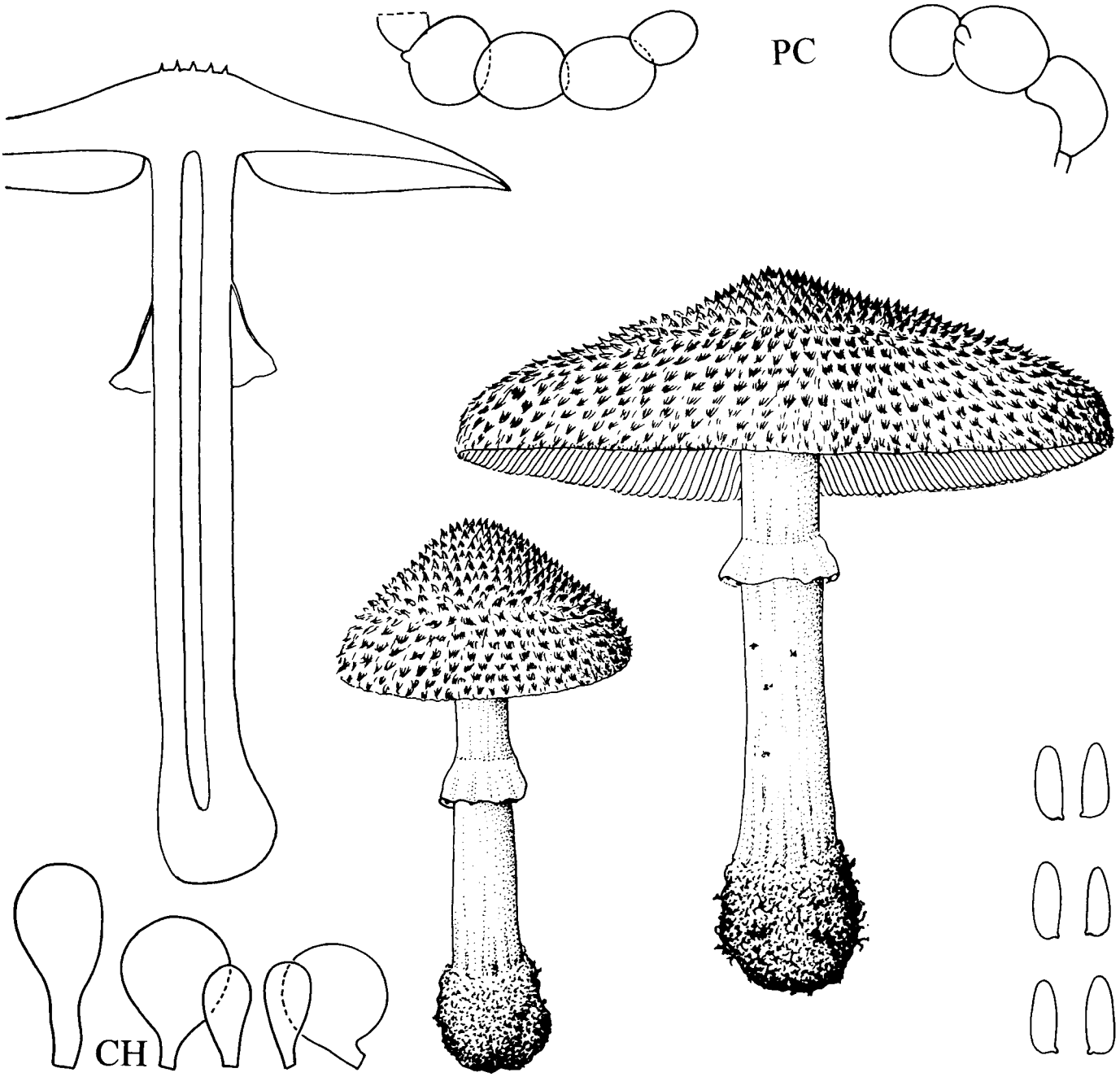

Fig. 112. *Lepiota aspera*.

Northern Hemisphere and everywhere scattered to moderately common, only lacking north of the arctic circle and in alpine habitats.

Lepiota aspera is very variable in terms of pileus covering; the spines can be big and standing out on a whitish background, but also small spines on a brown background do occur. The colouring is not constant either. Occasionally totally white or sordid-white specimens are encountered. Also whitish specimens with pale brown tips of the squamules are met with (see for example Balke in Coolia 13: 11-12. 1966). Rarely pink-brown colours occur, reminiscent of those of *L. fuscovinacea*. In all these cases, microscopical characters, and the other macroscopical features (annulus, size, number of lamellae etc.) leave no doubt that these variants still belong to *L. aspera*.

38. Lepiota perplexa Knudsen in Bot. Tidsskr. 75: 137. 1980. – Fig. 113.

Cystolepiota perplexa (Knudsen) M. Bon in Doc. mycol. 15 (60): 38. 1985; *Echinoderma perplexum* (Knudsen) M. Bon in Doc. mycol. 21 (82): 63. 1991.

MISAPPL. – *Lepiota acutesquamosa* var. *typica* sensu Kühner in Bull. trimest. Soc. mycol. Fr. 52: 209. 1936; *Lepiota acutesquamosa* sensu Mos., Röhrlinge Blätterpilze, 4. Aufl.: 238. 1978.

SEL. DESCR. & FIGS. – Candusso & Lanzoni, Lepiota: 148-150, fig. 22. 1990; Enderle & Krieglst. in Z. Mykol. 55: 84-85. 1989; Kelderman, Parasolzw. Zuid-Limburg: 54-55. 1994; Knudsen in Bot. Tidsskr. 75: 137-139, figs. 1I, 2E, 3L, 12 & 13. 1980.

VERN. NAME – Egelparasolzwam.

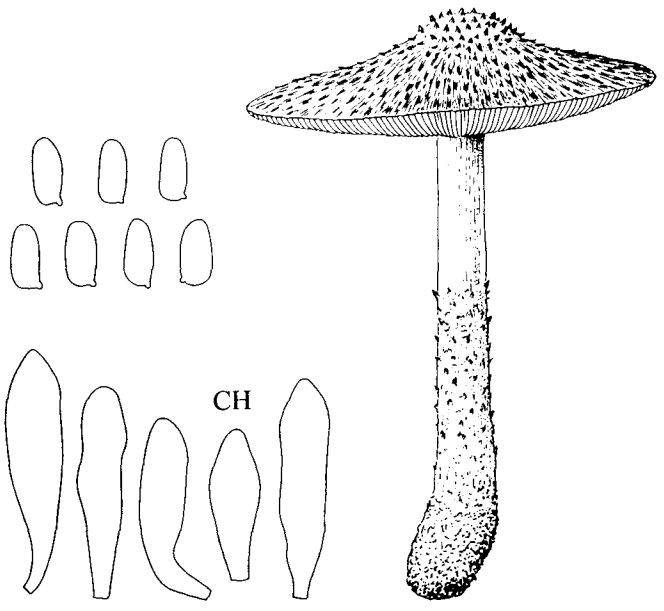

Fig. 113. *Lepiota perplexa*.

Pileus 28-55 mm, when young hemispherical with inflexed margin, expanding to plano-conical, plano-convex and eventually applanate with low, broad umbo, at centre densely set with irregular to conical warts up to 1 mm high, around centre with warts in concentrical zones or more scattered, with radial, arachnoid fibrils around base, on tomentose-felted background, pinkish brown (Mu. 7.5 YR 5/5, 5/6) at centre and pinkish buff (7.5 YR 7/6) at margin, sometimes darker (K. & W. 6C4 - 6D4) with concolorous to slightly darker warts (e.g. 7.5 YR 4/6); warts easily rubbed and washed off; when young with remnants of partial veil at margin, and margin exceeding lamellae. Lamellae, L = 55-70, l = 1-3, crowded, free and remote from stipe, not furcate, subventricose, ventricose, rather broad (up to 6 mm wide), sordid cream, sometimes with pinkish sheen, with white, subgranular edge. Stipe 35-70 × 5-11 mm, cylindrical with (sub)bulbous, up to 15 mm wide, base, fistulose, at utmost apex whitish to cream, below annular zone darkening towards pinkish brown at base, in lower 1/3 or less with darker reddish brown, slightly lanate, fibrils (7.5 YR 6-5/4-6) lengthwise and at base with distinct warts, concolorous or slightly darker than those on pileus. Context whitish in pileus, glassy cream or very pale brown in stipe and white around tube. Smell strong in cut basidiocarps, like the smell of *L. cristata*. Taste unpleasant, somewhat acrid-astringent. Spore print probably white.

Spores 5.0-6.5 × 2.5-3.0 µm, Q = 1.8-2.6, Qav = 2.05-2.35, in side-view oblong to cylindrical, some with slightly convex, abaxial side, some with suprahilar depression ('penguin-shaped'), in frontal view oblong to cylindrical, dextrinoid, metachromatic in Cresyl Blue, but not very distinctly so. Basidia 12.5-23 × 4.0-7.0 µm, 4-spored, very rarely 2-spored. Lamella edge sterile. Cheilocystidia 24-40(-50) × 7.0-10(-13) µm, fusiform, narrowly clavate, cylindrical, often with constriction, slightly thick-walled and colourless. Pleurocystidia absent. Pileus covering made up of cylindrical, brown-walled, 4.0-16 µm wide hyphae, giving rise to agglutinated chains of more or less globose elements, unified to warts; terminal elements of warts 16-60 × 12-57 µm, thick-walled and brown. Stipitipellis at apex of stipe a cutis of cylindrical, 3.0-6.0 µm wide, yellow-brown hyphae. Stipe covering made up of irregularly flexuous, cylindrical hyphae, brown and thick-walled, with elements as in squamules on pileus. Clamp-connections present in all tissues.

HABITAT & DISTR. – Gregarious, saprotrophic and terrestrial in deciduous woods or city-parks on humus-rich, nutrient-rich soils, rare, mainly in the western clay region, the river area and in southern Limburg. Aug.-Oct. Widespread but rare in temperate parts of Europe.

39. Lepiota hystrix Møller & J. Lange in J. Lange, Fl. agar. dan. 5: V. 1940.

Lepiota hystrix Møller & J. Lange in J. Lange, Fl. agar. dan. 1: 26. 1935 (not valid); *Cystolepiota hystrix* (Møller & J. Lange) Knudsen in Bot. Tidsskr. 73: 128. 1978; *Echinoderma hystrix* (Møller & J. Lange) M. Bon in Doc. mycol. 21 (82): 63. 1991.

SEL. ICON. – Breitenb. & Kränzl., Pilze Schweiz 4: pl. 227. 1995; J. Lange, Fl. agar. dan. 1: pl. 10E. 1935; R. Phillips, Paddest. Schimm.: 26. 1981; Stridvall in Jordstjärnan 12 (2): opp. p. 1. 1991.

SEL. DESCR. & FIGS. – Knudsen in Bot. Tidsskr. 75: 143-144, figs. 1K, 2F, 3F, 17 & 18. 1980.

CHARACTERISTICS – Pileus 30-70 mm, conical to convex with a broad umbo, tomentose, greyish orange or brown, covered with pointed, conical, rather persistent squamules, blackish and very crowded at centre, more scattered towards margin and paler with blackish tip, towards margin surrounded with arachnoid fibrils showing the whitish context in between; lamellae whitish with dark lamella edge; stipe 40-80 × 4-8 mm, cylindrical with annulus, below annulus with pointed squamules; annulus membranaceous, with woolly squamules on underside and when fresh exuding blackish drops; smell unpleasant, reminiscent of the smell of *L. cristata*.

Spores 5.5-7.0 × 2.5-3.0 µm, Q = 2.0-2.6, Qav = 2.3, cylindrical or subcylindrical with convex abaxial side in side-view, in frontal view narrowly ovoid; lamella edge sterile, with parallel hyphae which give rise to clusters of thick-walled cheilocystidia; cheilocystidia 17-40 × 6-10 µm, narrowly clavate, sometimes slightly capitate or cylindrical, hyaline at first, then with brown walls, finally with dark contents; pileus covering with warts, made up of chains of irregularly shaped and sized elements elements, up to 110 × 30 µm, with intracellular dark brown pigment which is soluble in ammonia, and with brown walls; clamp-connections present.

HABITAT & DISTR. – Solitary to gregarious, saprotrophic and terrestrial in deciduous woods on nutrient-rich soils. Not yet recorded in the Netherlands and rare in Europe.

The above description is based on descriptions in the literature and on observations on two collections from the same locality in northern France. *Lepiota hystrix* is easily recognized by the combination of the dark, almost black squamules on the pileus, and the dark lamella edge. *Lepiota calcicola* occasionally has a dark lamella edge, but in that species the elements of the warts are regularly shaped, ellipsoid to oblong (not globose), and the pigment is situated in the walls of the elements. Knudsen (in Bot. Tidsskr. 75: 144. 1980) stated that in *L. hystrix* the elements of the warts were typically 20-30 µm and globose; however, in the specimens studied the elements were very variable, both in shape and size. The shape was very irregular, and only a few elements were globose.

40. Lepiota calcicola Knudsen in Bot. Tidsskr. 75: 140. 1980. – Fig. 114.

Cystolepiota calcicola (Knudsen) Bon & Courtec. in Doc. mycol. 18 (69): 38. 1987; *Echinoderma calcicola* (Knudsen) M. Bon in Doc. mycol. 21 (82): 62. 1991.

MISAPPL. – *Lepiota hispida* sensu J. Lange, Fl. agar. dan. 1: 26. 1935; *Cystolepiota hispida* sensu M. Bon in Doc. mycol. 11 (43): 28. 1981.

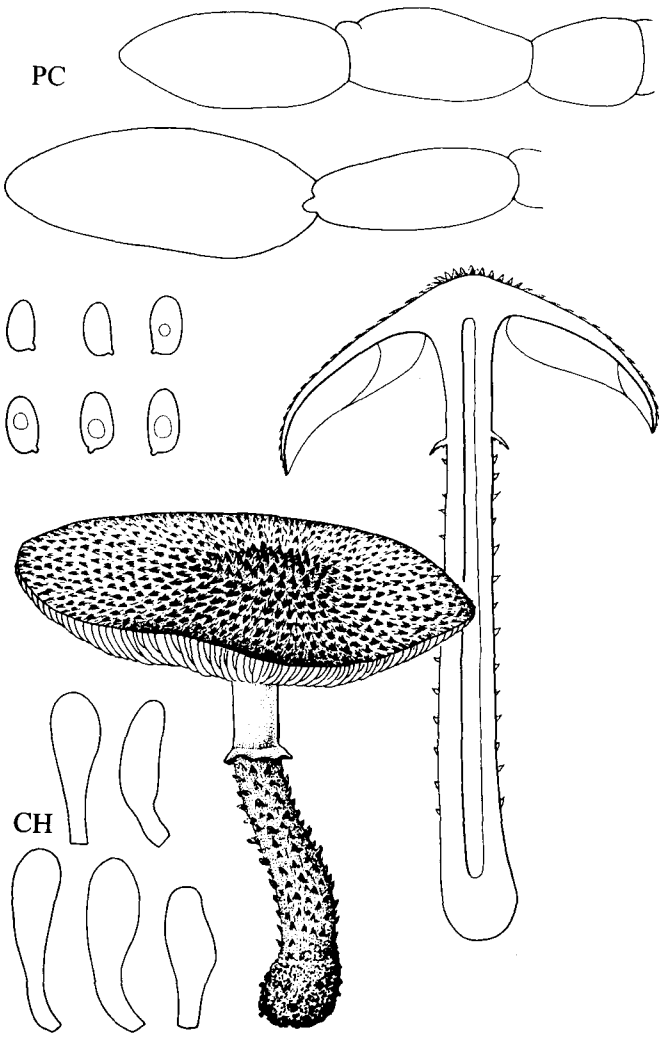

Fig. 114. *Lepiota calcicola*.

SEL. ICON. – Breitenb. & Kränzl., Pilze Schweiz 4: pl. 217. 1995; Heilmann-Clausen in Svampe 34: 33. 1996; Kasparek in Mittbl. Arbeitsgem. Pilzk. Niederrhein 11: after p. 102. 1993.

SEL. DESCR. & FIGS. – Candusso & Lanzoni, Lepiota: 132-134, fig. 18. 1990; Kasparek in Mittbl. Arbeitsgem. Pilzk. Niederrhein 11: 78-83. 1993; Kelderman, Parasolzw. Zuid-Limburg: 46-47. 1994; Knudsen in Bot. Tidsskr. 75: 140, figs. 1H, 2G, 3B, 15. 1980; Lohmeyer et al. in Z. Mykol. 59: 205-206. 1993.

VERN. NAME – Kalkstekelparasolzwam.

Pileus 26-85 mm, hemispherical, convex or rounded-conical with inflexed margin at first, expanding to applanate or plano-concave with umbo and undulating, deflexed margin, strongly fibrillose-squamose, at centre with large, pyramidal, slender squamules up to 5 mm high and 1.5 mm at base, towards margin with more appressed fibrillose squamules; underlying context hardly showing; rather equally brown or dark brown (K. & W. 7E4-5; Mu. 5 YR 4/3-2), sometimes more vinaceous brown (8D3-4); squamules not removable; margin with some overhanging velum remnants; when young with a cortina of white and brown fibrils between stipe and pileus margin. Lamellae, L = 70-80, l = 3-6, crowded to very crowded, free, ventricose, 5-8 mm wide, when young white, later more cream to yellowish, with concolorous, white, or rarely dark, even, pruinose to irregular edge. Stipe 30-90 × 4-14 mm, cylindrical, or slightly attenuate at apex and slightly widened towards subbulbous, 8-13 mm wide, base, fistulose with age, at apex white when young, brunnescent with age, and fibrillose, below annular zone completely covered with dark brown fibrils, with zones or girdles of acute squamules as on pileus, sometimes more widespread, showing more of the underlying context, and making a paler impression than pileus, sometimes very dark brown at base. Context thick, dull and white in pileus, whitish and shiny in stipe. Smell like soil or cellars; when basidiocarp cut, smell distinctly like *L. cristata* or fruity-resinaceous, and not reminiscent of *L. cristata*. Taste mild, fungoid. Spore print 'white'.

Spores 4.0-6.0 × 2.0-3.5 µm, Q = 1.4-2.2, Qav = 1.6-1.85, oblong to subcylindrical to cylindrical, in frontal view sometimes slightly ovoid, dextrinoid, congophilous, not metachromatic in Cresyl Blue. Basidia 15.5-22 × 5.0-7.0 µm, 4-spored. Lamella edge sterile. Cheilocystidia in fascicles, 18-35 × 4.0-10 µm, narrowly clavate, some cylindrical, some narrowly utriform, hyaline, very rarely with dark brown contents. Pleurocystidia absent. Elements of pileus covering in agglutinated chains; apical elements (20-)30-70(-100) × 15-40 µm, ellipsoid to oblong, a very few globose, with thickened, brown walls; intermediate elements more elongate-fusoid; basal elements, 2.0-6.0 µm wide, cylindrical, with brown walls. Stipitipellis a cutis of cylindrical, brown-walled, 3.0-5.0 µm wide, yellow-brown hyphae, with below annular zone, elements in squamules, as on pileus, or longer. Clamp-connections abundant in all tissues.

HABITAT & DISTR. – In small groups, gregarious, saprotrophic and terrestrial on humus-rich soils and on calcareous bedrock, in deciduous woods. Very rare in the Netherlands, only known from several places in southern Limburg; Aug.-Nov. Widespread and rare in Europe.

41. Lepiota efibulis Knudsen in Bot. Tidsskr. 75: 151. 1980.

Echinoderma efibule (Knudsen) M. Bon in Doc. mycol. 21 (82): 62. 1991.

SEL. DESCR. & FIGS. - Knudsen in Bot. Tidsskr. 75: 151. 1980.

VERN. NAME – Kasstekelparasolzwam.

CHARACTERISTICS – Pileus 20-55 mm, when young truncate-conical, expanding to plano-convex with broad, prominent umbo, when young completely covered with adjacent, acute warts, later at umbo covered with small up to 1 mm high warts, and around umbo with concentrical uplifted acute squamules, dark red-brown on umbo and warts (Mu. 7.5 YR 3/4) on paler background (7.5 YR 5/5 to 10 YR 8/6 at margin); cream context not or hardly showing at umbo; lamellae moderately distant, free, with up to 1 lamellula, ventricose, not furcate, creamy flocculose edge; stipe 35-55 × 3-5 mm, cylindrical, fistulose with age, with white mycelium cords at base, with distinct annulus 1/3 from apex, above annulus pinkish (5 YR 8/3), lengthwise fibrillose, below annulus purplish red-brown (5 YR 4/4, 7.5 YR 6/4) with in lower 1/3 zones of blunt floccose squamules; annulus with red-brown squamulose warts on upper part, less big and less acute than on pileus; context white and dull in pileus, in stipe concolorous with upper outer part, shiny white around tube; smell unpleasant, somewhat suggestive of the smell of *L. cristata*; taste none.

Spores 4.5-5.5 × 2.5-3.0(-3.5) µm, Q = 1.55-1.95, Qav = 1.7, oblong, dextrinoid, metachromatic in Cresyl Blue; basidia 4-spored; lamella edge sterile; cheilocystidia 18-32 × 8.0-12 µm, clavate; pileus warts made up of chains of globose to ovoid elements, 24-40 × 18-32 µm, with brown, thick walls; warts on stipe made up of more irregularly shaped elements than on pileus; clamp-connections absent in all tissues.

HABITAT & DISTR. – Gregarious, saprotrophic and terrestrial on humus-rich soil, very rare, only known from a non-heated greenhouse in Amsterdam. Sept. Also recorded from several greenhouses in Great Britain.

This species is aberrant with respect to the other representatives of the section in Europe on account of the absence of clamp-connections.

42. Lepiota echinacea J. Lange, Fl. agar. dan. 5: V. 1940. – Fig. 115.

Lepiota echinacea J. Lange, Fl. agar. dan. 1: 26. 1935 (not valid); *Cystolepiota echinacea* (J. Lange) Knudsen in Bot. Tidsskr. 73: 127. 1978; *Echinoderma echinaceum* (J. Lange) M. Bon in Doc. mycol. 21 (82): 63. 1991.

SEL. ICON. – Enderle & Krieglst. in Z. Mykol. 55: opp. p. 64. 1989; J. Lange, Fl. agar. dan. 1: pl. 10D. 1935; Vellinga & Huijser in Coolia 40: pl. 2. 1997.

SEL. DESCR. & FIGS. – Kelderman, Parasolzw. Zuid-Limburg: 50-51. 1994; Knudsen in Bot. Tidsskr. 75: 135, 137, figs. 1G, 3J, 9 & 10. 1980; Kühner in Bull. trimest. Soc. mycol. Fr. 52: 211-212. 1936.

VERN. NAME – Fijnschubbige parasolzwam.

Pileus 18-50(-60) mm, when young broadly hemispherical or broadly conical-hemispherical with inflexed margin, expanding to applanate, with straight, inflexed or deflexed margin, completely set with spines, those at centre fine and almost cylindrical to pyramidal, 0.5-1.5 mm high, around centre often in concentrical zones and more adnate, recurved and fibrillose; colour of spines dark brown (at least at apex) on a pinkish brown, pinkish orange-brown to occasionally cream background (Mu. 7.5 YR 7/4-6, 6/4, 6-8/5-6; K. & W. 4A3, 5B4); background felted-fibrillose, especially at centre in patches around squamules; spines sometimes washed off and leaving indistinct, pale scars; margin exceeding lamellae. Lamellae, L = 40-70, l = 1-5, crowded to moderately distant, free, ventricose to subventricose, up to 9 mm wide, white to cream or pinkish-creamy, with even to very fine-flocculose white edge. Stipe 22-62 × 4-12 mm, cylindrical, often slightly broadened at utmost base, fistulose, in upper half cream to pale brownish or pinkish cream and shiny to woolly fibrillose, in lower half, below indistinct annular zone, pale pink-brown to orange-brown (e.g. 7.5 YR 7/6) tomentose, with distinct and acute, though often less acute than on pileus, or floccose, dark red-brown or orange-brown squamules or warts, often in bands, rather densely set at base; at base with white mycelium cords. Context white, dull and firm in pileus, in stipe cream to brownish in lower part, shiny. Smell sweetish fruity like *L. cristata*, especially of cut basidiocarps. Taste like taste of *L. cristata*: rubber-like and unpleasant. Spore print probably white.

Spores (3.5-)4.0-5.5(-6.5) × (2.0-)2.5-3.5 µm, Q = 1.4-2.0(-2.15), Qav = 1.6-1.8, oblong or subcylindrical in side-view, similar or slightly ovoid in frontal view, dextrinoid, congophilous, and not metachromatic in Cresyl Blue. Basidia 15-26 × 4.5-7.0 µm, 4-spored, rarely 2-spored; old basidia in some cases thick-walled. Lamella edge heterogeneous or sterile. Cheilocystidia absent or present in tufts; 8.0-32 × 4-11.5 µm, clavate, narrowly clavate and narrowly utriform, slightly thick-walled, colourless. Pleurocystidia absent. Pileus covering made up of agglutinated chains of ellipsoid to rounded elements; terminal elements of chains of squamules 15-62 × 10-50 µm, ellipsoid, globose, with thick, brown walls. Stipitipellis a cutis made up of cylindrical hyphae, 4.0-10 µm wide, with pale brown, sometimes encrusted, walls, with squamules as on pileus, elements of these squamules often more cylindrical-ellipsoid than on pileus, with brown walls. Clamp-connections present in all tissues.

HABITAT & DISTR. – Gregarious in small groups, rarely in fairy rings, saprotrophic and terrestrial in deciduous woods, city-parks, mine waste heaps etc. on humus-rich, sandy or loamy-clayey, nutrient-rich, soils; rather rare, absent from the regions with nutrient-poor sand as main component of the soil. Mid Aug.-mid Nov. Widespread in Europe, but nowhere very common.

The squamules on pileus and stipe show a remarkable variability, from fine and short to more pyramidal; Knudsen (in Bot. Tidsskr. 75: 135. 1980) distinguished three types of velar coverings on pileus and stipe, but he also discovered transitions between the different types. On account of these transitions it was not possible to distinguish taxa on this character; nor was there a correlation between macromorphology and the presence or absence of cheilocystidia. This leaves *Lepiota echinacea* as a variable species.

43. Lepiota jacobi Vellinga & Knudsen in Vellinga in Persoonia 14: 407. 1992. – Fig. 116.

Echinoderma jacobi (Vellinga & Knudsen) Rald et al. in Svampe 26: 36. 1992 (not valid; as *E. jacobii*); *Lepiota langei* Knudsen in Bot. Tidsskr. 75: 130. 1980, non *Lepiota langei* Locq., 1945.

MISAPPL. – *Lepiota eriophora* sensu auct. eur.; *Cystolepiota eriophora* sensu Knudsen in Bot. Tidsskr. 73: 127. 1978; *Echinoderma eriophorum* sensu M. Bon in Doc. mycol. 21 (82): 63. 1991.

SEL. ICON. – Breitenb. & Kränzl., Pilze Schweiz 4: pl. 231. 1995 (as *L. langei*); J. Lange, Fl. agar. dan. 1: pl. 12H. 1935 (as *L. echinella* var. *eriophora*); Rald et al. in Svampe 26: 35. 1992 (as *Echinoderma jacobii*).

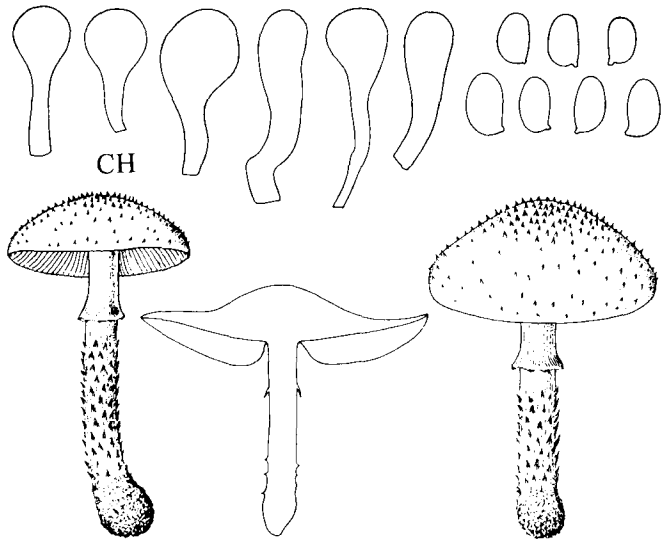

Fig. 115. *Lepiota echinacea*.

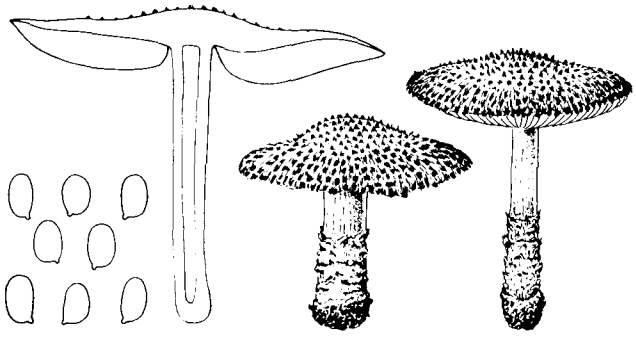

Fig. 116. *Lepiota jacobi*.

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SEL. DESCR. & FIGS. – Candusso & Lanzoni, Lepiota: 144-146, fig. 21. 1990 (as *L. langei*); Enderle & Krieglst. in Z. Mykol. 55: 78. 1989 (as *L. langei*); Kelderman, Parasolzw. Zuid-Limburg: 52-53. 1994; Knudsen in Bot. Tidsskr. 75: 130-131, figs. 1B, 3K & 6. 1980 (as *L. langei*); Schätzle & Ottmann in Ulmer Pilzfl. 3: 63-64. 1992 (as *L. langei*).

VERN. NAME – Wollige stekelparasolzwam.

Pileus 19-51 mm, when young hemispherical with inflexed margin, expanding to plano-convex or applanate with low, broad umbo, and undulating marginal zone, completely covered with small discrete acute spines, up to 1 mm high, higher than broad, towards margin spines concentrically arranged, slightly bigger and more adnate and fibrillose, around squamules, except at centre, showing the underlying pale sordid brown, beige to buff (Mu. 10 YR 8-7/4) background; squamules dark brown to black-brown (10 YR 2/2, 3/3-4); when young with velar remnants at margin. Lamellae, L = 35-50, l = 1-3, moderately crowded to moderately distant, free, subventricose, 4-6 mm wide, cream, or cream with pale orange tinge, with concolorous, even to white, flocculose edge. Stipe 20-60 × 3-6 mm, cylindrical, sometimes slightly broadened towards base, hollow, with annular zone halfway, above this zone white-cream when young to pale pinkish orange-tinged, or pale brown, fibrillose-flocculose (10 YR 8/5, 7.5 YR 7/6-8/5), below annular zone with girdles and zones of woolly, brown (7.5 YR 5-4/4) squamules on paler background. Context whitish and dull in pileus, whitish around tube in stipe, and concolorous with surface in outer part of stipe, shiny. Smell unpleasant, earth-like and sweet, a bit like the smell of *L. cristata*. Taste unpleasant, slightly bitterish raphanoid. Spore print cream (Breitenbach & Kränzlin, Pilze Schweiz 4: pl. 231. 1995).

Spores 3.5-5.5 × 2.0-3.0 µm, Q = 1.45-2.05, Qav = 1.65-1.75, ellipsoid to oblong, often with parallel sides in side-view, the same or slightly ovoid in frontal view, dextrinoid, not metachromatic in Cresyl Blue, often in tetrads. Basidia 13.5-22 × 4.0-6.0 µm, narrowly clavate, a few cylindrical, 4-spored. Lamella edge fertile. Cheilocystidia absent. Pleurocystidia absent. Elements of pileus covering organized in squamules, made up of more or less regular chains, with terminal elements globose, pyriform or ellipsoid, 20-60 × 15-48 µm, with brown, thick walls; intermediate elements brown-walled, inflated to cylindrical, 5.0-20 µm wide; basal elements cylindrical to inflated, 4.0-15 µm wide, with brown, not encrusted walls. Stipitipellis a cutis, lower part made up of cylindrical to inflated, 5.0-20 µm wide brown hyphae, with encrusted pigment, with elements in squamules as on pileus, with brown not-encrusted walls, and up to 110 × 45 µm. Clamp-connections present in all tissues.

HABITAT & DISTR. – Solitary to gregarious, saprotrophic and terrestrial on humus-rich or nutrient-rich loamy to clayey soil, in city-parks, gardens, deciduous and mixed woods, also on mine waste heaps. Rather rare, mostly occurring in southern Limburg and Holland. June-Oct. Widespread but not common in Europe.

This species has been known as *Lepiota eriophora* Atk., but this, according to Knudsen (in Bot. Tidsskr. 75: 131. 1980), is a different species, not occurring in Europe. Bon (in Doc. mycol. 21 (82): 63. 1991) did not agree with Knudsen's point of view and called the European species *E. eriophorum*. Unfortunately Knudsen (in Bot. Tidsskr. 75: 130. 1980) chose a new name already validly published in *Lepiota*, viz. *L. langei* Locq., for the European interpretation of *L. eriophora*, so again a name change was necessary: *L. jacobi* Vellinga & Knudsen (in Vellinga in Persoonia 14: 407. 1992).

44. Lepiota carinii Bres., Iconogr. mycol. 12: pl. 598. ('1929') 1930. – Fig. 117.

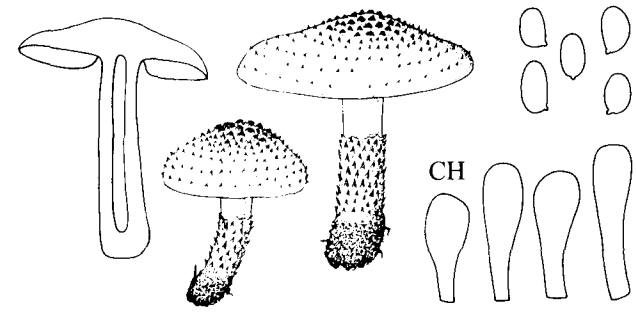

Fig. 117. *Lepiota carinii*.

Echinoderma carinii (Bres.) M. Bon in Doc. mycol. 21 (82): 63. 1991.

EXCL. – *Lepiota carinii* sensu Breitenb. & Kränzl., Pilze Schweiz 4: 194-195. 1995 (= *Lepiota* spec.).

MISAPPL. – *Lepiota echinella* var. *asperula* sensu J. Lange, Fl. agar. dan. 1: pl. 10C. 1935; *Lepiota eriophora* var. *asperula* sensu Mal. & Bert., Fl. Champ. sup. Maroc 1: 126-127. 1970.

SEL. ICON. – Bres., Iconogr. mycol. 12: pl. 598. ('1929') 1930; Gallinari & Tomasi in Boll. Circ. micol. G. Carini 15: opp. p. 18. 1988; J. Lange, Fl. agar. dan. 1: pl. 10C. 1935 (as *L. echinella* var. *asperula*); Partacini in Riv. Micol. 38: 283. 1995.

SEL. DESCR. & FIGS. – Gallinari & Tomasi in Boll. Circ. micol. G. Carini 15: 15. 1988; Knudsen in Bot. Tidsskr. 75: 131, 132, figs. 1D, 3C & 8. 1980; Mal. & Bert., Fl. Champ. sup. Maroc 1: 126-127. 1970 (as *L. eriophora* var. *asperula*); Migl. & Coccia in Micol. ital. 21 (2): 35-40. 1992; Partacini in Riv. Micol. 38: 282-284. 1995; Schätzle & Ottmann in Ulmer Pilzfl. 3: 65-67. 1992; Uljé in Coolia 27: 12-16. 1984.

VERN. NAME – Bruingele stekelparasolzwam.

Pileus 15-45 mm, when young hemispherical, then broad-conical with inflexed margin, expanding to plano-convex or convex, with undulating margin and broad umbo, completely beset with acute or blunt, orange-brown to dark brown squamules (darker than Mu. 7.5 YR 4/6; 7.5 YR 4/4), c. 0.5 mm high and broad, on a yellow-brown, pale orange-brown to (pale) brown background (5 YR 5/8, 7.5 YR 7/6, 8/6 or paler), when young with overhanging margin set with whitish woolly velum. Lamellae, L = 45-55, l = 1-3, rather crowded, free, ventricose, subventricose or segmentiform, 3-5 mm broad, white when young, cream and brown-spotted with age, with whitish, even or fimbriate (lens), concolorous edge. Stipe (15-)25-60 × 3.5-7(-8) mm, cylindrical or slightly widened at base, curved near base, hollow, in upper 1/4-1/3 part white and fibrillose-striate, in lower part with girdles of orange-brown, acute squamules, with white mycelial cords at base. Annulus woolly and evanescent. Context white and dull in pileus, in stipe white to pale creamy and shiny, with age brownish at base. Smell indistinct to strong and like the smell of *L. cristata*. Taste not known. Spore print colour white.

Spores (3.0-)3.5-4.5(-5.0) × 2.0-3.0 µm, Q = 1.35-1.8, Qav = 1.6-1.65, ellipsoid to oblong, dextrinoid, not or weakly metachromatic in Cresyl Blue, often in tetrads. Basidia 13.5-23 × 4.0-6.5 µm, 4-spored. Lamella edge fertile or with some scattered cheilocystidioid elements or rarely completely sterile. Cheilocystidia 16-33 × 5.0-8.5 µm, clavate, rarely cylindrical, hyaline and thin-walled. Pleurocystidia absent. Squamules on pileus made up of agglutinated chains of globose to ellipsoid elements, with the terminal elements more globose and bigger than the penultimate elements; terminal elements 10-25(-45) × 10-21(-35) µm with yellow-brown walls; intermediate hyphae

with inflated elements, 16-25 × 4-6 µm, with brown walls; elements of pileus covering made up of non-coloured, cylindrical hyphae, c. 4.0 µm wide. Stipitipellis a cutis made up of cylindrical, non-coloured hyphae, 2.0-5.0 µm in diam.; squamules on stipe made up of chains of elements, comparable in shape and size to those on pileus. Clamp-connections present in all tissues.

HABITAT & DISTR. – Solitary to gregarious, saprotrophic and terrestrial on the outskirts of deciduous woods and in city-parks on nutrient-rich, clayey or loamy soils. Very rare in the Netherlands, known from several places in southern Limburg and in the western clay area. Sept.-beginning of Nov. Rare in Europe, known northwards into Denmark, perhaps more common in Italy, and recorded from Morocco.

Lepiota sinopica comes very close, but it seems to lack distinct squamules on the stipe (see Romagnesi in Bull. Soc. nat. Oyonnax 10-11: 91-92. 1957 (Compl. Fl. anal. 7)). *Lepiota sinopica* is characterized by orange-brown colours, and a velvety pileus with small squamules. This species, however, is rather enigmatic and the finds of it since Romagnesi's description are dubious (e.g. Braiotto in Boll. Ass. micol. ecol. Romana 25: 28-33. 1992). In the latter the pink colours and the small mealy squamules indicate a possible similarity of the collection depicted with *Cystolepiota moelleri*.

45. Lepiota pseudoasperula (Knudsen) Knudsen in Bot. Tidsskr. 75: 128. 1980. – Fig. 118.

Cystolepiota pseudoasperula Knudsen in Bot. Tidsskr. 73: 125. 1978; *Echinoderma pseudoasperulum* (Knudsen) M. Bon in Doc. mycol. 21 (82): 63. 1991.

EXCL. – *Lepiota pseudoasperula* sensu Enderle & Krieglst. in Z. Mykol. 55: 86. 1989 (= *Cystolepiota moelleri*); *Lepiota* aff. *pseudoasperula* sensu Breitenb. & Kränzl., Pilze Schweiz 4: 204-205. 1995 (= probably *L. carinii*)

MISAPPL. – *Lepiota eriophora* sensu D. Reid in Trans. Br. mycol. Soc. 41: 426-427. 1958.

SEL. ICON. – Rald et al. in Svampe 26: 35. 1992.

SEL. DESCR. & FIGS. – Candusso & Lanzoni, Lepiota: 151-152, fig. 23. 1990; Courtecuisse in Beitr. Kenntn. Pilze Mitteleur. 3: 314-316, fig. 2. 1987; Huijser & Kelderman in Coolia 34: 83-86, fig. 2. 1991; Knudsen in Bot. Tidsskr. 75: 128, figs. 1C, 3G & 4. 1980.

VERN. NAME – Kleine stekelparasolzwam.

Pileus 10-27 mm, when very young hemispherical, later more conical with blunt apex, expanding to plano-convex with low umbo, beset with pinkish brown to dark reddish brown (Mu. 5 YR 3/3, 4/4-6), pointed squamules up to 1 mm high and 1 mm broad, close together at centre, more spaced out towards margin, on pale, radially short-fibrillose background (7.5 YR 7-8/4-6); squamules easily removable; margin exceeding lamellae. Lamellae, L = 25-45, l = 0-3, moderately crowded, free, segmentiform to slightly ventricose up to 2 mm broad, cream with pale salmon sheen, with even, concolorous edge. Stipe 20-45 × 1.5-3 mm, cylindrical or slightly broadened at base, hollow with age, cream coloured and almost glabrous at apex, in lower 3/4 with slightly woolly girdles of squamules, more or less concolorous with squamules on pileus (5 YR 5/4-6) on cream or slightly pinkish background. Context in pileus white-cream and dull, in stipe shiny cream at apex to pink-brown at base. Smell of cut basidiocarps strong, unpleasant, mealy-turpentine-like and slightly sweetish. Taste unpleasant, like the taste of *L. cristata*. Spore print probably white.

Fig. 118. *Lepiota pseudoasperula*.

Spores (3.5-)4.0-5.0(-6.0) × 2.0-3.0 µm, Q = (1.4-)1.55-2.1(-2.35), Qav = 1.65-1.9, oblong to cylindrical in side-view and in frontal view, often in clusters, dextrinoid, (weakly) metachromatic in Cresyl Blue. Basidia 14-24 × 4.5-6.5 µm, cylindrical to narrowly clavate, 4-spored, a few 2-spored. Lamella edge fertile. Cheilocystidia and pleurocystidia absent. Squamules on pileus made up of chains of elongate to more ellipsoid to globose terminal elements; terminal elements (15-)30-55 × (15-)26-48 µm, with yellow-brown walls. Basal elements cylindrical, 3.0-6.0 µm wide, with brown walls. Stipitipellis a cutis of cylindrical, 2.0-6.0 µm wide elements; covering made up of elements resembling those on pileus, often with spheropedunculate elements. Clamp-connections abundant in all tissues.

HABITAT & DISTR. – Solitary or gregarious, saprotrophic and terrestrial on humus-rich, clayey or loamy soils, in deciduous woods and on a mine waste heap. Very rare in the Netherlands, known from several places in southern Limburg, and from the province of Flevoland. End of July-Oct. Very rare and scattered in Europe, from Norway in the north, to the north of Italy in the south.

Lepiota pseudoasperula is often mistaken for *Cystolepiota moelleri* (and vice versa) in the field. The microscopical data, viz. cheilocystidia absent in *L. pseudoasperula*, present in *C. moelleri*, and spores dextrinoid in *L. pseudoasperula* and non-dextrinoid in *C. moelleri*, are decisive, and easy to check.

46. Lepiota boertmannii Knudsen in Bot. Tidsskr. 75: 150. 1980. – Fig. 119.

Echinoderma boertmannii (Knudsen) M. Bon in Doc. mycol. 21 (82): 62. 1991.

SEL. ICON. – Rald et al. in Svampe 26: 35. 1992.

SEL. DESCR. & FIGS. – Knudsen in Bot. Tidsskr. 75: 150-151, figs. 1F, 2D & 3D. 1980.

VERN. NAME – Buitenbeenstekelparasolzwam.

Pileus 20-40 mm, rounded conical with inflexed margin to plano-convex with or without broad umbo, set with conical, pink-brown (K. & W. 7EF6) or dark brown (Mu. 5-7.5 YR 4/4) squamules up to 0.75 mm high on felted cream-pink or dark isabella (7.5 YR 7/6) background. Lamellae, L = c. 60, l = 3, moderately crowded to crowded, free, up to 3 mm broad, whitish but rather yellowish when looked into (3A2-3), with white flocculose edge. Stipe 30-40 × 3-4(-9) mm, cylindrical and slightly broadened at base, with whitish to pink-brown annular zone, above this zone smooth, below this zone woolly and with woolly girdles of squamules as on pileus (10 YR 4/4), with longitudinal brown fibrils over whole length. Context white in pileus and stipe. Smell more or less like *L. cristata*, or not distinct. Taste not known. Spore print white.

Spores 4.0-6.0(-6.5) × 2.5-3.0 µm, Q = 1.6-2.3, Qav = 1.85-2.0, oblong to cylindrical in side-view, in frontal view more ovoid, non-amyloid, not dextrinoid (not colouring in Lugol, nor in Melzer's Reagent), pale pink in Congo Red, metachromatic in Cresyl Blue. Basidia 14-24 × 5.0-6.5 µm, 4-spored, some 2-spored, or even 1-

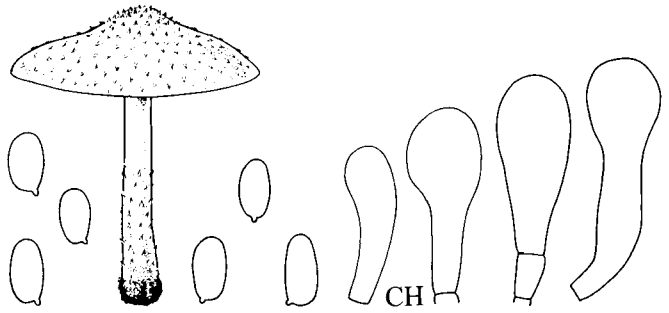

Fig. 119. *Lepiota boertmanii*.

spored. Lamella edge sterile. Cheilocystidia 15-31 × 5.5-10 µm, narrowly clavate to clavate, slightly thick-walled, hyaline. Pleurocystidia absent. Pileus covering consisting of squamules, made up of agglutinated elements in chains, 12-35(-47) × 10-30(-40) µm, globose to ellipsoid, with brown, thickened walls; intermediate hyphae inflated-cylindrical, c. 30-40 × 12-20 µm; basal hyphae cylindrical, 4.0-6.0 µm, with encrusting brown pigment. Stipitipellis with squamules as on pileus, but elements slightly smaller and more irregular. Clamp-connections present in all tissues.

HABITAT & DISTR. – Solitary or in small groups, saprotrophic and terrestrial on nutrient- and humus-rich soils in deciduous woods. Very rare in the Netherlands, known from two localities in southern Limburg (Elsloo, Bunderbos; Bemelen); Aug.-Sept. Very rare in Europe, recorded from Germany and Denmark.

The macroscopical description is based on the original description by Knudsen (in Bot. Tidsskr. 75: 150-151. 1980) and on notes accompanying the Netherlands' collections.

The photograph published by Rald et al. (in Svampe 26: 35. 1992) depicts a specimen of this species with a different kind of pileus covering than the Dutch specimens. In the Netherlands' collections, the pilei were covered with a tomentose layer, set with small, pointed squamules. It is entirely possible that this species, just like *Lepiota aspera* and *L. echinacea*, shows a wide variation in pileus covering.

8. **Chamaemyces** Batt. ex Earle

ELSE C. VELLINGA

Chamaemyces Batt. ex Earle in Bull. N.Y. bot. Gdn 5: 446. 1909; *Lepiota* subgen. *Lepiotella* E.J. Gilb., Genre Amanita: 159. 1918; *Lepiotella* (E.J. Gilb.) Konr. in Schweiz. Z. Pilzk. 12: 177. 1934, non *Lepiotella* J. Rick, 1938. – *Drosella* Maire in Kühn. & Maire in Bull. trimest. Soc. mycol. Fr. 50: 15. 1934 (not valid).

SELECTED LITERATURE – Migl. & Zecchin in Micol. ital. 22 (3): 142-156. 1993.

Basidiocarp collybioid; pileus rather fleshy, viscid; lamellae free or almost free and then emarginate; spore print pale cream.

Spores hyaline, without germ pore, binucleate, non-amyloid, not dextrinoid; complete wall metachromatic in Cresyl Blue; hymenophoral trama regular; cystidia present; covering of pileus a hymeniderm; clamp-connections present; development monovelangiocarpic and stipitocarpic; universal veil with radiating hyphae at the outside present on pileus only (Reijnders in Persoonia 8: 318. 1975). – Holotype species: *Armillaria fracida* (Fr.) Gillet.

HABITAT & DISTRIBUTION – Saprotrophic, terrestrial and on very decayed wood. One species known from Europe and possibly two other species in South America.

Chamaemyces fracidus (Fr.) Donk in Beih. Nova Hedwigia 5: 48. 1962. – Fig. 120.

Agaricus fracidus Fr., Epicrisis: 25. 1838; *Armillaria fracida* (Fr.) Gillet, Hyménomycètes: 77. 1874; *Drosella fracida* (Fr.) Sing. in Lilloa 22: 446. ('1949') 1951 (not valid). – *Lepiota irrorata* Quél. in C. r. Ass. franç. Av. Sci. (La Rochelle, 1882) 11: 387. 1883 (Champ. Jura Vosges Suppl. 11); *Lepiotella irrorata* (Quél.) Konr. in Schweiz. Z. Pilzk. 12: 177. 1934; *Drosella irrorata* (Quél.) Kühner & Maire in Bull. trimest. Soc. mycol. Fr. 50: 15. 1934 (nom. invalid). – *Chamaemyces fracidus* var. *pseudocastaneus* Bon & Boiff. in Bull. trimest. Soc. mycol. Fr. 90: 303. ('1974') 1975; *Chamaemyces pseudocastaneus* (Bon & Boiff.) Contu in Bol. Soc. Brot., Sér. II, 63: 384. 1990; *Lepiotella irrorata* f. *pseudocastanea* (Bon & Boiff.) Migl. & Zecchin in Micol. ital. 22 (2): 51. 1993. – *Lepiotella irrorata* f. *passerinii* Migl. & Zecchin in Micol. ital. 22 (2): 51. 1993. – *Agaricus demisannulus* Fr., Epicrisis: 19. 1838; *Lepiota demisannula* (Fr.) Sacc., Syll. Fung. 5: 69. 1887; *Drosella demisannula* (Fr.) Locq. in Bull. mens. Soc. linn. Lyon 23: 54. 1954 (not valid); *Chamaemyces demisannulus* (Fr.) Mos., Röhrlinge Blätterpilze, 3. Aufl.: 194. 1967.

SEL. ICON. – Breitenb. & Kränzl., Pilze Schweiz 4: pl. 200. 1995; Dähncke, 1200 Pilze: 509. 1993; Læssøe in Svampe 41: 56. 2000; Migl. & Zecchin in Micol. ital. 22 (3): 146-147. 1993 (as *Lepiotella irrorata*, incl. f. *passerinii* and f. *pseudocastanea*); Pepetti et al. in Boll. Circ. micol. G. Carini 39: 15. 1999 (as *Lepiotella irrorata*); Pat. in Bull. trimest. Soc. mycol. Fr. 102: Atlas pl. 245. 1986 (as *Lepiota irrorata*).

SEL. DESCR. & FIGS. – Anon. in Bull. trimest. Soc. mycol. Fr. 102: Atlas pl. 245. 1986 (as *Lepiota fracida*); Breitenb. & Kränzl., Pilze Schweiz 4: 182. 1995; Kühner in Bull. trimest. Soc. mycol. Fr. 52: 202-204. 1936 (as *Lepiota irrorata*); Migl. & Zecchin in Micol. ital. 22 (3): 144-150, figs. 1-3. 1993 (as *Lepiotella irrorata*, incl. f. *passerinii* and f. *pseudocastanea*); Reijnders in Persoonia 8: 309-311; 313-315; pl. 48, 49A, B. 1975 (on the development of the basidiocarps).

VERN. NAME – Druppelparasolzwam.

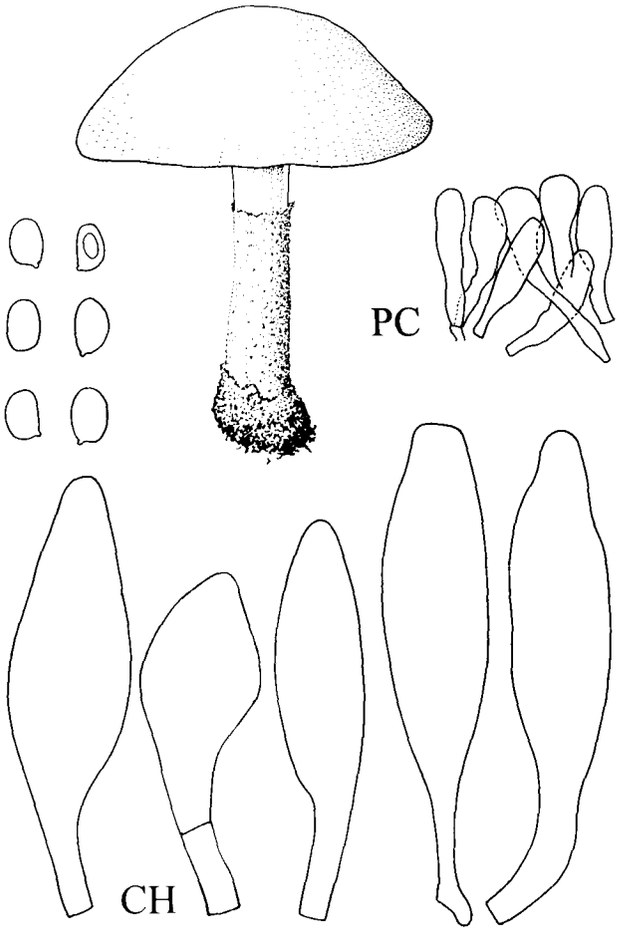

Fig. 120. *Chamaemyces fracidus*.

Pileus 37-65 mm, when young more or less hemispherical, expanding to applanate with low, broad umbo or plano-convex with applanate centre, ochre-yellow or creamy-pinkish at centre to very pale yellow at margin, when moist a bit viscid, discolouring when handled, smooth, but in marginal part slightly radially rugose, with fibrillose velar remnants between margin and stipe. Lamellae, L = c. 40, l = c. 3, moderately crowded to crowded, free or narrowly adnate, ventricose, up to 6 mm broad, white, pale beige or cream with pinkish sheen, with even, concolorous edge. Stipe 40-65 × 10-12 mm, narrowing towards base, fistulose, white, smooth and glabrous at apex, below annular zone with small brownish floccules on whitish to ochre-brown background, when young with droplets. Annulus present and ascending, or only as a velar zone. Context white and dull in pileus, shiny and cream in stipe. Smell like *L. cristata*, or sweet and more sourish when basidiocarp cut. Taste not known. Spore print pale cream.

Spores (4.0-)4.5-5.5(-6.0) × 2.5-4.0 µm, Q = (1.25-)1.35-1.75, Qav = 1.5-1.55, ellipsoid, though some oblong, sporadically broadly ellipsoid in side-view, in frontal view more ovoid, non-dextrinoid, not congophilous, metachromatic in Cresyl Blue, cyanophilous. Basidia 15.5-30 × 5.0-8.5 µm, 4-spored. Lamella edge heterogeneous. Cheilocystidia abundant, occasionally very rare, similar to pleurocystidia. Pleurocystidia abundant, 36-73 × 11.5-21 µm, oblong-utriform, rounded-fusiform or more clavate, with at least in dry material refractive, evenly distributed or at base a bit granular, content, sometimes with crystal floes at apex; cystidia occasionally very rare and then hyaline; walls metachromatic in Cresyl Blue. Pileus covering a hymenioderm, covered with or without gelatinous layer up to 10 µm thick, made up of clavate and narrowly clavate elements, 24-60 × 8.5-19 µm, with or without more cylindrical elements, 20-50 × 4.0-8.5 µm, with brown refractive pigment; walls of elements metachromatic in Cresyl Blue. Stipitipellis a cutis, made up of cylindrical, colourless hyphae, 2.0-4.0 µm wide, with in lower part of stipe scattered clusters of brown-coloured, irregular, sometimes ascending hyphae, up to 50 × 5.0 µm. Clamp-connections present in all tissues, very conspicuous.

HABITAT & DISTR. – In small groups, probably saprotrophic, terrestrial in avenues and woods on nutrient-rich and calcareous sandy and loamy soils, also known from chalk-grasslands. In the Netherlands rare, especially occurring in the river area, the dune area and southern Limburg, declining. Sept.-Oct. Widespread in Europe, but absent or very rare in the northern countries.

Donk (in Beih. Nova Hedwigia 5: 48-49. 1962) has been followed for the nomenclature of this species.

Chamaemyces demisannula is, according to Locquin (in Bull. mens. Soc. linn. Lyon 23: 54. 1954), a different species, characterized by a hardly developed gelatinous layer on the pileus and scarce cystidia. However, these characters are not correlated; basidiocarps with a low number of cystidia may have a thick gelatinous layer, so the two species are considered synonymous.

Dark variants of *Ch. fracidus* are recognized as forma *pseudocastanea* (Bon & Boiff.) Migl. & Zecchin, but this taxon has not yet been encountered in the Netherlands.

9. **Cystolepiota** Sing.

ELSE C. VELLINGA

Cystolepiota Sing. in Sing. & Digilio in Lilloa 25: 281. ('1951') 1952. – *Pulverolepiota* M. Bon in Doc. mycol. 22 (88): 30. 1993. – *Lepiota* subgen. *Sphaerocystae* Wasser in Ukr. bot. Zh. 35: 517. 1978.

SELECTED LITERATURE – M. Bon in Doc. mycol. 11 (43): 23-26. 1981; M. Bon, Fl. mycol. Eur. 3, Lépiotes: 38-42. 1993; Candusso & Lanzoni, Lepiota: 77-114. 1990; Kelderman, Parasolzw. Zuid-Limburg: 29-41. 1994; Vellinga & Huijser in Persoonia 16: 513-526. 1998; Zecchin in Riv. Micol. 43: 147-165. 2000.

Basidiocarp pluteoid, rather small; pileus covered in granules from velum universale; velum partiale leaving an annular zone on stipe; lamellae free; spore print white to pale yellow or pale lilac.

Spores hyaline, with smooth or slightly rough wall, without a germ pore, uninucleate, in a few species binucleate, often in tetrads, non-amyloid nor dextrinoid, rarely (faintly) dextrinoid, in most species with inner wall pink in Cresyl Blue, congophilous, with walls not swelling in ammonia ($NH_{3(aq)}$) and acetic acid ($CH_3COOH_{(aq)}$; cheilo- and pleurocystidia present or absent, or only cheilocystidia present; hymenophoral trama regular; pileus covering made up of more or less loosely arranged globose to oblong or elongate, inflated elements; clamp-connections present, in some species absent. Development bivelangiocarpic and pileostipitocarpic. – Type species: *Cystolepiota constricta* Sing.

HABITAT & DISTRIBUTION – Saprotrophic, terrestrial in woods, world-wide, but very rare in alpine and arctic regions.

Cystolepiota is closely related to the genus *Melanophyllum* Velen. and to *Lepiota* sect. *Echinatae* Fay. It differs from *Melanophyllum* mainly in the coloration of the spores, and from *Lepiota* sect. *Echinatae* by the structure of the veil: only thin hyphae and globose (or inflated), relatively loosely arranged elements in *Cystolepiota,* versus thin hyphae, gradually transient into globose to ellipsoid elements, agglutinated to form pyramidal squamules in *Lepiota* sect. *Echinatae*. Furthermore, in most *Cystolepiota* species the spores are uninucleate, whereas they are binucleate in *Lepiota* sect. *Echinatae*. For an extensive comparison of the two taxa see also Knudsen (in Bot. Tidsskr. 75: 123-127. 1980).

The neutral term 'pileus covering' is used for all the covering layers of the pileus, not taking into account their origin.

KEY TO THE SPECIES

1. Basidiocarps with distinct lilac or violaceous tinges and a strong smell of coal gas, or with yellow (sulphur-yellow or yellowish brown) tinges in all parts; spores dextrinoid (though the reaction may be slow)
   2. Basidiocarps with distinct lilac or violaceous tinges and a strong smell of indole (coal gas); spores (6.5-)7.0-9.0(-10.0) µm long . . . . . **6. C. bucknallii**
   2. Basidiocarps yellow (sulphur-yellow or yellowish brown), smell indistinct; spores 3.5-5.5(-6.0) µm long **7. C. icterina**

   (if pileus margin sulcate, clamp-connections absent, and spores 5.0-8.5 × 4.0-7.0 µm, see *Leucocoprinus straminellus*)
1. Basidiocarps with white, greyish, orange or pink to brownish colours; spores not reacting in Melzer's Reagent (if slowly and weakly dextrinoid, then elements of pileus covering elongate)
   3. Elements of pileus covering elongate, oblong, inflated; clamp-connections absent; cystidia absent **8. C. pulverulenta**

   (if spores with germ pore, and cheilocystidia present, see *Leucocoprinus*)
   3. Elements of pileus covering globose; clamp-connections present; cystidia present or absent
      4. Cheilocystidia absent; pileus white, rarely pale pink or yellowish, not discolouring with age or when damaged **5. C. seminuda**
      4. Cheilocystidia present; pileus either white and discolouring orange-brown, or with other colours
         5. Basidiocarps white, cream or greyish, discolouring (orange-)brown with age or on bruising

6. Cheilocystidia and pleurocystidia with yellow contents and exudates ..... **1. C. cystidiosa**
6. Cheilocystidia (and pleurocystidia) without yellow contents and exudates
   7. Spores 4.0-6.0(-6.5) × 2.0-3.0(-3.5) µm, Q = (1.5-)1.6-2.1(-2.3), Qav = 1.8-2.0; pleurocystidia present, especially close to lamella edge ..... **2. C. hetieri**
   7. Spores 5.0-6.5(-7.0) × 2.0-3.0 µm, Q = (1.8-)2.0-2.6, Qav = 2.1-2.4; pleurocystidia absent **3. C. adulterina**
5. Basidiocarps with greyish, pale lilac-brown, cream or pink(-brown) covering, not discolouring orange-brown when damaged or with age
   8. Pileus covered with small pink-coloured granulose warts, often resembling members of *Lepiota* sect. *Echinatae*; cheilocystidia narrowly clavate to obovate, usually with cylindrical, moniliform or branched excrescence at apex; pleurocystidia absent ..... **4. C. moelleri**
   8. Pileus covered with a uniform, thick velar layer, or with pinkish grey-brown to greyish yellow, pyramidal warts; pleurocystidia present or absent, if present with distinct yellow contents
      9. Cheilocystidia and pleurocystidia with yellow contents or exudate; spores 3.5-5.5(-6.0) × 2.0-3.0 µm, Q = 1.5-2.2(-2.4), Qav = 1.7-2.1; elements of pileus covering (10-)20-70(-95) µm **1. C. cystidiosa**
      9. Cheilocystidia without yellow contents or exudate; pleurocystidia absent; spores 5.0-6.5(-7.0) × 2.0-3.0 µm, Q = (1.8-)2.0-2.6, Qav = 2.1-2.4; elements of pileus covering 15-45 µm **3. C. adulterina**

Sect. **Cystolepiota**

Spores not dextrinoid, nor amyloid; clamp-connections present; velar elements globose.

1. Cystolepiota cystidiosa (A.H. Smith) M. Bon in Doc. mycol. 11 (43): 26. 1981. – Fig. 121.

Lepiota cystidiosa A.H. Smith in Papers Mich. Acad. Sci., Arts Letters 27: 58 ('1941') 1942. – *Lepiota luteicystidiata* D. Reid in Fung. rar. Ic. col. 2: 9. 1967; *Cystolepiota luteicystidiata* (D. Reid) M. Bon in Doc. mycol. 6 (24): 43. 1976. – *Lepiota lycoperdoides* Kreisel in Wiss. Z. Ernst Moritz Arndt-Univ. Greifswald 16: 238. 1967; *Cystolepiota luteicystidiata* var. *lycoperdoides* (Kreisel) M. Bon in Doc. mycol. 11 (43): 26. 1981.

MISAPPL. – *Lepiota rufescens* sensu Huijsman in Meded. Ned. mycol. Vereen. 28: 47-48. 1943.

SEL. ICON. – Lonati in Boll. Ass. micol. ecol. Romana 12: 15. ('1987') 1988 (as *C. luteicystidiata*); Migl. et al. in Riv. Micol. 32: 103. 1989 (as *C. luteicystidiata*); D. Reid in Fung. rar. Ic. col. 2: pl. 10b. 1967 (as *Lepiota luteicystidiata*, dark specimens); Zecchin in Riv. Micol. 43: 159. 2000.

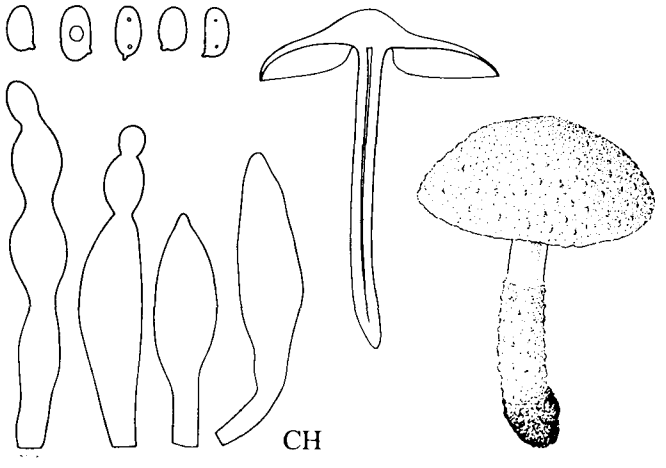

Fig. 121. *Cystolepiota cystidiosa*.

SEL. DESCR. & FIGS. – Huijsman in Schweiz. Z. Pilzk. 39: 51. 1961; Kreisel in Wiss. Z. Ernst Moritz Arndt-Univ. Greifswald 16: 237-238. 1967 (as *Lepiota lycoperdoides*); D. Reid in Fung. rar. Ic. col. 2: 9-10, fig 3. 1967 (as *Lepiota luteicystidiata*); A.H. Smith in Papers Mich. Acad. Sci., Arts Letters 27: 58-60, pl. 1, 2. ('1941') 1942; H.V. Smith in Lloydia 17: 318-319. 1954; Vellinga & Huijser in Persoonia 16: 518-521, figs. 2b-d, 3b-c. 1998; Winterhoff & Bon in Carolinea 52: 6. 1994; Zecchin in Riv. Micol. 43: 158-159. 2000.

VERN. NAME – Geelcellige poederparasol.

Pileus 20-40(-70) mm, when young spherical to hemispherical with inflexed margin, expanding to applanate-campanulate, plano-convex with or without broad umbo, covered with floccose, granular pyramidal warts, up to several millimeters high, varying in colour from whitish when very young, to cream discolouring pinkish, to pinkish grey-brown, pinkish-brownish (Mu. 7.5 YR 6/4, 10 YR 4/3-7.5 YR 5/4, 10 YR 7/6, 10 YR 8/4 to 7.5 YR 7/6), often staying paler at margin, where covering is thinner, showing the whitish context; when warts are removed, a whitish 'scar' remains; margin exceeding lamellae. Lamellae, L = 30-45, l = 1-3, moderately crowded to crowded, free, segmentiform to slightly ventricose, up to 4.5 mm wide, cream coloured, and brown-spotted with age, with even or flocculose, white to concolorous edge, which is also brown-spotted with age. Stipe 15-70 × 2.5-5 mm, cylindrical, sometimes widened at apex, occasionally curved in lower part, fistulose, at apex whitish or cream, finely pubescent, glabrescent with age, in lower half or 3/4 of length, below an annular zone which is more or less distinct, granular floccose or with floccose patches, concolorous with pileus, often discolouring (e.g. pinkish brown, 7.5 YR 6/6) when touched. Context white or whitish cream and dull in pileus, shiny and cream in stipe, brownish or vinaceous downwards. Smell fungoid or 'lepiotoid', often like *Lepiota cristata*, but not always. Taste a bit unpleasant, musty fungoid, with unpleasant lingering aftertaste. Spore print cream.

Spores 3.5-5.5(-6.0) × 2.0-3.0 µm, Q = 1.5-2.2(-2.4), Qav = 1.7-2.1, ellipsoid to cylindrical with parallel sides, sometimes in side-view slightly widened at base, often in tetrads, colourless, with slightly thickened wall, non-dextrinoid, non-amyloid, cyanophilous, and inner wall pink in Cresyl Blue. Basidia 12.5-20 × 4.5-6.5 µm, 4-spored. Lamella edge sterile, in fresh specimens covered in a yellow exudate.

Cheilocystidia 17-40(-50) × 6.5-12 µm, cylindrical-fusoid, narrowly clavate, rather variable in shape, without or with apical excrescence, varying from a small capitulum, 3.0-4.0 × 3.0 µm, to a long moniliform neck, up to 45 µm long; occasionally whole cystidium moniliform; often thick-walled, with yellow, often granular, contents. Pleurocystidia abundant, similar to cheilocystidia, but without or with short-moniliform neck; at a magnification of 400 × cystidia clearly visible as yellow dots, evenly distributed over lamella surface. Pileus covering a velar epithelium, made up of elements (10-)20-70(-95) µm in diam., globose to slightly subglobose, thin-walled or slightly thick-walled, often with slightly brownish walls; in fresh specimens with very small yellow droplets or particles. Stipitipellis a cutis made up of cylindrical narrow hyphae, 1.5-5.0 µm in diam.; below covered in elements as on pileus, and often more irregular in shape (pyriform, ellipsoid etc.). Clamp-connections present in all tissues.

HABITAT & DISTR. – Gregarious, sometimes in big flocks, saprotrophic and terrestrial in deciduous woods on nutrient-rich soils, and in greenhouses. Known in the Netherlands from several localities in southern Limburg. Aug.-Oct. in the wild, throughout the year in greenhouses. Also found in several regions of Germany, and in North America.

Cystolepiota cystidiosa is to be recognized by the yellow contents of cystidia on the sides and the edge of the lamellae. It is easily confused with *C. hetieri*, but that species lacks the yellow contents in the cystidia and is white, discolouring orange-red.

For an extensive discussion on synonymy see Vellinga & Huijser (in Persoonia 16: 520-521. 1998).

2. Cystolepiota hetieri (Boud.) Sing. in Beih. Sydowia 7: 67. 1973. – Fig. 122.

Lepiota hetieri Boud. in Bull. Soc. mycol. Fr. 18: 137. 1902; *Cystoderma hetieri* (Boud.) Sing. in Schweiz. Z. Pilzk. 17: 53. 1939. – *Agaricus granulosus* var. *rufescens* B. & Br. in Ann. Mag. nat. Hist. Ser. V, 7: 124. 1881 (Notic. Brit. Fungi 1834); *Lepiota rufescens* (B. & Br.) J. Lange in Dansk bot. Ark. 9 (6): 65. 1938, non *Lepiota rufescens* Morgan, 1906; *Lepiota langei* Locq. in Bull. mens. Soc. linn. Lyon 14: 87. 1945, non *Lepiota langei* Knudsen, 1981; *Cystolepiota langei* (Locq.) M. Bon in Doc. mycol. 22 (88): 27. 1993.

EXCL. – *Lepiota hetieri* sensu J. Lange, Fl. agar. dan. 1: 35-36, pl. 14J. 1935 (= *C. adulterina*); *Cystolepiota hetieri* sensu Breitenb. & Kränzl., Pilze Schweiz 4: pl. 210. 1995 (= *C. adulterina* or *C. cystidiosa*). – *Lepiota rufescens* sensu Huijsman in Meded. Ned. mycol. Vereen. 28: 46-51. 1943 (= *C. cystidiosa*); sensu Kühner & Romagn., Fl. anal. Champ. sup.: 396. 1953 (= *Cystolepiota* spec.).

SEL. ICON. – Boud. in Bull. Soc. mycol. Fr. 18: pl. 6, fig. 1. 1902; J. Lange, Fl. agar. dan. 1: pl. 14I. 1935; Rald et al. in Svampe 26: 34. 1992; Zecchin in Riv. Micol. 43: 156. 2000.

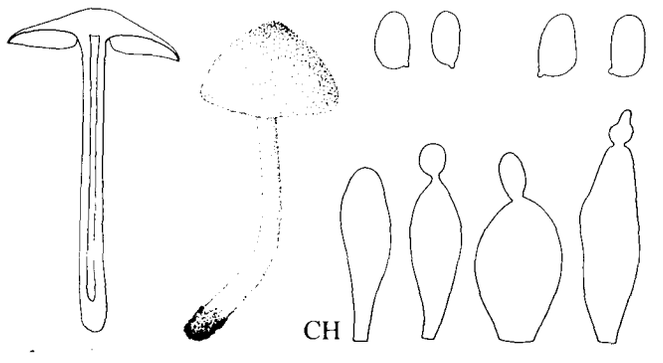

Fig. 122. *Cystolepiota hetieri*.

SEL. DESCR. & FIGS. – Herink in Ceská Mykol. 15: 226-233, figs. 6-8. 1961; Kelderman, Parasolzw. Zuid-Limburg: 36-37. 1994; Kühner in Bull. trimest. Soc. mycol. Fr. 52: 205-206. 1936; F. Møller in Friesia 6: 25. ('1957-1958') 1959; Vellinga & Huijser in Persoonia 16: 521-524, figs. 2e & 3d. 1998.

VERN. NAME – Vlekkende poederparasol.

Pileus 10-22(-30) mm, when young hemispherical, expanding to planoconvex with umbo, with velar remnants at margin, at first white to whitish cream, rarely greyish, soon discolouring to orange-brown in patches or totally discoloured (Mu. 5 YR 5/6-8), granulose to more or less squamulose, when young often with low pyramidal warts on woolly background; warts at centre rather crowded. Lamellae, L = 35-60, l = 3, moderately crowded, free, segmentiform to subventricose, up to 3 mm broad, white to cream coloured, with age discolouring, especially at edge, to orange-brown or rarely to pale buff (7.5 YR 8/4) when touched, with white, concolorous even edge. Stipe 15-40 (50) × 2-4 mm, cylindrical, fistulose, with or without woolly ring-like zone, whitish cream, rarely greyish, at apex pruinose, below ring-like zone granulose to flocculose, often rather quickly discolouring orange-brown or red-brown, especially when touched, with white basal tomentum. Context whitish in pileus, in stipe apex cream coloured, and orange-brown (7.5 YR 4/6) at base, white around cavity. Smell variably recorded, unpleasant sweetish-fungoid, suggestive of the smell of *Lepiota cristata*, or not at all like *L. cristata*. Taste not recorded. Spore print colour not known.

Spores 4.0-6.0(-6.5) × 2.0-3.0(-3.5) µm, Q = (1.5-)1.6-2.1(-2.3), Qav = 1.8-2.0, oblong, some (sub-)cylindrical, some slightly broadened at basal part, colourless, with slightly thickened wall, often in tetrads, non-dextrinoid, non-amyloid, with cyanophilous wall; inner wall pink in Cresyl Blue. Basidia 15-25 × 5.0-7.0 µm, 4-spored. Cheilocystidia usually abundant, 14-32 × 7.0-12 µm, with up to 15 µm long abrupt, capitulate and cylindrical or moniliform excrescent at apex, clavate or ellipsoid, thin-walled to slightly thick-walled especially in apical part, usually colourless, some with brownish granular contents. Pleurocystidia present, especially near lamella edge, sometimes rather rare, similar to cheilocystidia. Hymenium at lamella edge brown coloured. Pileus covered with a velar epithelium, made up of globose to ellipsoid and spheropedunculate elements, 20-60(-80) µm in diameter, slightly thick-walled, with, rarely without, brownish parietal pigment. Stipitipellis at apex a cutis of cylindrical elements, 4-10 µm in diam., usually colourless, sometimes red-brown coloured, slightly thick-walled, lower down with chains of globose elements, 20-60 µm in diam., slightly thick-walled and brown coloured. Clamp-connections present in all tissues.

HABITAT & DISTR. – Saprotrophic and terrestrial, gregarious in deciduous woods on clayey, loamy soils, rich in humus, often rich in lime; also in greenhouses. In the Netherlands widespread, but not common. Occurring from the end of Aug.-Oct.(-Nov.), but in greenhouses throughout the year. Known from temperate regions of Europe.

Cystolepiota hetieri can be confused with *C. pulverulenta*. The latter is characterized by the volatile, flocculose veil, and the oblong elements of which it is made up, the absence of cystidia and clamp-connections, and the slightly rough spores.

For the differences with respect to *C. adulterina*, see the notes accompanying the description of that species.

Cystolepiota cystidiosa differs in the presence of yellow contents of the cystidia, and the abundance of pleurocystidia.

Three *Cystolepiota*-species have been tested for the presence of amanitins: *C. seminuda*, *C. bucknallii* and *C. hetieri* (as *Lepiota rufescens*) (Gérault & Girre in C. r. hebd. Séanc. Acad. Sci., Paris, Sér. D, 280: 2842. 1966). Only the last was found to be toxic.

3. Cystolepiota adulterina (F. Møller) M. Bon in Doc. mycol. 7 (27-28): 54. 1977.

Lepiota adulterina F. Møller in Friesia 6: 23. ('1957-1958') 1959. – *Cystolepiota adulterina* f. *reidii* M. Bon in Doc. mycol. 11 (43): 25. 1981; *Cystolepiota adulterina* var. *reidii* (M. Bon) M. Bon in Doc. mycol. 22 (88): 27. 1993. – *Cystolepiota subadulterina* M. Bon in Doc. mycol. 6 (24): 43. 1976; *Cystolepiota adulterina* var. *subadulterina* (M. Bon) M. Bon in Doc. mycol. 22 (88): 27. 1993.

MISAPPL. – *Cystolepiota hetieri* sensu J. Lange, Fl. agar. dan. 1: 35-36, pl. 14J. 1935.

EXCL. – *Cystolepiota adulterina* sensu Kelderman in Coolia 31: 15. 1988 (= *C. cystidiosa*). – *Cystolepiota adulterina* f. *reidii* sensu M. Bon in Doc. mycol. 11 (43): 25. 1981; sensu Lanzoni & Zecchin in Riv. Micol. 31 (3-4): 104. 1988; sensu Candusso & Lanzoni, Lepiota: 88-90. 1990 (in all cases *C. moelleri*).

SEL. ICON. – J. Lange, Fl. agar. dan. 1: pl. 14J. 1935 (as *C. hetieri*); Rald et al. in Svampe 26: 34. 1992 (dry specimens); Ryman & Holmåsen, Svampar: 411. 1984; Zecchin in Riv. Micol. 43: 1590. 2000.

SEL. DESCR. & FIGS. – F. Møller in Friesia 6: 22-23, figs. a-d. ('1957-1958') 1959; D. Reid in Fung. rar. Ic. col. 6: 10-11, figs. 18a & b. 1972; Vellinga & Huijser in Persoonia 16: 515-518, figs. 2a & 3a. 1998; Zecchin in Riv. Micol. 43: 148-160. 2000.

CHARACTERISTICS – Pileus 15-30(-50) mm, conico-convex, applanate to convex, when young covered with a thick cream whitish, to beige layer, later with cream-ochre to greyish yellow flocculose warts; margin with velar remnants. Lamellae crowded, free, sordid cream. Stipe 30-60 × 3-7 mm, cylindrical or tapering downwards, fistulose, at apex whitish, lower down covered with floccules, concolorous with pileus, brown discolouring at base; smell and taste not known.

Spores 5.0-6.5(-7.0) × 2.0-3.0 µm, Q = (1.8-)2.0-2.6, Qav = 2.1-2.4, cylindrical to slightly broadened in basal part, non-dextrinoid, with pink inner wall in Cresyl Blue; basidia 14.5-23 × 5.0-9.0 µm, (2-)4-spored; cheilocystidia abundant, 17-32 × 5.5-9.0 µm, lageniform with abrupt, cylindrical to slightly moniliform, flexuous, 1.5-4.0 µm wide neck, rarely without neck or only with short excrescence, colourless.; pleurocystidia absent; pileus covering a velar epithelium made up of globose elements, 13-46 µm in diam., thick-walled and slightly encrusted, colourless; clamp-connections present in all tissues.

HABITAT & DISTR. – In small groups, saprotrophic and terrestrial, often on mull, in deciduous woods, often on calcareous soils. Sept.-Oct. Not yet known from the Netherlands, rare and scattered in Europe, from southern Scandinavia southwards, not yet recorded from Mediterranean countries.

Cystolepiota adulterina is often confused with *C. hetieri*, but easily distinguished from that species by the narrower and longer spores, the absence of pleurocystidia and the different shape of the cheilocystidia (see Møller in Friesia 6: 20-25. ('1957-1958') 1959; and Vellinga & Huijser in Persoonia 16: 516-518. 1998 for discussions of the characters). The latter authors also extensively treat the synonymy of the species.

Though this species has been recorded from adjacent regions in Germany and Belgium, and is also known to occur in Great Britain, it has not yet been found in the Netherlands.

4. Cystolepiota moelleri Knudsen in Bot. Tidsskr. 73: 134. 1978. – Fig. 123.

Lepiota rosea Rea in Trans. Br. mycol. Soc. 6: 61-62. ('1917') 1918; *Cystolepiota rosea* (Rea) M. Bon in Doc. mycol. 6 (24): 43. 1976, non *Cystolepiota rosea* Sing., 1969; *Cystolepiota rosella* Mos., Röhrlinge Blätterpilze, 4. Aufl.: 236. 1978 (superfluous).

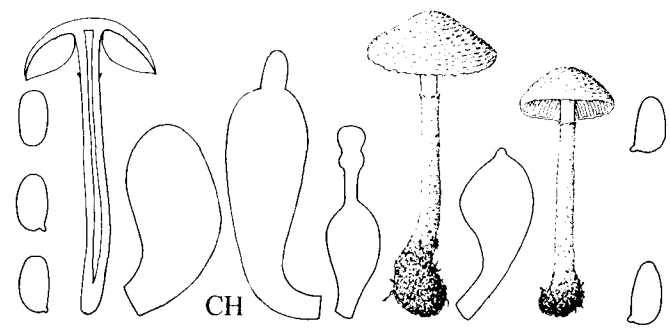

Fig. 123. *Cystolepiota moelleri*.

MISAPPL. – *Cystolepiota adulterina* f. *reidii* sensu M. Bon in Doc. mycol. 11 (43): 25. 1981; sensu Lanzoni & Zecchin in Riv. Micol. 31 (3-4): 104. 1988; sensu Candusso & Lanzoni, Lepiota: 88-90. 1990; *Lepiota pseudoasperula* sensu Enderle & Krieglst. in Z. Mykol. 55: 86. 1989.

SEL. ICON. – Enderle & Krieglst. in Z. Mykol. 55: opp. p. 96. 1989 (as *Lepiota pseudoasperula*); R. Phillips, Paddest. Schimm.: 30. 1981 (as *Lepiota rosea*); Zecchin in Riv. Micol. 43: 153 & 155. 2000 (as *C. rosea*).

SEL. DESCR. & FIGS. – Kelderman in Coolia 31: 12-14, fig. 1. 1988; P.D. Orton in Trans. Br. mycol. Soc. 43: 287. 1960 (as *Lepiota rosea*); Vellinga & Huijser in Persoonia 16: 524-525, figs. 2f & 3e. 1998; Zecchin in Riv. Micol. 43: 153-155. 2000 (as *C. rosea*).

VERN. NAME – Roze poederparasol.

Pileus 8-40 mm, when young hemispherical with inflexed margin, expanding to plano-convex with shallow central depression, or with applanate centre, at centre densely set with low acute and (sub-)pyramidal pink or pinkish red-brown squamules or warts (Mu. 2.5 YR 3/5, 3-2.5/2, 2.5-5 YR 4/4), at margin with more widespread squamules, on a very pale pinkish-brownish background (7.5 YR 7/6), with velar remnants at margin when young. Lamellae, L = 30-40, l = 1-3, moderately crowded to crowded, free, segmentiform to ventricose, up to 3.5 mm wide, whitish cream, greyish cream with age, with concolorous to pinkish even to flocculose (lens!) edge. Stipe 15-40(-70) × 2-5 mm, cylindrical or slightly broadening towards base, curved at base, fistulose, at apex pinkish cream and pruinose at fibrillose background, lower down with scattered pink or reddish brown flocculose or lanate bands of warts (2.5 YR 6/4) on pale pink to vinaceous red background. Context in pileus white to cream, white to pale pinkish in stipe. Smell faint and sweetish, pleasant or like *Lepiota cristata*. Taste indistinct, fungoid. Spore print 'white'.

Spores 4.0-5.5(-6.0) × 2.5-3.0 µm, Q = (1.5-)1.6-2.2(-2.3), Qav = 1.7-1.9(-2.0), oblong to cylindrical, some slightly phaseoliform in side-view, thin-walled and colourless, non-dextrinoid, with pink inner wall in Cresyl Blue, often in tetrads. Basidia 16-26 × (3.5-)5.0-7.5 µm, 4-spored. Lamella edge sterile. Cheilocystidia abundant, 15-35(-39) × 7.0-15 µm, narrowly clavate to obovate, usually with cylindrical, moniliform or branched, excrescence at apex, up to 22 µm long, colourless and thin-walled. Pleurocystidia not present. Squamules on pileus made up of globose to ellipsoid elements, 15-70 µm in diam., slightly thick-walled, with brown parietal pigment. Stipitipellis at apex of stipe a cutis of cylindrical to inflated, 4.0-8.0 µm wide, not coloured elements, lower down with chains of globose to ellipsoid elements, 30-60 µm in diam., brown-coloured and slightly thick-walled. Clamp-connections present in all tissues.

HABITAT & DISTR. – Gregarious or solitary, saprotrophic and terrestrial in mixed deciduous woods on loamy, calcareous or nutrient-rich

soils; in the Netherlands rare, mostly in southern Limburg, Aug.-Oct. Widespread and rather rare in temperate parts of Europe.

Bon (Fl. mycol. Eur. 3, Lépiotes: 40. 1993) cited this taxon as *Cystolepiota rosea* (Rea) Sing. However, Singer (in Beih. Nova Hedwigia 29: 168. 1969) validly described the new species *Cystolepiota rosea*, a species in its own right, differing from *C. moelleri* in the absence of cheilocystidia and in the rather smooth surface of the pileus.

Cystolepiota moelleri macroscopically resembles *Lepiota pseudoasperula*, but is microscopically quite distinct, because of the non-dextrinoid spores and the clavate cheilocystidia that are often provided with an apical excrescence.

5. Cystolepiota seminuda (Lasch) M. Bon in Doc. mycol. 6 (24): 43. 1976. – Fig. 124.

Agaricus seminudus Lasch in Linnaea 3: 157. 1828; *Lepiota seminuda* (Lasch) Kumm., Führ. Pilzk.: 136. 1871; *Cystoderma seminudum* (Lasch) Fay. in Annls Sci. nat., Bot., Sér. VII, 9: 351. 1889; *Lepiota sistrata* var. *seminuda* (Lasch) Quél. in Mém. Soc. Émul. Montbéliard, Sér. II, 5: 231. 1872 (Champ. Jura Vosges 1). – *Lepiota sororia* Huijsman in Persoonia 1: 326. 1960; *Cystolepiota sororia* (Huijsman) Sing. in Beih. Sydowia 7: 67. 1973. – *Lepiota seminuda* f. *minima* J. Lange, Fl. agar. dan. 1: 36. 1935 (not valid); *Lepiota sistrata* f. *minima* (J. Lange) Babos in Annls hist.-nat. Mus. natn. hung. 50: 91. 1958.

MISAPPL. – *Lepiota sistrata* and *Cystolepiota sistrata* sensu auct. eur.

EXCL. – *Lepiota sistrata* sensu Herink in Ceská Mykol. 15: 217. 1961 (= *C. pulverulenta*).

SEL. ICON. – Breitenb. & Kränzl., Pilze Schweiz 4: pl. 211. 1995; Candusso & Lanzoni, Lepiota: pl. 2a. 1990 (as *C. sistrata*); Dähncke, 1200 Pilze: 512. 1993 (as *C. sistrata*); J. Lange, Fl. agar. dan. 1: pl. 14A, 14B. 1935; Lanzoni & Candusso in Boll. Gruppo micol. G. Bres. 26: 116. 1983 (as *C. sistrata*); R. Phillips, Paddest. Schimm.: 30. 1981; Zecchin in Riv. Micol. 43: 152. 2000.

SEL. DESCR. & FIGS. – Atk. in Mem. N.Y. bot. Gdn 6: 216-221, pl. 22, 25 & 26. 1916 (development); Babos in Annls hist.-nat. Mus. natn. hung. 50: 91. 1958 (as *Lepiota sistrata* f. *minima*); Candusso & Lanzoni, Lepiota: 80-81, fig. 7. 1990; Huijsman in Persoonia 1: 326-327. 1960 (as *Lepiota sororia*); Kelderman, Parasolzw. Zuid-Limburg: 32-33. 1994; Vellinga in Persoonia 13: 321-325, figs. 1-4. 1987; Zecchin in Riv. Micol. 43: 150-151. 2000.

VERN. NAME – Kleine poederparasol.

Pileus 3-20(-30) mm, hemispherical or obtusely conical when young, with inflexed margin and with velar remnants attached, expanding to plano-convex with or without low umbo, white, white with cream to yellowish tinge at centre or white with pinkish tinge at centre, rarely with brownish centre, when young with densely floccose-verrucose covering, later on granulose to pruinose-farinose or even glabrous when very old or after heavy rain. Lamellae, L = 30-40, l = 1-3, rather crowded, free or nearly free, ventricose to subventricose, 2-3 mm wide, white, yellowish-creamy, or with pale lemon-yellow tinge, with even to finely flocculose, concolorous edge. Stipe 15-50(-70) × 1-3 mm, cylindrical, fistulose, cream to pale lemon-yellow, with age and when touched in lower half and especially at base purplish or vinaceous pink, very rarely not discolouring at all, minutely pubescent at apex, when young whitish pruinose, glabrescent with age. Context thin, concolorous with surfaces. Smell not distinct to fruity-fungoid. Taste indistinct. Spore print white.

Fig. 124. *Cystolepiota seminuda*.

Spores 3.5-5.0(-5.5) × 2.0-3.0 µm, Q = 1.35-2.1(-2.2), Qav = 1.45-1.95, ellipsoid to cylindrical, rather thin-walled, with distinct or indistinct hilar appendage, non-dextrinoid, with inner wall pink in Cresyl Blue, slowly pink in Congo Red. Basidia 11-19 × 4.5-6.5 µm, 4-spored. Cheilo- and pleurocystidia absent. Pileus covered with a velar epithelium, made up of a layer of rather thin-walled to slightly thick-walled globose, spheropedunculate or ellipsoid elements, 15-40 µm in diameter; inner elements thin-walled and compressed, colourless; outer elements with encrusting, colourless pigment. Stipitipellis a cutis made up of cylindrical, 4.0-10 µm wide hyphae with some globose elements as on pileus. Clamp-connections present.

HABITAT & DISTR. – Gregarious, rarely solitary, saprotrophic and terrestrial on soils rich in humus and nutrients, in deciduous and in coniferous woods, not uncommon, Aug.-Oct. Known from temperate regions of the Northern Hemisphere.

Cystolepiota seminuda is very variable in size and colours of the basidiocarps. The spores may be smooth, or rough as observed by Scanning Electron Microscope (see Keller, Atl. Basidiomyc.: pl. 284. 1997 (as *C. sistrata*) for a picture of rough spores).

The name *C. sistrata* (Fr.: Fr.) Sing. ex Bon & Bellù has been used for this species, but is here considered a nomen dubium, as Fries (Syst. mycol. 1: 24. 1821) described a rather big species, and various interpretations of this name exist in literature (see Vellinga in Persoonia 13: 323. 1987).

Sect. **Pseudoamyloideae** Sing. & Clém.

Spores dextrinoid; clamp-connections present; velar elements globose.

6. Cystolepiota bucknallii (B. & Br.) Sing. & Clém. in Nova Hedwigia 23: 338. ('1972') 1973. – Fig. 125.

Agaricus bucknallii B. & Br. in Ann. Mag. nat. Hist. Ser. V, 7: 124. 1881 (as *A. bucknalli*) (Notic. Br. Fungi 1836); *Lepiota bucknallii* (B. & Br.) Sacc., Syll. Fung. 5: 50. 1887. – *Lepiota seminuda* var. *lilacina* Quél. in Bull. Soc. bot. Fr. 23: 325. 1877 (Champ. Jura Vosges Suppl. 4); *Lepiota lilacina* (Quél.) Boud. in Bull. Soc. mycol. Fr. 9: 6. 1893; *Cystolepiota bucknallii* var. *lilacina* (Quél.) M. Bon in Doc. mycol. 7 (27-28): 21. 1977 (not valid).

SEL. ICON. – Breitenb. & Kränzl., Pilze Schweiz 4: pl. 209. 1995; Candusso & Lanzoni, Lepiota: pl. 6b. 1990; B. Hanff in Pilzfl. Nordwestoberfrankens 1-4: pl. 8 (023). 1982; Kühner in Bull. trimest. Soc. mycol. Fr. 52: Atlas pl. 72, fig. 2. 1936; Lavorato in Schweiz. Z. Pilzk. 67: 207. 1989; R. Phillips, Paddest. Schimm.: 30. 1981; Rald et al. in Svampe 26: 34. 1992; Zecchin in Riv. Micol. 43: 161. 2000.

SEL. DESCR. & FIGS. – Candusso & Lanzoni, Lepiota: 108-110, fig. 15. 1990; Kelderman, Parasolzw. Zuid-Limburg: 30-31. 1994; Kühner in Bull. trimest. Soc. mycol. Fr. 52: 204-205. 1936; Lavorato in Schweiz. Z. Pilzk. 67: 204-208. 1989; Sing. & Clém. in Nova Hedwigia 23: 338-339. ('1972') 1973.

VERN. NAME – Violetstelige poederparasol.

Pileus 8-25 mm, when young hemispherical or bluntly conical with inflexed margin, expanding to (conico-)convex, with broad umbo or

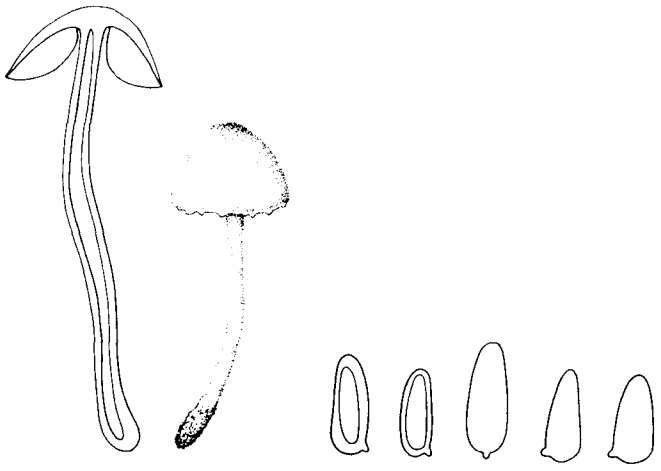

Fig. 125. *Cystolepiota bucknallii*.

broadly campanulate, cream to white at margin, usually with violaceous or lilac tinge (e.g. K. & W. 15D4, 14D3), when old with ochraceous or yellowish tinge at centre, completely finely micaceous granulose, when young with some velar remnants at margin. Lamellae, L = 25-40, l = (1-)3-5, moderately distant to moderately crowded, free, ventricose, white to cream coloured with age, with white even edge. Stipe 22-80 × 1.5-4 mm, cylindrical or broadening upwards, sometimes with subbulbous base, fistulose, white at apex, darkening to violet, deep violaceous or discoloured to dark brown at base, (14F4, 15D4-F5), pruinose to flocculose at apex, finely granulose to glabrous lower down, when young with some floccules of annulus. Context white in pileus; in stipe concolorous with surface, but sometimes darker in base. Smell strong, like indole (coal gas, like *Tricholoma sulphureum*). Taste never tried. Sporeprint white.

Spores in side view (6.5-)7.0-9.0(-10.0) × 2.5-3.5(-4.0) µm, Q = (2.3-)2.4-3.1(-3.3), Qav = 2.6-2.95, cylindrical, for the greater part with truncate base, some even slightly spurred, not coloured, slightly thick-walled, slowly colouring pale orange-brown in Melzer's Reagent, pink in Congo Red, often in tetrads; inner wall pink in Cresyl Blue. Basidia 18-35 × 6-8 µm, 4-spored. Cheilo- and pleurocystidia absent. Pileus covering a loose velar epithelium made up of globose to ellipsoid, some spheropedunculate elements, 10-35 µm in diam., colourless, some with diffuse very pale brown intracellular pigment, slightly thick-walled, with some incrustations (not evanescent in hydrochloric acid). Stipitipellis a cutis with loosely arranged or attached globose and spheropedunculate velar elements, up to 20 µm in diam., like those on pileus. Clamp-connections present, very occasionally absent.

HABITAT & DISTR. – Gregarious, rarely solitary, saprotrophic and terrestrial in deciduous woods of *Fagus*, *Corylus*, *Carpinus* on calcareous loamy soils rich in nutrients. In the Netherlands mostly in southern Limburg and known from a very few places in the Pleistocene areas (Dorst, and in the province of Drenthe), which are locally rich in loam, or enriched with shells. Aug.-Oct. In temperate regions of Europe, and also known from North America.

7. Cystolepiota icterina Knudsen in Bot. Tidsskr. 73: 130. 1978.

Lepiota icterina F. Møller in Friesia 7: 453. ('1965') 1967 (nom. nud.).

SEL. ICON. – Candusso & Lanzoni, Lepiota: pl. 61. 1990; Lonati in Boll. Ass. micol. ecol. Romana 12: 14. ('1987') 1988; Ryman & Holmåsen, Svampar: 412. 1984.

SEL. DESCR. & FIGS. – Knudsen in Bot. Tidsskr. 73: 131, figs. 3-4, 13 (upper left row). 1978; Lonati in Boll. Ass. micol. ecol. Romana 12: 12-14. ('1987') 1988.

CHARACTERISTICS – Pileus 15-30 mm, obtusely conical to convex with low, broad umbo, with undulating marginal zone, sulphur-yellow at first, pallescent to yellowish or pale buff, or brownish yellow, finely floccose-farinose, almost glabrous at margin; lamellae rather crowded, free, cream-coloured; stipe 30-55 × 2-3 mm, cylindrical, concolorous with pileus, brownish at base, floccose-farinaceous at first, glabrescent with age; context thin and concolorous with surfaces; smell and taste not distinct; spore print pale cream.

Spores 3.5-5.5(-6.0) × 2.5-3.0 µm, oblong, ovoid, dextrinoid; basidia 4-spored; cheilocystidia scattered, 30-45 × 5.0-8.0 µm, irregularly sinuous, narrowly clavate or fusiform; pleurocystidia absent; elements of velar covering globose to subglobose, 20-30(-40) µm in diam., with yellowish vacuolar pigment; clamp-connections present in all tissues.

HABITAT & DISTR. – Gregarious, saprotrophic and terrestrial in deciduous woods. Not with certainty known from the Netherlands, probably found once in southern Limburg; very rare in Europe, only known from a few finds in Denmark, Sweden, Belgium and Italy.

Unfortunately no material of the Netherlands find of *Cystolepiota icterina* has been conserved; the characteristics above are compiled from the descriptions cited.

Sect. **Pulverolepiota** (M. Bon) Vellinga

Spores very slowly becoming red-brown in Melzer's Reagent or not colouring at all, rough, and binucleate; velar elements elongate and inflated.

8. Cystolepiota pulverulenta (Huijsman) Vellinga in Persoonia 14: 407. 1992. – Fig. 126.

Lepiota pulverulenta Huijsman in Persoonia 1: 328. 1960; *Leucoagaricus pulverulentus* (Huijsman) M. Bon in Doc. mycol. 8 (30-31): 70. 1978; *Leucoagaricus pulverulentus* (Huijsman) Mos., Röhrlinge Blätterpilze, 4. Aufl.: 246. 1978 (superfluous); *Pulverolepiota pulverulenta* (Huijsman) M. Bon in Doc. mycol. 22 (88): 30. 1993. – *Leucoagaricus pulverulentus* f. *minimus* M. Bon et al. in Doc. mycol. 19 (75): 54. 1989; *Pulverolepiota pulverulenta* f. *minima* (M. Bon et al.) M. Bon in Doc. mycol. 22 (88): 30. 1993; *Cystolepiota pulverulenta* f. *minima* (M. Bon et al.) Chiusa in Riv. Micol. 41: 152. 1998. – *Lepiota hetieriana* Locq. in Bull. mens. Soc. linn. Lyon 14: 94. 1945 (not valid); *Cystolepiota hetieriana* (Locq.) Bresinsky in Bresinsky & Haas in Beih. Z. Pilzk. 1: 46. 1976 (not valid).

MISAPPL. – *Lepiota sistrata* sensu Herink in Ceská Mykol. 15: 217. 1961.

SEL. ICON. – Partacini in Riv. Micol. 30 (3-4): front cover. 1987; D. Reid in Fung. rar. Ic. col. 2: pl. 9e, 9f. 1967; Vellinga & Huijser in Coolia 40: pl. 1. 1997.

SEL. DESCR. & FIGS. – Huijsman in Persoonia 1: 328-329. 1960; Kelderman, Parasolzw. Zuid-Limburg: 34-35. 1994; Partacini in Riv. Micol. 30: 132-133. 1987; D. Reid in Fung. rar. Ic. col. 2: 6-7. 1967; Vellinga in Persoonia 14: 407-408, fig. 1. 1992.

VERN. NAME – Kegelpoederparasol.

Pileus 11-50 mm, when young conical with rounded apex or conico-convex, with inflexed margin, expanding to plano-convex or plano-

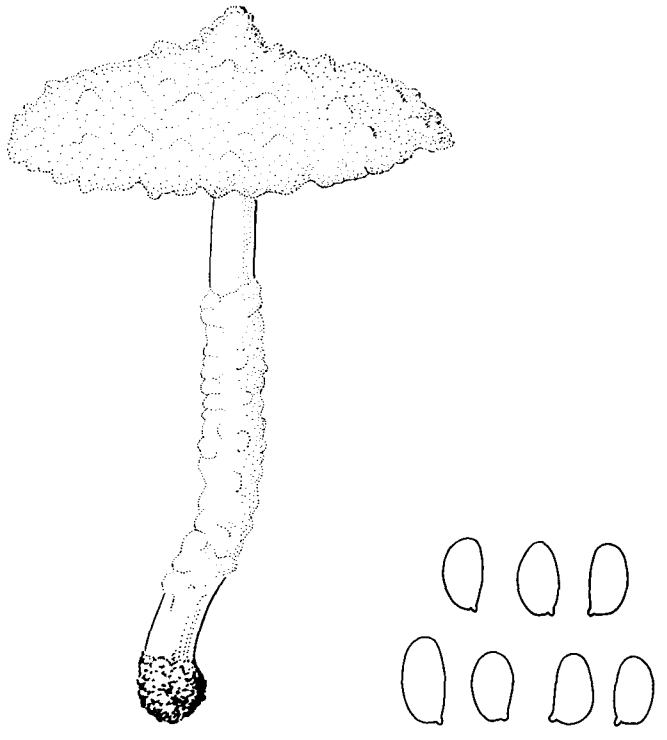

Fig. 126. *Cystolepiota pulverulenta.*

concave, with or without obtuse umbo or papilla, with straight margin, whitish or cream-coloured at first, later on and when touched pinkish brown (Mu. 7.5 YR 5/6), pink-brown (7.5 YR 7/6) or rusty brown to dark hazel-brown (7.5 YR 4/4-6/6, 10 YR 4/4), covered with a thick, loose, flocculose layer, uniformly thick or with warts, with overhanging floccules or with a rim at margin. Lamellae, L = 30-35, l = 1-7, moderately crowded to crowded, free and remote from stipe, thin, slightly ventricose, 2-4.5 mm broad, cream-coloured, pale cream to cream-yellow, sometimes slightly pinkish, with even, concolorous or paler edge. Stipe 30-65 × 2-5.5 mm, cylindrical or slightly tapering towards base, sometimes with up to 8 mm wide, subbulbous base, flexuous, fistulose, at apex cream-coloured and glabrous to slightly pruinose; rest of stipe covered with pale cream flocci, like those on pileus, and discolouring like flocci on pileus. Context whitish or creamy in pileus and stipe, and discolouring to orange-brown, especially in base of stipe, when disposed to air. Smell indistinct, unpleasant. Taste not known. Spore print white.

Spores in side-view (3.5-)4.0-5.5(-6.0) × (2.0-)2.5-3.5 µm, Q = (1.3-)1.4-2.25(-2.35), Qav = 1.55-2.0, ellipsoid to oblong with parallel to convex sides, in frontal view oblong, often in tetrads, with slightly rough wall, slowly or not at all dextrinoid, with pink inner wall in Cresyl Blue, binucleate. Basidia 13-25 × 4.0-7.5 µm, 4-spored. Cheilo- and pleurocystidia absent. Elements of velar, epithelial covering on pileus and stipe 60-110 × 9.0-15 µm, elongate, inflated with rounded apices, sometimes branched, catenulate, with encrusting colourless or pale brownish substance. Stipitipellis a cutis of cylindrical, 4.0-6.0 µm wide, hyphae, with yellow, not encrusting pigment. Clamp-connections absent.

HABITAT & DISTR. – In small groups, saprotrophic and terrestrial in deciduous woods on rather nutrient-rich, loamy and moist soils. In the Netherlands known from several localities in the province of Limburg (Cadier en Keer, Heerlen, Linne, and Valkenburg), very rare elsewhere (Wassenaar). Aug.-Oct. This species might reach the northern limit of its European distribution area in the Netherlands and Germany.

The reasons to include this species in *Cystolepiota* are given by Vellinga (in Persoonia 14: 409-410. 1992), and are supported by molecular data.

Cystolepiota pulverulenta has, in contrast to the species in sections *Cystolepiota* and *Pseudoamyloideae*, binucleate spores, and no clamp-connections.

Cystolepiota pseudogranulosa (B. & Br.) Pegl., a tropical species known from Sri Lanka, East Africa, Central and South America comes very close. The pileus covering of that species is also made up of inflated, oblong elements and the spores are rough as well, but the hyphae are provided with numerous, though small, clamp-connections (Pegler, pers. comm., Febr. 1996), and the spores are said to be strongly dextrinoid (Dennis in Kew Bull. 7: 486. 1952), though personal observations contradict this.

The spores of *C. pulverulenta*, as seen with Scanning Electron Microscope, have discrete, rounded warts.

10. **Melanophyllum** Velen.

ELSE C. VELLINGA

Agaricus subgen. *Melanophyllum* (Velen.) Pilát in Acta Mus. natn. Prag. 7B (1): 26. 1951; *Melanophyllum* Velen., Ceské Houby: 569. 1921. – *Chlorospora* Mass. in Kew Bull. 1898: 136. 1898, non *Chlorospora* Speg., 1891; *Glaucospora* Rea, Brit. Basidiomyc.: 62. 1922. – *Chlorosperma* Murrill in Mycologia 14: 96. 1922.

SELECTED LITERATURE – Candusso & Lanzoni, Lepiota: 68-76. 1990; Sing., Agar. mod. Taxon., Ed. 4: 491-492. 1986.

Basidiocarp pluteoid with persistent velum universale, made up of globose elements; velum partiale an evanescent annulus; lamellae free, brightly coloured; spore print when fresh green or blue-green, in one species on drying turning into brown and finally to black.

Spores ellipsoid to oblong, finely verrucose, non-amyloid, non-dextrinoid, metachromatic in Cresyl Blue, and walls not swelling in ammonia ($NH_{3(aq)}$) and acetic acid ($CH_3COOH_{(aq)}$); cheilocystidia present and inconspicuous or absent; hymenophoral trama subregular; clamp-connections present. Development of basidiocarp bivelangiocarpic and pileostipitocarpic. – Type species: *Melanophyllum canali* Velen.

HABITAT & DISTRIBUTION – Saprotrophic and terrestrial; cosmopolitan.

The genus *Melanophyllum* is very closely related to *Cystolepiota* Sing., differing mainly in the pigmentation of the spores. Because of the coloured spores it was often placed close to *Agaricus* L.: Fr. in tribus Agariceae (e.g. Singer, Agar. mod. Taxon., Ed. 4: 482-483. 1986), but that is not supported by molecular, nor by morphological, data.

KEY TO THE SPECIES

1. Basidiocarp dark brown, discolouring black in exsiccates; lamellae reddish coloured ..... **1. M. haematospermum**
1. Basidiocarp white to pale yellow-brown, not changing into black in exsiccates; lamellae greenish blue ..... **2. M. eyrei**

1. Melanophyllum haematospermum (Bull.: Fr.) Kreisel in Reprium nov. Spec. Regni veg. 95: 700. 1984. – Fig. 127.

Agaricus haematospermus Bull., Herb. France: pl. 595. 1793; *Agaricus haematospermus* Bull.: Fr., Syst. mycol. 1: 282. 1821; *Lepiota haematosperma* (Bull.: Fr.) Quél. in Bull. Soc. mycol. Fr. 9: 6. 1893; *Psalliota haematosperma* (Bull.: Fr.) Lund. & Nannf. in Fungi exs. suec. no. 341. 1935. – *Agaricus echinatus* Fr.: Fr., Syst. mycol. 1: 286. 1821; *Psalliota echinata* (Fr.: Fr.) Kumm., Führ. Pilzk.: 73. 1871; *Pratella echinata* (Fr.: Fr.) Gillet, Hyménomycètes: 565. 1874; *Lepiota echinata* (Fr.: Fr.) Quél., Enchir. Fung.: 8. 1886; *Inocybe echinata* (Fr.: Fr.) Sacc., Syll. Fung. 5: 773. 1887; *Naucoria echinata* (Fr.: Fr.) Schroet. in Cohn, Krypt.-Fl. Schlesien 1: 607. 1889; *Cystoderma echinatum* (Fr.: Fr.) Sing. in Annls Mycol. 34: 338. 1936; *Melanophyllum echinatum* (Fr.: Fr.) Sing. in Lilloa 22: 436. ('1949') 1951. – *Melanophyllum canali* Velen., Ceské Houby 3: 569. 1921. – *Lepiota haematosperma* f. *gracilis* J. Lange, Fl. agar. dan. 1: 37. 1935 (not valid).

EXCL. – *Melanophyllum haematospermum* sensu Mitchell & Bresinsky in Mycologia 91: 811-819. 1999 (= *Leucoagaricus* spec.).

SEL. ICON. – Boud., Ic. mycol. 1: pl. 12. 1905 (as *Lepiota haematosperma*); Candusso & Lanzoni, Lepiota: pl. 1a. 1990; Lütjeharms in Fl. batava 28: pl. 2203. 1934 (as *Lepiota echinata*); Krieglst. in Südwestd. Pilzrundschau 17 (2): 2. 1981 (as *M. echinatum*); Lazzari & Bellù, Atl. iconogr.: 207. 1985; Pegl. & Brand in Mycologist 11: 180. 1997.

SEL. DESCR. & FIGS. – Horak, Syn. Gen. Agar.: 379-380. 1968 (as *M. echinatum*); Krieglst. in Südwestd. Pilzrundschau 17 (2): 1-3. 1981 (as *M. echinatum*); Lazzari & Bellù, Atl. iconogr.: 206-207. 1985; Pegl. & Brand in Mycologist 11: 180. 1997; Wasser, Tr. Agariceae Soviet Union: 11-13. 1989.

VERN. NAME – Verkleurzwammetje.

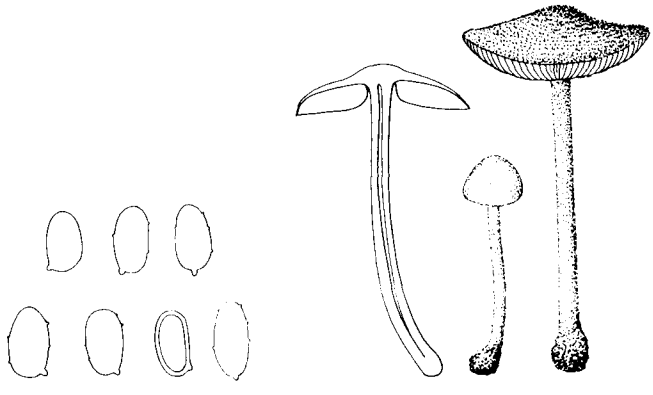

Fig. 127. *Melanophyllum haematospermum*.

Pileus 6-35 mm, at first convex or bluntly conical, expanding to applanate with or without low broad umbo, at centre dark grey-brown (Mu. 10 YR 3/2 - 4/3), towards margin paler brown on pinkish-reddish background, on drying pallescent to pale pink-brown, completely covered with granules in heaps, the biggest at centre, after heavy rainfall completely glabrous; margin when very young with triangular velar remnants then flocculose-fimbriate, exceeding lamellae. Lamellae, L = 27-40, l = 1-7, moderately crowded to crowded, free, straight to ventricose, up to 3.5 mm broad, young red then purplish pink to red-brown or vinaceous red (2.5 YR 3/4 - 5 YR 3/3) with even and concolorous edge. Stipe 10-50 × 1-3.5 mm, cylindrical, fistulose with age, when young vinaceous pink and with fugacious annulus, later reddish or purple-brown (2.5 - 7.5 YR 3/2) lengthwise fibrillose with granulose covering as on pileus. Context in pileus pale cream to pinkish white, in stipe concolorous with surface, in inner parts paler. Smell strong, like the smell of *Lepiota cristata* or *L. aspera*, earth-like. Taste suggestive of *L. cristata*. Spore print when fresh green (K. & W. 28D4) turning into vinaceous red, on drying into black.

Exsiccate black.

Spores (4.5-)5.0-6.5(-7.0) × 2.5-4.0 µm in side view, Q = (1.4-)1.5-2.0(-2.3), Qav = 1.55-1.95, oblong, a few cylindrical, slightly thick-walled, pale greenish-brownish in ammonia, slightly verrucose all over, non-amyloid, non-dextrinoid, with pink inner wall in Cresyl Blue. Basidia 14-25 × 5.0-7.0 µm, 4-spored, some 2-spored. Cystidia not observed, but see notes. Hymenophoral trama with brown parietal pigment. Pileus covered with velum universale, forming an epithelium made up of mostly globose and some ellipsoid or spheropedunculate to pyriform elements, 10-55 µm in diam., thick-walled with brown intracellular pigment; terminal elements also with some encrusting pigment; elements in heaps. Stipitipellis a cutis of cylindrical thick-walled hyphae, 4.0-20 µm wide, with brown intracellular and parietal pigment, with some loosely attached globose velar elements. Clamp-connections present.

HABITAT & DISTR. – Gregarious, saprotrophic and terrestrial in deciduous forests on clay or loam, on compost heaps, in gardens, parks, and hothouses. In the Netherlands not uncommon, throughout the country (for a distribution map see Nauta & Vellinga, Atl. Nederl. Paddest.: 205. 1995); (July-)Aug.-Oct.(-Nov.), in hothouses throughout the year. Cosmopolitan.

The use of the epithet 'haematospermum' instead of 'echinatum' has been discussed by Lanzoni & Bellù (Atl. iconogr.: 207. 1985). Pegler (in Kew Bull. add. Series 12: 316. 1986) gave an extensive list of synonyms of *Melanophyllum haematospermum*.

Cheilocystidia were not observed in the Dutch material, though Bon (in Doc. mycol. 11 (43): 23. 1981) and Pegler & Brand (in Mycologist 11: 180. 1997) stated them to be present and inconspicuous, rare, and clavate.

The spores are ornamented with more or less isolated warts, as can be seen with Scanning Electron Microscope.

On drying the colour of the spore print changes from green, via dingy brown to black (Melzer in Ceská Mykol. 8: 82-87. 1954).

2. Melanophyllum eyrei (Mass.) Sing. in Lilloa 22: 436. ('1949') 1951. – Fig. 128.

Schulzeria eyrei Mass. in Grevillea 22: 38. 1894; *Chlorospora eyrei* (Mass.) Mass. in Kew Bull. 1898: 136. 1898; *Lepiota eyrei* (Mass.) J. Lange, Fl. agar. dan. 1: 36. 1935.

SEL. ICON. – Candusso & Lanzoni, Lepiota: pl. 1b. 1990; J. Lange, Fl. agar. dan. 1: pl. 13B. 1935; Lanzoni & Zecchin in Riv. Micol. 31: 100. 1988; R. Phillips, Paddest. Schimm.: 30. 1981.

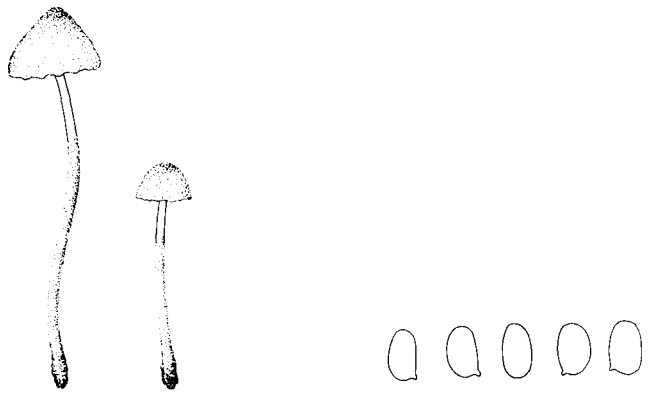

Fig. 128. *Melanophyllum eyrei*.

SEL. DESCR. & FIGS. – Babos in Annls hist.-nat. Mus. natn. hung. 50: 87. 1958; Horak, Syn. Gen. Agar.: 658-660. 1968 (as *Glaucospora eyrei*).

VERN. NAME – Groenplaatzwammetje.

Pileus 6.5-25 mm, paraboloid or conico-campanulate when young, expanding to applanate, often with low broad umbo, very young almost white or cream, then yellow-brown or pale pinkish brown (c.Mu. 10 YR 8/4) at centre, pallescent towards margin (10 YR 8/6), and there sometimes slightly bluish, completely finely granulose (lens!), when young with triangular velar remnants at margin. Lamellae, L = 25-30, l = 1-3(-6), moderately crowded, free, ventricose, up to 3 mm broad, strikingly greyish blue-green or blue-green. Stipe 20-55 × 1-3 mm, cylindrical, fistulose, at apex cream and finely pubescent or more or less glabrous, lower down pale pink-brown, concolorous with pileus and granulose, browning when touched. Context white to cream in pileus. Smell indistinct, slightly resembling the smell of *Lepiota cristata*. Taste not known. Spore print bluish green.

Spores (3.5-)4.0-5.5(-6.0) × 2.5-3.5 µm, Q = (1.2-)1.4-1.8(-2.0), Qav = 1.5-1.7, ellipsoid, oblong, some more cylindrical, or amygdaliform with rounded apex, slightly thick-walled, with bluish wall in ammonia, verrucose, non-amyloid, non-dextrinoid, cyanophilous, metachromatic in Cresyl Blue. Basidia 17-23 × 5.0-7.0 µm, 4-spored or mixed 2- and 4-spored. Cystidia not observed. Hymenophoral trama not coloured. Pileus covered with velum universale, composed of globose and spheropedunculate elements, 15-45(-55) µm, slightly thick-walled, with pale yellow-brown parietal pigment. Stipitipellis a cutis of cylindrical 4.0-10 µm wide colourless hyphae covered with elements as on pileus. Clamp-connections present in all tissues.

HABITAT & DISTR. – Solitary to gregarious, saprotrophic and terrestrial in mixed deciduous forests (with *Fagus*) on humus-rich soil, rich in nutrients, probably also calcareous and loamy. Up to now known from several localities in the southern part of the Netherlands (Valkenburg, Schaelsberg; Cadier en Keer, Riesenberg and Örenberg), not recorded from Belgium. Sept.-Oct. Widespread and very rare in temperate Europe.

Urbonas (in Urbonas et al., Konsp. agar. Grib. LSSR, LSSR, ESSR: 54. 1974) described *Melanophyllum eyrei* var. *macrosporum*, with spores 5-7.5 × 2-2.5 µm: bigger and slightly narrower than those of the typical variety.

The spores are ornamented with isolated rounded warts, as seen with Scanning Electron Microscope.

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Volume numbers are given in Roman numerals; accepted names are printed in bold.