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THE GENUS CREPIDOTUS (FR.) STAUDE IN EUROPE

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The genus *Crepidotus* in Europe is considered. After an examination of 550 collections seventeen species and eight varieties are recognized. Two keys are supplied; all taxa accepted are typified.

Morphological, ecological and chorological characters are critically evaluated. Descriptive statistics are used for basidiospore size. An infrageneric classification is proposed based on phenetic relationships using different cluster methods. The new combinations *C. calolepis* var. *squamulosus* and *C. cesatii* var. *subsphaerosporus* are introduced. The spore ornamentation as seen in the scanning electron microscope provides the best character for species delimitation and classification.

INTRODUCTION

Fries (1821: 272) established *Agaricus* series *Derminus* tribus *Crepidotus* for more or less pleurotoid species with ferruginous or pale argillaceous spores and an ephemeral, fibrillose veil (!). His fourteen species include such taxa as *Paxillus atrotomentosus*, *Lentinellus vulpinus*, *Panellus violaceo-fulvus* and *Entoloma depluens* which nowadays are placed in quite different genera and families. Only three of Fries' species belong to the genus *Crepidotus* as conceived now. This demonstrates the importance of microscopic characters, neglected by Fries, for the circumscription of species and genera.

Staude (1857) raised the tribus *Crepidotus* to generic rank with *C. mollis* as the sole species. Hesler & Smith (1965) dealt with the history of the genus *Crepidotus* in more detail.

In recent years several regional floras have been published, e.g. Ortega & Buendia (1989) for Spain, Watling & Gregory (1989) for the British Isles and Norstein (1990) for Norway. None of these includes critical revisions of type collections.

Pilát (1948) provided the first European monograph. Since then six new species have been described and new techniques and methods have been developed, e.g. the study of ultrastructures and numerical taxonomy, which allow a critical reassessment of the taxonomy in this genus.

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A. GENERAL PART

1. MATERIAL AND METHODS

The microscopic structures were mainly observed in dried material. Fragments of lamellae were mounted in Congo red, heated and examined in 5% KOH. The structure of the pileipellis was examined in 10% ammonia or 5% KOH. The ornamentation and the colour of the spores were studied in 5% KOH.

The spore sizes are given with an approximation of 0.5 μm; they are based on 20 spores measurements per collection. Spores measured were taken from the surface of the pileus. Q is the length-width ratio of spores.

For basidia and cystidia the arithmetic mean of the smallest and the largest object per collection, with 10 measurements in each case, is given. Unusually extreme sizes are added in parentheses. The bar equals 1 μm in the SEM pictures, 10 μm in the drawings of microscopic characters, and 1 cm in the drawings of fruit-bodies.

Colours are compared with Munsell Soil Colour Charts (abbreviated M) and named with Ridgway (1912) or with Kornerup & Wanscher (1978, abbreviated K&W).

The SEM investigations were carried out with a JEOL JSM-T 300 using accelerating voltages between 10 and 15 kV. Air-dried spores were coated with gold for 3 minutes. The nuclei were observed using DAPI staining and fluorescence or by staining with acetocarmine acid.

Material from the following herbaria has been investigated: B, BERN, BRNM, C, G, GDAC, IB, K, L, LAU, M, NMLU, NY, SOM, SZU, TAA, UPS, W, WAG-W, WU (abbreviations in accordance with Index Herbariorum), La Laguna (Tenerife), Lugano and from private herbaria: F. Bellu, M. Bon, E. Chételat, H. Engel, H. Hallgrimsson, M. Josserand, N. Luschka, J. Mornand, J. Prongué, A.F.M. Reijnders, A. Runge, J.A. Schmitt, F. Tjallingii, W. Winterhoff.

The nomenclature of mentioned vascular plants follows Ehrendorfer (1973). Pieces of wood were determined with Schweingruber (1978).

Collections marked with an asterisk (*) in the list of collections examined are those in which the number of nuclei in mature spores has been counted (see 2.6).

2. NOTES ON CHARACTERS

2.1. Shape of fruit-body — Fig. 1

The fruit-bodies of all European *Crepidotus* species are pleurotoid, i.e. when seen from above, semicircular, rounded flabelliform, reniform, more rarely spathuliform, when seen from the side plano-convex, applanate, convex, more rarely campanulate. They are dorsally or laterally, more rarely centrally attached to the substratum. Fully developed, they reach 10–30 (100) mm across.

Some species have characteristic shapes: 1) younger fruit-bodies are often unguiculate in the *C. cesatii* aggr. and in *C. luteolus*; 2) old fruit-bodies are often crenate at the margin and furrowed in *C. variabilis* and *C. lundellii*; 3) convex caps with a low umbo are typical for *C. mollis*; 4) caps are mostly spathuliform to flabelliform in the terrestrial *C. autochthonus* and occasionally in large fruit-bodies of *C. applanatus* on logs.

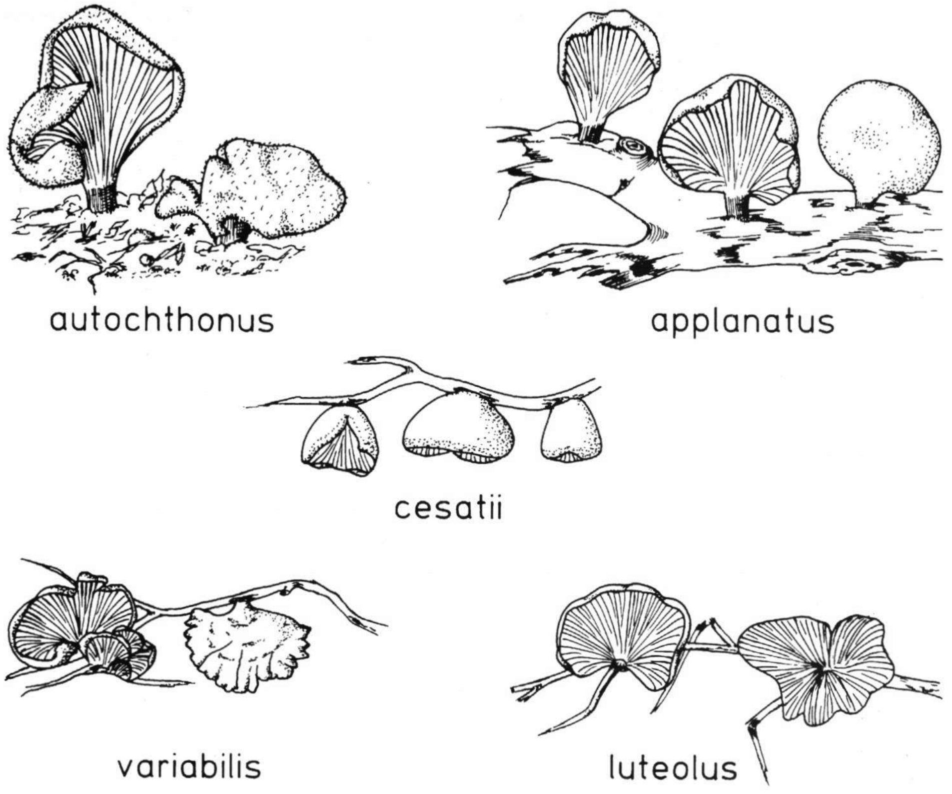


Fig. 1. Fruit-body shapes.

The pileus surface of all species with the exception of the *C. mollis*-group is tomentose to felted. The degree in which this characteristic surface texture expresses itself may vary according to age, weather conditions and probably type of habitat. While the central part of the pileus surface becomes adpressed-felted to almost smooth, the pileus margin often remains distinctly tomentose. Scales that can be observed macroscopically are to be found in *C. crocophyllus* and *C. calolepis*.

2.2. Lamellae

The shape and the spacing of the lamellae is rather uniform: subventricose, more rarely ventricose, or arcuate, usually crowded, distant only in *Crepidotus cesatii*. The young lamellae in all species observed were decurrent at first. Only after expansion of the cap they become adnexed or almost free. In most species the lamellae are white to very pallid at first, turning ochraceous-tawny, cinnamon, sayal-brown or snuff-brown with age, with pinkish tinges mainly in *C. cesatii* and occasionally in *C. variabilis* and *C. epibryus*. Aberrant are *C. roseoornatus* and *C. cinnabarinus* with orange-pink or salmon-red, *C. crocophyllus* and *C. ehrendorferi* with pale orange to cinnamon, and *C. sambuci* sensu Orton with yellow lamellae; in *C. luteolus* they are only very pale yellowish.

In all species the edge of the lamellae is finely fimbriate, floccose only in very young stages, becoming even. In *Crepidotus cinnabarinus* it is strikingly red because of the presence of cystidia with coloured contents.

2.3. Fruit-body development — Figs. 26, 28

In many collections early stages of the fruit-body development are to be seen. They all show the same stipitocarpous development. However, the earliest stages of tissue differentiation have not been observed, therefore an arrangement in Reijnders' classification (1963) must remain tentative. Primordia can be seen as small, hemispherical warts on the surface of the substratum without any extended basal mycelium. Very early centrally stipitate fruit-bodies develop a strongly involute pileus densely covered with erect hyphae (see Figs. 25, 27). Plate no. 321 in Sowerby (1803) illustrates this development stage. No velum was observed. The stipe consists of a densely packed trama with parallel hyphae. At about the height of 1–2 mm the stipe stops growing, the pileus develops excentrically away from the substratum. The stipe is soon hidden by the young lamellae and the fleshy parts of the cap; in mature stages of development it is normally obliterated.

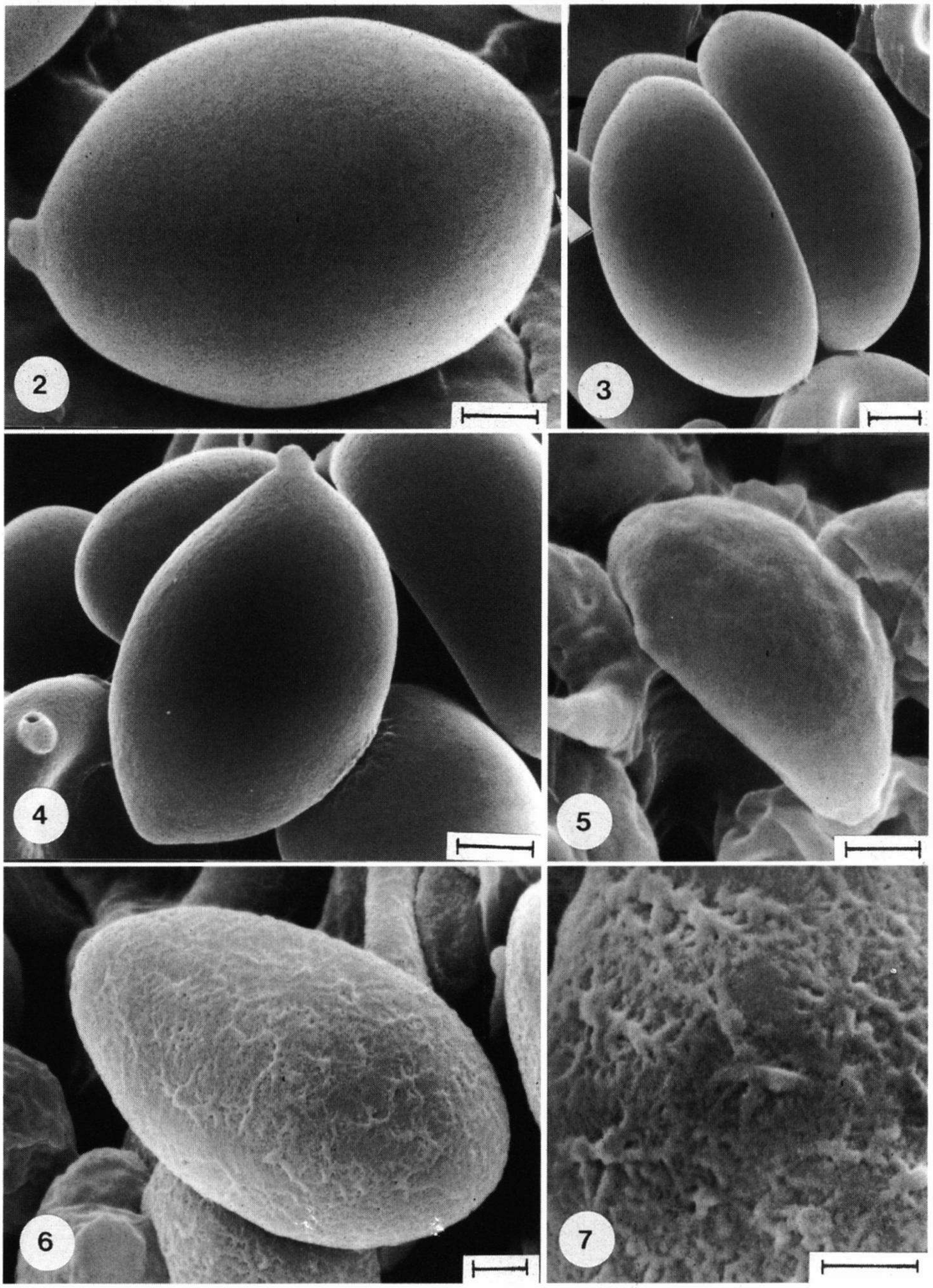
The *Crepidotus mollis*-group and sometimes *C. applanatus* develop short and thick stipes: the stipe grows longer than in the other species, becomes thicker and coalesces with part of the pileus, but remains visible only from below.

2.4. Basidiospores — Figs. 2–25

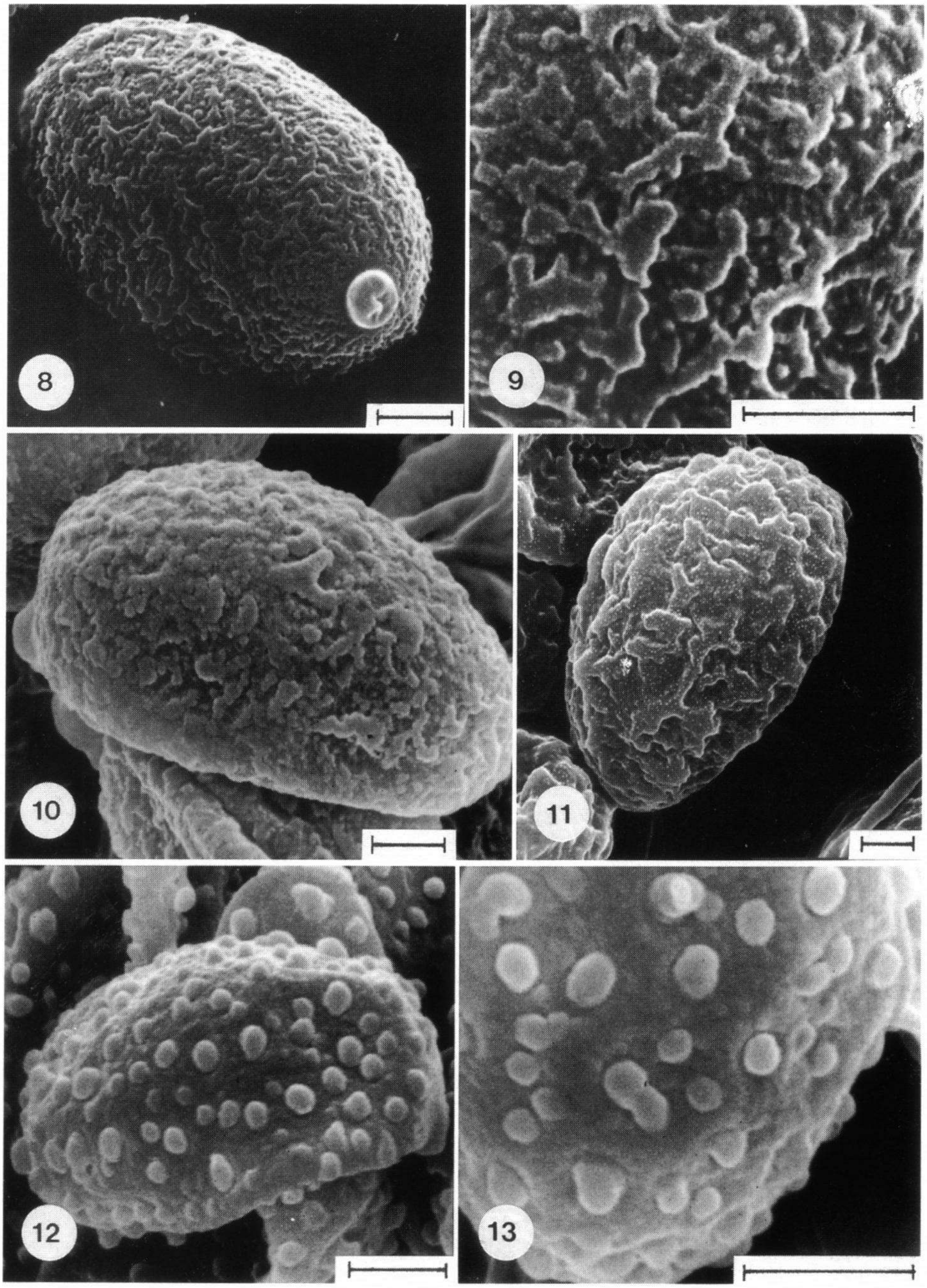
Characters of the spores are taxonomically the most important ones in the genus *Crepidotus*. I agree with Hesler & Smith (1965) that spore shape and ornamentation are of prime importance and that spore size is a diagnostic feature mainly used at species level. Important is also the colour of the spore deposit and of the spore wall under the light microscope. A difficulty in establishing spore deposit colour is that a good spore deposit is not always readily obtained and that the colour changes with age in the herbarium, which hampers a synoptical comparison of various collections at the same time. As differences between many species are modest – but probably very constant – the practical use of this character in identification work is negligible. Under the light microscope three categories may be discerned (Norstein, 1990): spore wall faintly, moderately and strongly coloured.

The colour of the spore print once played an important role at generic level. Patouillard (1887) separated *Crepidotus* with ochraceous to rust-brown spores from the genus *Dochmiopus*, with *C. variabilis* as type, on account of its pink spores. Pilát (1948) rejected this separation on generic level, added the pinkish colour of young lamellae and a verruculose or echinulate spore ornamentation as further characters of *Dochmiopus* reduced to subgeneric rank. Hesler & Smith (1965) finally characterized their enlarged subgenus *Dochmiopus* by the shape of the spores and the presence of clamp-connections. Pinkish or reddish colours do not play a part in their definition of subgenus *Dochmiopus*. Kühner (1980) agrees with the rejection of spore colours as the decisive character for *Dochmiopus*.

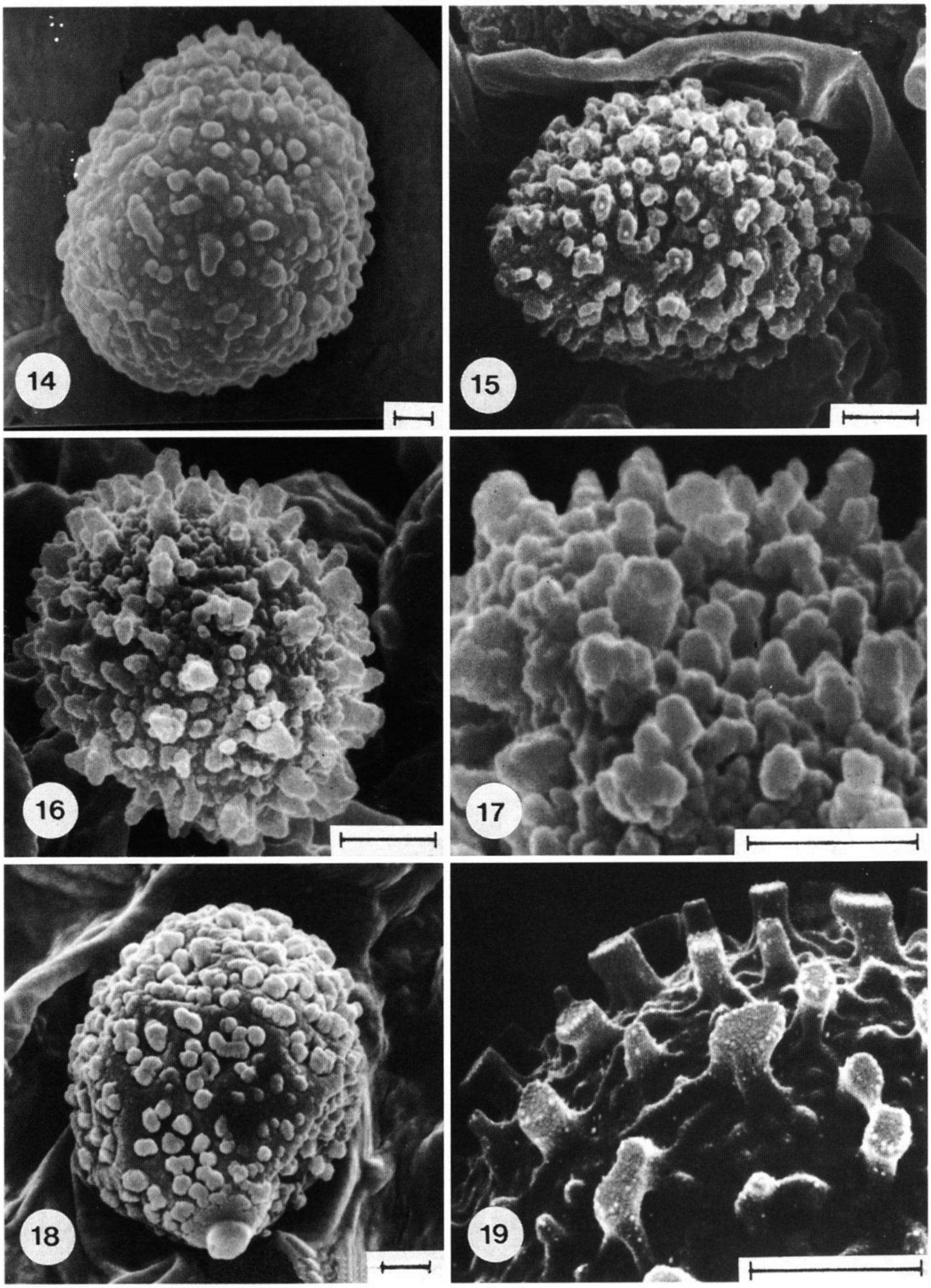
Under the light microscope the spores of several species, especially in section *Dochmiopus* show granular refractive contents, which are missing in subgenus *Crepidotus*, but usually also in *C. autochthonus* and *C. epibryus* belonging to subgenus *Dochmiopus*.



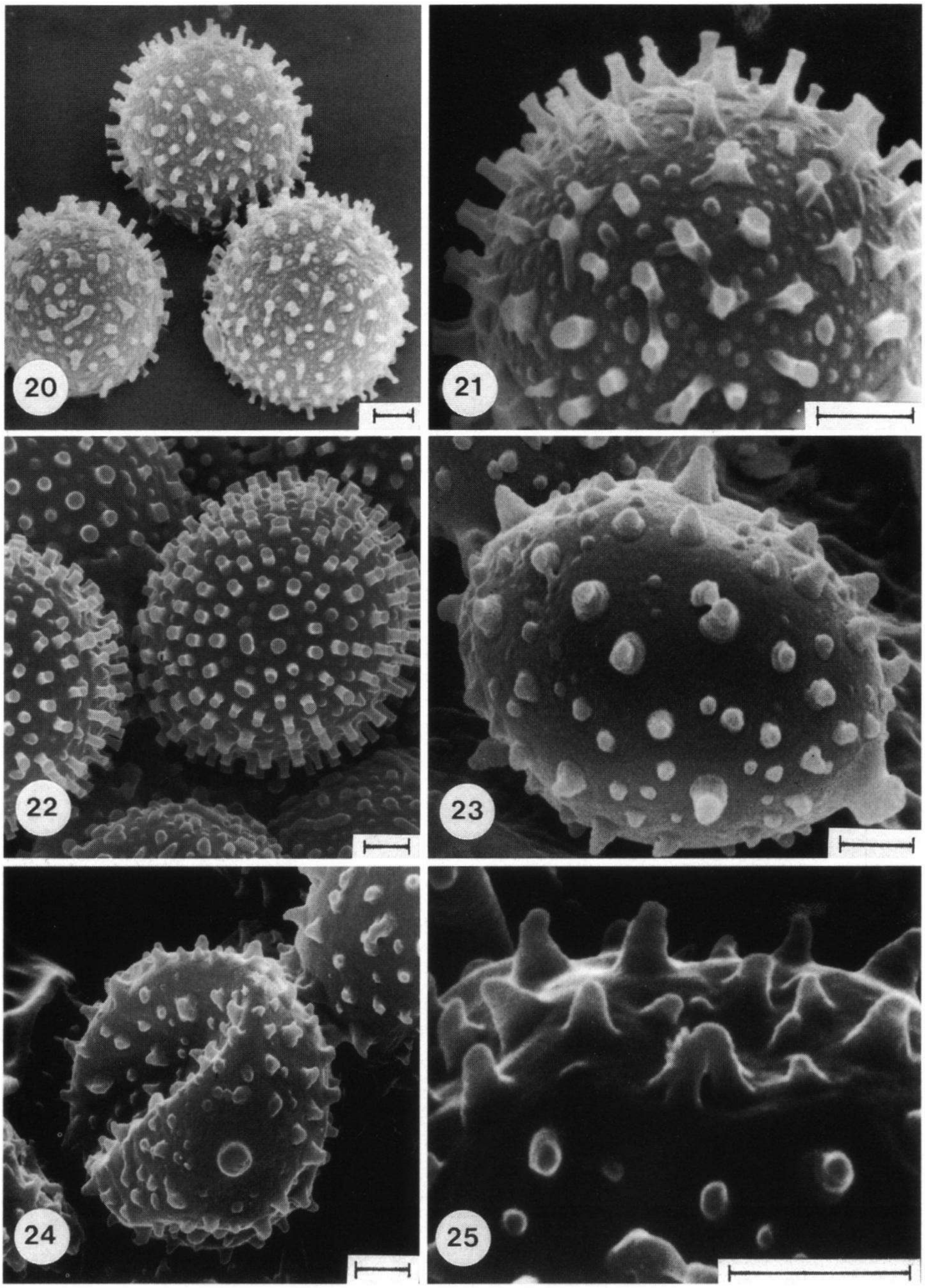
Figs. 2–7. SEM pictures of spores. – 2. *Crepidotus mollis* (coll. 89/135 BERN). – 3. *C. calolepis* var. *squamulosus* (coll. 89/9, BERN). – 4. *C. autochthonus* (coll. 88/485, BERN). – 5. *C. epibryus* (coll. 90/4, BERN). – 6. *C. versutus* (coll. Lugano). – 7. *C. versutus* (detail).



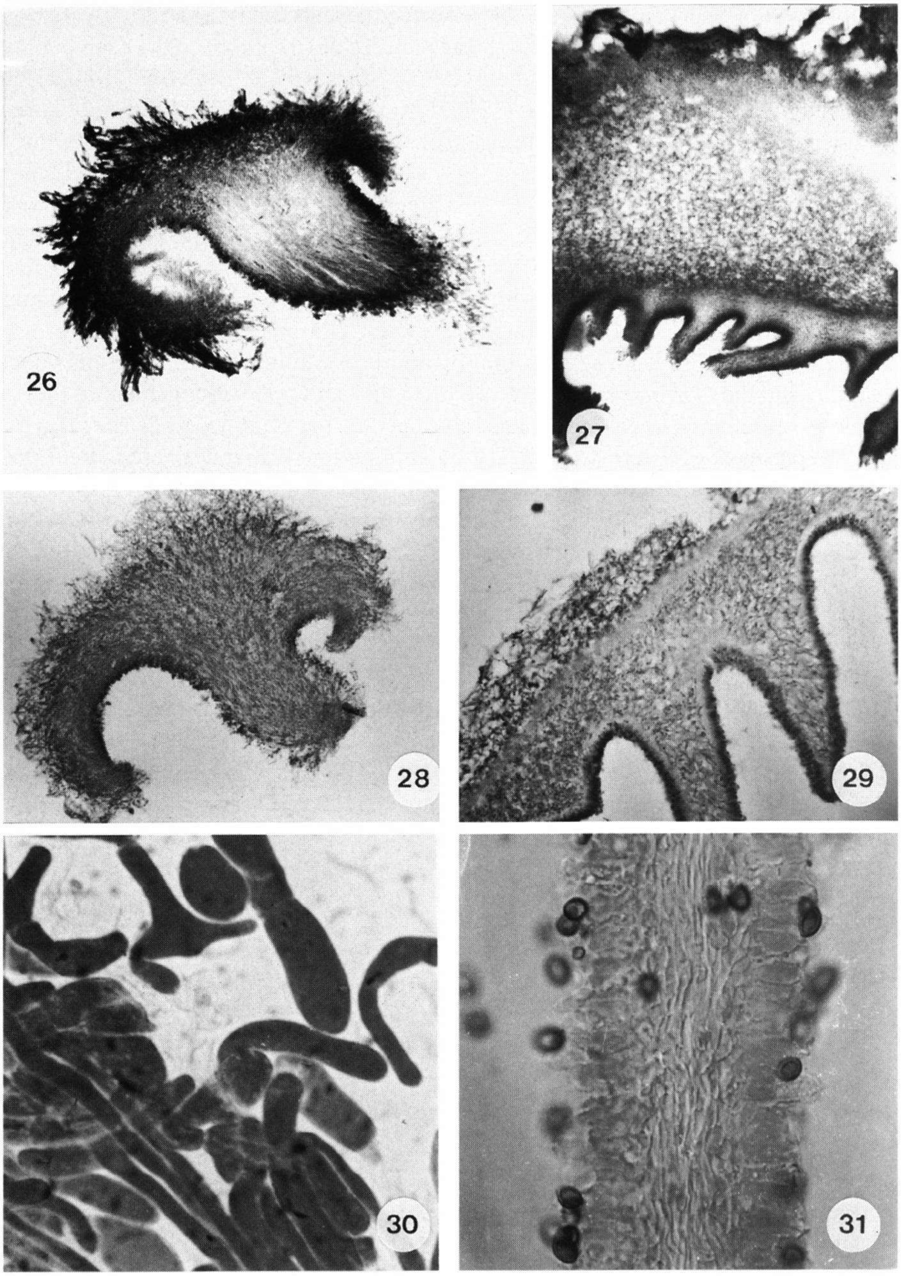
Figs. 8–13. SEM pictures of spores. – 8. *Crepidotus lundellii* (coll. 88/462, BERN). – 9. *C. lundellii* (detail). – 10. *C. luteolus* (coll. 5144, WAG-W). – 11. *C. subverrucisporus* (coll. 13810, G). – 12. *C. variabilis* (coll. ECH 21, BERN). – 13. *C. variabilis* (detail).



Figs. 14–19. SEM pictures of spores. – 14. *Crepidotus cinnabarinus* (coll. 960.110-176, L). – 15. *C. roseoornatus* (type). – 16. *C. carpaticus* (coll. herb. Bon). – 17. *C. carpaticus* (detail). – 18. *C. macedonicus* (coll. ZT 63/230). – 19. *C. applanatus* (coll. 13806, G).



Figs. 20–25. SEM pictures of spores. – 20. *Crepidotus crocophyllus* (coll. 313035, BRNM). – 21. *C. crocophyllus* (detail). – 22. *C. ehrendorferi* (type). – 23. *C. cesatii* var. *subsphaerosporus* (coll. 89/240, BERN). – 24. *C. cesatii* var. *cesatii* (coll. IB 76/11). – 25. *C. cesatii* var. *cesatii* (detail).



Figs. 26–31. Anatomical details. – 26. Young fruit-body of *Crepidotus calolepis* (coll. TAA no. 72404); diameter of the pileus: 0.8 mm. – 27. Gelatinous layer in younger fruit-bodies of *C. calolepis* (coll. TAA no. 72404). – 28. Young fruit-body of *C. luteolus* (coll. BERN 89/243). – 29. Pileus of *C. cesatii* var. *cesatii* (coll. BERN 87/274) with distinct subpellis. – 30. Old hymenophoral trama of *C. epibryus* (coll. Lugano 3178). – 31. Lamellae of *C. autochthonus* (coll. Tjallingii).

At the level of SEM analyses, the spore surface reveals the most striking variation of ornamentation types within the agarics. SEM pictures of *Crepidotus* have been published by Pegler & Young (1972), Clémençon (1977), Strid (1975), Bigelow (1980), Luther & Redhead (1981) and Moreno et al. (1984). All data published by these authors refute Singer's hypothesis (1947) of the heterogeneous spore wall showing immersed short and thin columns (see especially Clémençon, 1977).

The only published TEM pictures known are of *Crepidotus cesatii* and *C. applanatus* (Pegler & Young, 1972; Clémençon, 1977). The eusporium, i.e. the inner tegument of the spore wall, is composed of a thick coriotunica; a pure corium is absent. The myxosporium, i.e. the outer layer of the spore wall, is composed of a heterogeneous epitunica, which contributes to the ornamentation of the spores. The spines in *Crepidotus cesatii* are hollow. Clémençon (1977) discusses the relationships in ultrastructural details between *Crepidotus* and the *Cortinariaceae.* According to this author the arrangement of the spore wall layers resembles *Tubaria* more than *Cortinarius*, but affinities to *Cortinarius* exist, e.g. in the presence of a cerostratum. The most important differences are to be found in the fine layers of the epitunica: hollow spines are unknown in *Cortinarius* and the podostratum, present in *Cortinarius,* is absent in *Crepidotus.*

The ornamentation of European species of *Crepidotus* may be classified in five categories. The height of the ornamentations always measures less than 1 µm, which is at the boundary of perceptibility with the light microscope.

(i) Spores smooth

Under the light microscope as well as in SEM the spores are completely smooth: *C. autochthonus, C. mollis, C. calolepis, C. epibryus.*

The SEM pictures published by Pegler & Young (1972) display a minutely warty surface in *C. mollis.* I interpret this as an artefact due to electric charges during pretreatment.

In SEM analyses *C. mollis* and *C. calolepis* often reveal a small apical depression (see arrow in Fig. 2) which may be interpreted as an apical thinning of the spore wall. Yet neither a truncate spore apex nor an apical thinning is visible under the light microscope.

(ii) Spores rugulose-verruculose

The spore ornamentation consists of low ridges and warts, which may be confluent, forming at times a rudimentary net with an irregular pattern. Under the light microscope the spore surface is seen as spotted-granulated.

Ornamentation up to 0.5 µm:	*C. subverrucisporus.*
Ornamentation 0.2–0.35 µm:	*C. luteolus, C. lundellii.*
Ornamentation 0.1–0.25 µm:	*C. lundellii.*

(iii) Spores verruculose

The spore wall forms isolated warts. In type 1 these warts are isolated hemispherical in side view and round when seen from above. In type 2 these warts are irregular in all views, often consisting of 2–3 confluent warts and at times decorated by small outgrowths. Under the light microscope the spores appear punctate; it is therefore not possible to distinguish between these verruculose types and the baculate type of ornamentation.

Ornamentation 0.2–0.4 µm, verruculose, type 1: *C. variabilis, C. cinnabarinus.*

Ornamentation 0.2–0.4 µm, verruculose, type 2: *C. carpaticus, C. roseoornatus, C. macedonicus.*

(iv) Spores baculate

The spore wall forms truncate, rod-shaped warts or cylindrical processes which are round as seen from above and which under the light microscope are hardly visible in optical section, otherwise the spores appear punctate with thick spore walls.

Ornamentation 0.3–0.8 µm: *C. applanatus, C. crocophyllus, C. ehrendorferi.*

(v) Spores echinulate

The ornamentation consists of isolated spines. Under the light microscope these spines are readily seen in optical section. The surface of the spores appears punctate.

Ornamentation 0.3–0.7 µm: *C. cesatii* s.l.

2.5. Basidia

All European species exhibit four-spored basidia of the common normal cylindric type in agarics. In some collections two-spored basidia and four-spored basidia occur together. This always affects the variability of spore size and is interpreted as a result of disturbed fruit-body development (coldness, drought).

In older fruit-bodies basidia with sterigmata are often lacking. It seems that in those cases the sterigmata are dissolved and the remnants of the basidia have changed their shape towards short, broadly cylindrical to almost globose elements, which stain deep red in Congo red or phloxine. Connected with this ageing process is a swelling of the hyphae in subhymenium and hymenophoral trama.

Basidia with thickened walls, so-called crassobasidia (Watling & Chandra, 1983) were observed only two times.

2.6. Nuclei

The nuclei in mature spores from at least two collections per species (marked with * in the list of collections examined) were counted after special treatment. For all species, two nuclei were found. These results are in accordance with those of Kühner (1980).

2.7. Cystidia

The lamella edge of all species examined is completely sterile, i.e. cheilocystidia are always present and basidia are absent. Only old damaged exsiccata or old fruit-bodies may lack cheilocystidia (e.g. *C. applanatus, C. epibryus*), in which case they have probably been rubbed off or disintegrated.

No pleurocystidia have been observed in any European collection.

Although the shape of the cheilocystidia within one species or even on the segment of one individual lamella edge varies considerably, there are still characteristic patterns to be found (see Table I).

2.8. Trama

The hymenophoral trama of *Crepidotus* in general can be described as regular to subregular. Detailed studies, however, reveal two subtypes: one found exclusively in subgenus *Crepidotus*, the other in subgenus *Dochmiopus*. In the latter, the narrow, 2–4 µm wide, medium long, cylindrical hyphae first run parallel forming at the time of spore maturation bundles of slightly undulating hyphae, which later partially swell up to 30 µm and branch during the ageing process. These swollen elements (see Fig. 3) have rounded tips and are often somewhat constricted.

Table I. Patterns of shapes of cheilocystidia.

	lageniform, narrowly utriform	clavate	cylindrical, flexuous	fusoid	whip-like
never branched	*mollis* *calolepis* *autochthonus* *subverrucisporus* *cinnabarinus*	*applanatus* *autochthonus*	*versutus* *applanatus*	*cinnabarinus*	
sometimes branched	*lundellii*	*applanatus* *crocophyllus*	*luteolus* *ehrendorferi*		*epibryus*
always branched	*cesatii* *variabilis* *carpaticus* *roseoornatus* *macedonicus*		*luteolus*		

In subgenus *Crepidotus* the hyphae are from the beginning short-celled and distinctly wider. Often a well differentiated gelatinous subhymenium develops (see Fig. 26), which is thickest near the lamella edge. An excellent description of the trama of subgenus *Crepidotus* is given by Singer (1973: 447).

In the pileus trama the same two types exist: subgenus *Crepidotus* has its characteristic gelatinous layer with thin hyphae loosely embedded in a hyaline gelatinous mass. The inferior part of the pileus trama consists of short-celled, branched hyphae which are like a jigsaw puzzle. In all other groups the pileus trama is composed of one single type without special differentiations. In some collections the uppermost layer may consist of more densely packed hyphae (see Fig. 28). The taxonomic importance of that character is doubtful and is not used for species delimitation.

Some species of *Crepidotus* exhibit refractive vascular hyphae in the pellis and the uppermost layers of the pileitrama.

2.9. *Pileipellis*

Two main types exist, i.e. a simple cutis in subtypes and a trichoderm. Each of these two types can be divided into two subtypes: the cutis with (e.g. *Crepidotus calolepis*) or without distinct squamules (e.g. *C. mollis*) and the trichoderm in a subtype with more or less differentiated terminal cells (e.g. *C. subverrucisporus*) and a subtype with loosely interwoven, narrowly cylindrical hyphae without differentiated terminal cells (e.g. *C. variabilis*). Pileocystidia more or less in the shape of cheilocystidia are present in *Crepidotus applanatus* and *C. cinnabarinus*. In subgenus *Dochmiopus* a trichoderm is characteristic, however, a fully developed trichoderm may be found only in very young specimens or at the margin in older carpophores, because the pileipellis turns into a cutis in transitional stages. In many species of subgenus *Dochmiopus* the pileipellis hyphae may be coiled in various degrees. In opposition to Hesler & Smith (1965) but in accordance with Norstein (1990) I do not believe in the reliability of that character for taxonomic purposes, because intermediate forms are very frequent. In most fully developed fruit-bodies with an intact not yet eroded pileus surface, such coiled hyphae can be found at the margin. At the point of attachment of the fruit-body, however, the hyphae are always very straight and most often arranged in bundles, forming a rather stiff, strigose tomentum.

2.10. Pigments

Nothing is known about the chemical compounds of the various red, yellow and brown pigments in *Crepidotus.*

Mr. N. Arnold (Regensburg) kindly tried to analyse two small fragments of *C. cinnabarinus* with HPLC. The red pigments proved to be hardly soluble and instable in acid solutions. They show an intensive blue fluorescence at 366 nm. This means that a close relationship of the *C. cinnabarinus* pigments with anthrachinons, styrylpyrons, terphenylquinons, and derivates of pulvinic acid can be excluded. After some days the dissolved soluble red pigments turned to yellow.

3. ECOLOGY

All *Crepidotus* species are probably saprophytes of wood or woody substrates, mainly of semi-decomposed twigs or bark of branches and stems, sometimes on culms of herbaceous plants. In all woody substrates signs of white rot were observed. In all cases studied no other lignicolous agaric was fruiting in the immediate vicinity during the fruiting period of the concerning species of *Crepidotus,* nor were there more fruit-bodies of more than one *Crepidotus* species present on the substrate.

One species, *Crepidotus autochthonus,* fruits almost exclusively and a second, *C. versutus,* frequently on soil, most probably, however, always in connection with forest litter or wood. Two other species (*C. luteolus, C. epibryus*) occur mainly on dead culms of phanerogams (*Urtica, Rumex, Solidago, Gramineae, Equisetum,* among others).

Table II gives a survey of all registered substrates. As several different substrates can be present in one collection, the number of substrates is higher than the number of collections.

About 70% of all collections occur on deciduous wood, 11% on coniferous wood, 11% on culms of different phanerogams and 4% on mosses and litter (of hardwood). Almost each species can grow on hardwood, but several do not occur on coniferous wood. In relation to their presence in European forests *Salix, Fraxinus,* and probably also *Alnus* are over-represented, indicating a habitat preference of many *Crepidotus* species for moist alluvial forests or montane ravine forests.

Specific literature on the sociology of *Crepidotus* species is still very scarce. According to the few articles, *Crepidotus* species never form the dominant element in any European vegetation unit. Nevertheless, one mycosociological unit has been named after a *Crepidotus* species: *Crepidotus calolepis* is described by Jahn (1966) as being the most important species of the *Crepidotetum calolepidis,* a saprophytic association on decayed wood of *Populus tremula* in Sweden. Out of four distinct degradation stages, *C. calolepis* is the characteristic species of stage three, the optimal phase for basidiomycetes.

Table II. Substrates of European species of *Crepidotus*.

	as	cs	au	mc	ap	cr	ep	ca	li	cc	mo	lu	su	va	ve	ci	ms	ma	er	ro	vt
no. of coll.	11	26	10	14	22	8	54	8	46	76	25	60	34	42	19	4	4	1	1	1	1
	coniferous wood:																				
Picea	7	16	–	–	–	–	2	1	2	–	–	5	–	2	–	–	–	–	–	–	–
Pinus	4	1	–	–	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
conifers[1]	–	2	–	–	1	–	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Abies	–	5	–	–	–	–	–	–	–	–	–	–	1	–	–	–	–	–	–	–	–
	various substrates:																				
litter[2]	–	–	–	–	–	–	9	–	–	–	–	–	2	4	–	–	–	–	–	–	–
soil	–	–	8	–	–	–	–	–	–	–	–	1	–	–	3	–	–	–	–	–	–
mosses[3]	–	1	–	–	–	–	7	–	1	–	–	2	–	–	–	–	–	–	–	–	–
herbs[4]	–	–	–	–	–	–	16	–	3	–	–	18	1	6	–	–	–	–	–	–	–
	deciduous trees and shrubs:																				
hardwood[1]	–	–	2	3	8	2	2	2	7	14	3	5	6	8	1	2	3	–	–	–	1
Fraxinus	–	–	–	1	2	1	2	1	6	10	2	3	2	2	–	–	–	–	–	–	–
Fagus	–	–	–	–	9	1	4	–	5	10	8	1	–	1	2	–	–	1	1	–	–
Quercus	–	–	–	–	–	–	1	1	1	4	1	3	2	7	1	–	–	–	–	–	–
Alnus	–	–	–	–	–	–	–	1	2	1	1	3	6	2	2	–	–	–	–	–	–
Salix	–	–	–	1	–	–	–	–	11	13	2	2	2	1	1	–	–	–	–	–	–
Populus	–	–	–	5	–	–	–	–	1	1	5	–	1	1	–	–	–	–	–	–	–
Ulmus	–	–	–	–	–	3	–	–	2	1	–	1	–	1	1	–	–	–	–	–	–
Betula	–	–	–	1	–	–	1	–	1	–	–	–	–	2	8	–	–	–	–	–	–
Acer	–	–	–	–	1	–	1	1	1	2	–	–	–	–	–	–	–	–	–	–	–
Carpinus	–	–	–	–		1	1	–	–	–	–	1	2	1	–	–	–	–	–	–	–
Tilia	–	–	–	–	–	–	–	–	–	1	1	–	1	–	–	1	–	–	–	–	–
Robinia	–	–	–	–	–	–	1	–	–	–	–	3	2	–	–	–	–	–	–	1	–
Eucalyptus	–	–	–	2	–	–	–	–	–	2	–	–	–	–	–	–	1	–	–	–	–
Frangula	–	–	–	–	–	–	3	–	1	1	–	–	–	–	–	–	–	–	–	–	–
Ulex	–	–	–	–	–	–	1	–	–	–	–	–	1	2	–	–	–	–	–	–	–

Various mycocoenological investigations give indications about the most frequent and easily recognisable species:

Crepidotus mollis is reported from a hygrophilous birchwood on peat (*Betuletum pubescentis*) in Poland (Bujakiewicz, 1986), from alluvial forests on calcareous grounds near Leipzig (Buch & Kreisel, 1957) and Colmar (Carbiener, 1981), from mesophilous beech forests (*Mercuriali-Fagetum*) in Poland (Lisiewska, 1974) as well as from more dry, acidophilous oak-hornbeam forests (*Galio-Carpinetum*) near Munich (Einhellinger, 1964) and near Geneva (Horak & Röllin, 1988). My own collections mainly origin from alluvial forest types.

(Table II continued)

	as	cs	au	mc	ap	cr	ep	ca	li	cc	mo	lu	su	va	ve	ci	ms	ma	er	ro	vt
no. of coll.	11	26	10	14	22	8	54	8	46	76	25	60	34	42	19	4	4	1	1	1	1
	deciduous trees and shrubs (contd):																				
Castanea	–	–	–	–	–	–	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Viburnum	–	–	–	–	–	–	–	–	1	4	–	–	1	–	–	–	–	–	–	–	–
Sambucus	–	–	–	–	–	–	–	–	3	–	–	3	1	–	–	–	–	–	–	–	–
Crataegus	–	–	–	–	–	–	–	–	1	–	–	1	–	–	–	–	–	–	–	–	–
Platanus	–	–	–	–	–	–	–	–	–	1	1	–	–	–	–	–	–	–	–	–	–
Lonicera	–	–	–	–	–	–	–	–	–	1	–	1	–	–	–	–	–	–	–	–	–
Corylus	–	–	–	–	–	–	–	–	–	4	–	–	1	–	–	–	–	–	–	–	–
Rosa	–	–	–	–	–	–	–	–	–	1	–	–	1	1	–	–	–	–	–	–	–
Sarothamnus	–	–	–	–	–	–	–	1	–	1	–	–	–	2	–	–	–	–	–	–	–
Cornus	–	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Spiraea	–	–	–	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
rope	–	–	–	–	–	–	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Vitis	–	–	–	–	–	–	–	–	–	1	–	–	–	–	–	–	–	–	–	–	–
Pyrus	–	–	–	–	–	–	–	–	–	–	1	–	–	–	–	–	–	–	–	–	–
Rubus	–	–	–	–	–	–	–	–	–	–	–	5	–	–	–	–	–	–	–	–	–
Clematis	–	–	–	–	–	–	–	–	–	–	–	1	–	–	–	–	–	–	–	–	–
Prunus	–	–	–	–	–	–	–	–	–	–	–	1	–	–	–	–	–	–	–	–	–
Berberis	–	–	–	–	–	–	–	–	–	–	–	–	1	–	–	–	–	–	–	–	–

[1] unidentified; [2] litter of deciduous trees (*Fagus, Quercus, Castanea,* among others); [3] *Plagiomnium affine, Hypnum spec., Rhytidiadelphus triqueter,* and *Pseudoscleropodium purum*; [4] *Urtica, Solidago, Rumex, Filimendula, Poaceae.*

ap = *applanatus* var. *applanatus*, as = *applanatus* var. *subglobigera*, au = *autochthonus*, ca = *carpaticus*, cc = *cesatii* var. *cesatii*, ci = *cinnabarinus*, cr = *crocophyllus*, cs = *cesatii* var. *subsphaerosporus*, ep = *epibryus*, er = *ehrendorferi*, li = *lundellii*, lu = *luteolus*, ma = *macedonicus*, mc = *calolepis* var. *calolepis*, mo = *mollis*, ms = *calolepis* var. *squamulosus*, ro = *roseoornatus*, su = *subverrucisporus*, va = *variabilis* var. *variabilis*, ve = *versutus*, vt = *variabilis* var. *trichocystis.*

Crepidotus variabilis was observed in vegetation units which differ significantly in their ecological claims: mesophilous beech forests (*Mercuriali-Fagetum, Melico-Fagetum*) in Poland (Lisiewska, 1963, 1974), moist alder forests (*Carici elongatae-Alnetum*) in Berlin (Gerhardt, 1978), moist heathland (*Arnico-Genistetum anglicae*) in the Netherlands (Arnolds, 1982), acid oakwoods (*Dicrano-Quercetum, Querco-Betuletum*) in the Netherlands (Jansen, 1984) and acid oak-hornbeam forests (*Galio-Carpinetum*) near Geneva (Horak & Röllin, 1988).

As opposed to *Crepidotus variabilis* which is obviously more frequently reported from woods on acid soils, *C. cesatii* var. *cesatii* prefers woods on more basic soils. *Crepidotus cesatii* is reported from alluvial forest in Alsace (Carbiener, 1981) and from a thermophilous beech forest (*Carici-Fagetum*) in Switzerland (Brunner, 1987). Own observations confirm a coherence with *Fagion* and *Alno-Padion* associations, i.e beech forests and alluvial forests.

4. CHOROLOGY

An accurate assessment of European or holarctic distribution patterns exhibited by fugitive organisms such as small agarics which need a time-consuming microscopic examination, will likely remain an impossible task still for many years. Nevertheless, thanks to several regional floras published in recent years (Hallgrimsson, 1973; Ortega & Buendia, 1989; Watling & Gregory, 1989; Norstein, 1990; Senn-Irlet, 1992a) our knowledge on distribution patterns has increased. On the one hand northern boundaries of *Crepidotus* species in Norway are rather well known (Norstein, 1990). Expeditions to Greenland gave further information on the few species which extend in subarctic and arctic areas (Senn-Irlet, 1992b). On the other hand the southern boundaries are imperfectly known. While some information exists from the western mediterranean region including the Canary Islands (Malençon & Bertault, 1975; Bañares-Baudet et al., 1986; Ortega & Buendia, 1989), almost no records are known from the eastern mediterranean region.

Despite these problems I have tentatively assigned the *Crepidotus* species treated to some general distribution types, based, however, exclusively on specimens examined by myself. The distribution types are based on the north-south zonation proposed by Meusel et al. (1965) and mainly characterized by a temperature gradient.

In addition to this gradient in latitude Meusel et al. (1965) distinguish a gradient in longitude. This west-east gradient in Europe, i.e. the degree of continentality in the terminology of these authors, is mainly determined by precipitation. As almost all agarics need humid conditions to develop fruit-bodies, the presence of *Crepidotus* species in dry areas with cold winter must be restricted to local habitats with more humid conditions which cannot find expression in diagrams of the macroclimate. Without a better knowledge of *Crepidotus* habitats in eastern Europe possible differences in distribution related to longitude gradients cannot be discussed.

1) meridional – submeridional
   C. calolepis var. *squamulosus*
2) meridional – submeridional – temperate
   C. calolepis var. *calolepis*
3) meridional – submeridional – temperate – boreal
   C. variabilis var. *variabilis*, *C. epibryus*
4) submeridional
   C. variabilis var. *trichocystis*, *C. roseoornatus*, *C. macedonicus* (single collections!)
5) submeridional – temperate
   C. applanatus var. *applanatus*, *C. applanatus* var. *subglobigera*, *C. cesatii* var. *cesatii*, *C. cinnabarinus*, *C. crocophyllus*, *C. luteolus*, *C. mollis*

6) submeridional – temperate – boreal
   C. subverrucisporus, C. lundellii
7) temperate
   C. autochthonus, C, carpaticus, C. ehrendorferi
8) temperate – boreal
   C. cesatii var. *subsphaerosporus*
9) temperate – boreal – arctic
   C. versutus

The distribution areas of most European species of *Crepidotus* seem to be continuous. Exceptions are *C. carpaticus* occurring at some isolated spots from Great Britain to the Vosges (France), Alps (Switzerland) and Carpathes (Ucrainia), *C. cesatii* var. *subsphaerosporus* with records from the boreal region and the montane zone of the temperate regions (Alps) and probably occurring elsewhere in spruce forests or plantations, and *C. calolepis* var. *calolepis*, which seems to have a genuine disjunct distribution: numerous records prove the presence of a southern area in the mediterranean region and a northern one in Scandinavia and the Baltic. The isolated European localities of the very conspicuous *C. cinnabarinus* suggest introduction by man from North America.

5. RESULTS OF STATISTICAL ANALYSES

5.1. Descriptive statistics of basidiospore size

As stated before the basidiospores exhibit the most important taxonomic characters in *Crepidotus*. In addition to the spore ornamentation the size and shape, the latter expressed with the length-width ratio Q, provide unique dimensions for each species.

Based on a random sample of 20 measured spores per collection (usually one fruitbody), the 95% population limits (p = sd × t; sd = standard deviation with population parameter 'n-1', t = tolerance limit according to Wissenschaftliche Tabellen Geigy 1980) of the spore size can be calculated to gain some information about the range of each collection and furthermore, by computing the limits with the mean values of each collection, about the totality of the collections that are grouped in one species (Table III). Figs. 32 and 33 visualize the frequency distribution of my measurements.

On the strength of one parameter alone (spore length, width or volume) not all species can be separated. But combinations of at least two of these characters allow for an individual characterization as can be seen in Fig. 34.

5.2. Special problems

In species complexes, where several taxa may be involved, a statistical approach seems suitable. In all cases the spores are concerned.

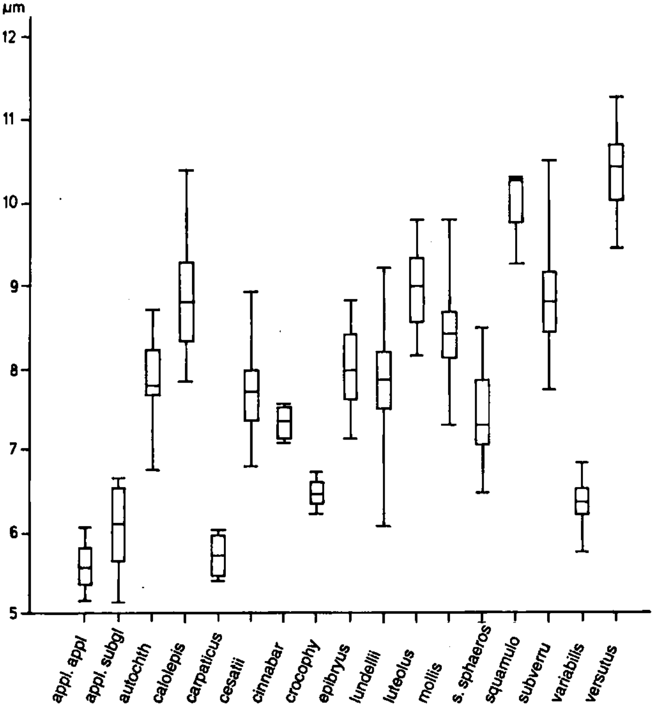
5.2.1. Crepidotus mollis-group — Fig. 35; Table IV

In European literature *C. calolepis* and its var. *squamulosus* have often been treated as varieties of *C. mollis*. According to a widely accepted morphological species concept (see Kuyper, 1988) a good species differs in at least two interindependent morphological characters. Spore size in combination with features of the pileipellis fulfil this claim.

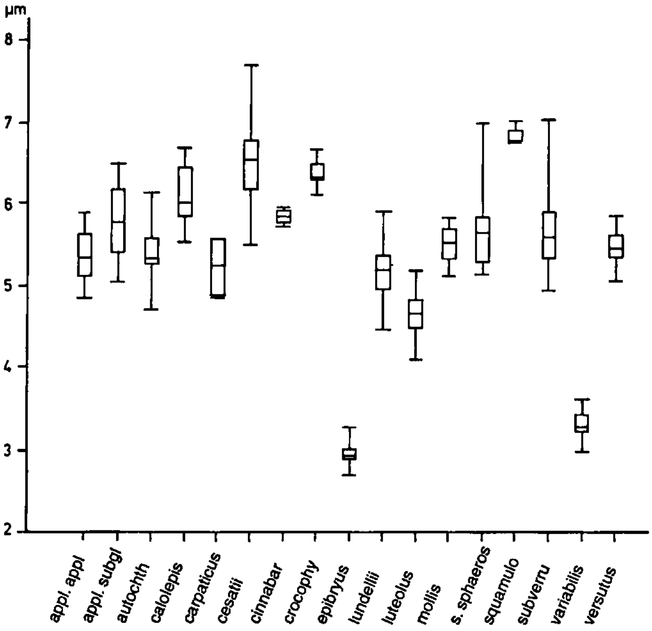
Table III. Spore size measurements.

(Spore size: range of calculated population limits. Maximum, minimum: absolute measurements.)

species spore size	Q = l/w	max. l	max. w	min. l	min. w	n./coll.
1. *applanatus* var. *applanatus*						
4.7–6.5 × 4.4–6.4	0.99–1.11	6.9	6.2	4.5	4.0	298/14
2. *applanatus* var. *subglobigera*						
5.0–7.1 × 4.8–6.8	1.00–1.09	8.6	7.2	4.5	4.5	208/11
3. *autochthonus*						
6.7–9.1 × 4.7–6.0	1.33–1.63	8.7	6.1	6.8	4.7	240/13
4. *calolepis* var. *calolepis*						
7.5–10.3 × 5.4–6.7	1.35–1.59	12.5	7.2	7.0	5.0	403/19
5. *calolepis* var. *squamulosus*						
8.6–11.5 × 6.5–7.2	1.28–1.66	11.3	8.0	8.0	6.0	79/4
6. *carpaticus*						
4.9–6.6 × 4.1–6.3	1.02–1.18	6.5	6.0	4.5	4.0	62/4
7. *cesatii* var. *cesatii*						
6.9–8.6 × 5.7–7.3	1.09–1.30	8.9	7.7	7.0	5.6	1062/53
8. *cesatii* var. *subsphaerosporus*						
6.6–8.5 × 4.9–6.6	1.19–1.46	8.5	7.0	7.0	5.2	453/21
9. *cinnabarinus*						
6.7–8.0 × 5.6–6.1	1.16–1.36	8.5	6.6	6.0	5.0	76/4
10. *crocophyllus*						
6.1–6.9 × 6.0–6.7	1.00–1.04	8.0	7.5	5.4	5.4	188/8
11. *ehrendorferi*						
5.6–7.2 × 5.5–7.1	0.97–1.07	7.0	7.0	5.5	5.5	20/1
12. *epibryus*						
6.9–9.1 × 2.7–3.2	2.32–3.09	10.0	4.5	6.0	2.2	431/23
13. *lundellii*						
6.5–9.1 × 4.5–5.8	1.32–1.71	11.0	7.0	5.4	3.7	990/50
14. *luteolus*						
8.1–9.9 × 4.2–5.1	1.79–2.07	11.0	5.8	6.9	3.6	1013/50
15. *macedonicus*						
6.2–7.9 × 4.6–5.8	1.20–1.54	8.0	5.8	6.0	4.8	20/1
16. *mollis*						
7.3–9.8 × 4.9–6.3	1.40–1.67	11.0	6.7	6.5	4.6	605/29
17. *roseoornatus*						
5.8–7.8 × 3.9–5.9	1.21–1.59	8.0	6.0	6.0	4.2	22/1
18. *subverrucisporus*						
7.7–10.7 × 4.8–6.6	1.38–1.74	11.5	8.0	7.0	4.5	892/43
19. *variabilis* var. *variabilis*						
6.0–6.8 × 3.0–3.6	1.73–2.14	8.1	4.3	5.2	2.5	614/30
20. *variabilis* var. *trichocystis*						
6.4–8.8 × 3.4–4.4	1.62–2.25	9.0	4.5	6.2	3.2	61/1
21. *versutus*						
9.5–11.4 × 5.1–5.9	1.76–2.05	13.0	6.5	8.2	4.0	514/29



32



33

Fig. 32. Box- and Whisker-Plots for spore lengths. — Fig. 33. Box- and Whisker-Plots for spore widths. — The rectangle (= box) for each species covers the middle 50% of the measurements of the length of the spores. The horizontal line in the box indicates the median value. The length of the vertical bars connects the absolute (measured) minimum with maximum length.

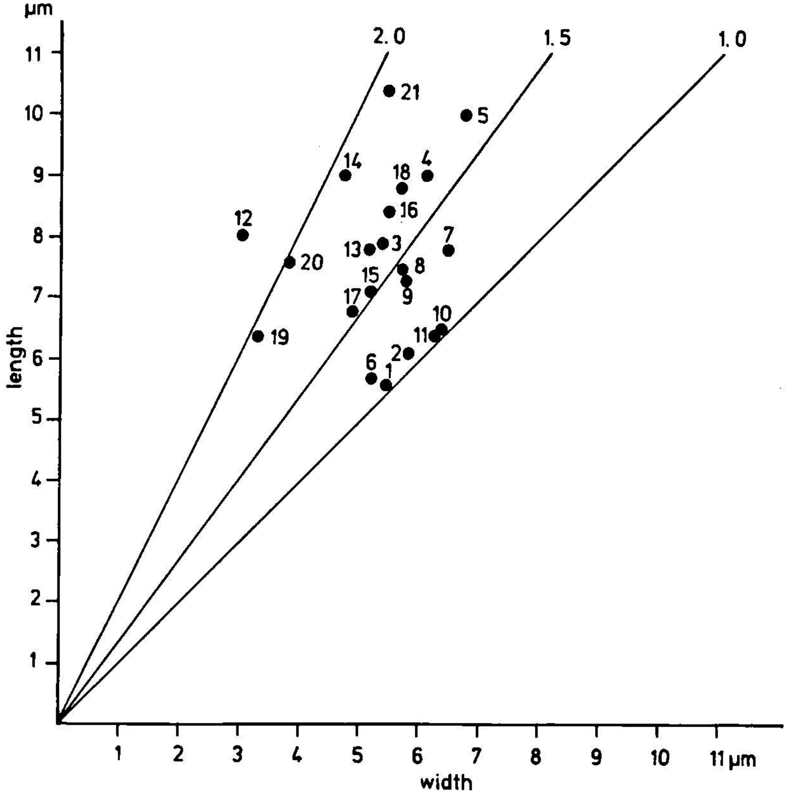


Fig. 34. Scatter diagram of the mean values of the length vs width of European *Crepidotus* species; the numbers refer to Table III.

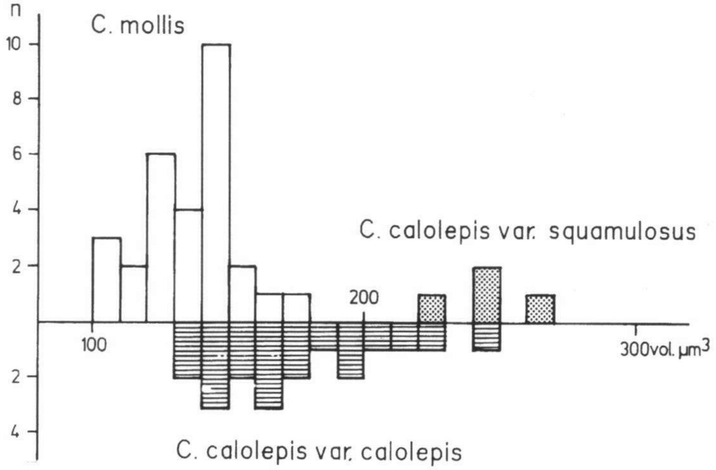


Fig. 35. *Crepidotus mollis*-group: histogram of spore volumes, grouped according to presence or absence of scales (*Crepidotus mollis* vs *Crepidotus calolepis*) and width of pileipellis hyphae (*Crepidotus calolepis* var. *calolepis* vs var. *squamulosus*).

Table IV. *Crepidotus mollis* s.l.: Data on spore volumes, calculated for an ellipsoid.

Spore volumes in µm^3, sd = standard deviation, n = number of collections

species	mean	sd	median	max.	min.	n
C. mollis	134	17	137	175	102	29
C. calolepis						
var. *calolepis*	174	31	167	242	129	19
var. *squamulosus*	246	18	247	265	221	4

Table V. *Crepidotus applanatus* s.l.: Data on spore volumes.

Spore volumes in µm^3, sd = standard deviation, n = number of collections

species	mean	sd	median	max.	min.	n
C. applanatus						
var. *applanatus*	85	14	82	109	64	16
var. *subglobigera*	111	31	113	194	48	11
C. crocophyllus	139	25	135	156	121	8

Recently Norstein (1990) used descriptive and inductive statistics in the *C. mollis*-group. He proved that collections with a scaly pileus grow most frequently on *Fraxinus* whereas those with a glabrous pileus are more frequent on *Populus*. Moreover, the width of the spores is highly correlated with the scaliness of the pileus.

In Fig. 35 a histogram displays the frequency distribution for spore sizes, expressed as the volume, grouped on the basis of independent morphological characters, viz. the presence or absence of scales on the pileus and the diameter of the hyphae of the scales. The scales are formed by hyphae which are brown incrusted with intra- and extracellular pigments. It is obvious that three distinct groups exist. The Wilcoxon-Mann-Whitney test, which does not require a normal distribution of the data, as well as the t-test performed with values transformed into normal logarithms showed highly significant differences at a 0.01 level.

5.2.2 Crepidotus applanatus-group — Fig. 36; Table V

In the group of *C. applanatus* the differences in spore size are less obvious than in the *C. mollis*-group. Yet, a grouping of the spores (volumes) with regard to their substrate (hardwood versus coniferous wood) in Fig. 36 shows clear tendencies towards a small-spored taxon on hardwood and a large-spored taxon on coniferous wood. However, two collections from hardwood exhibit spore volumes which are almost double as large as the mean of the small-spored group. These collections are omitted in Table V as they may represent an undescribed taxon from Eastern Europe. Once more the Wilcoxon-Mann-Whitney test and the t-test, again performed with transformed values, proved the presence of two significantly different populations within *C. applanatus*.

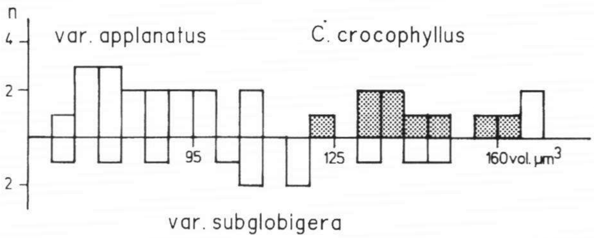


Fig. 36. *Crepidotus applanatus* s.l.: histogram of spore volumes according to substrate (upper half: hardwood, lower half: coniferous wood) and squamulose pileus (*Crepidotus applanatus* vs *C. crocophyllus*).

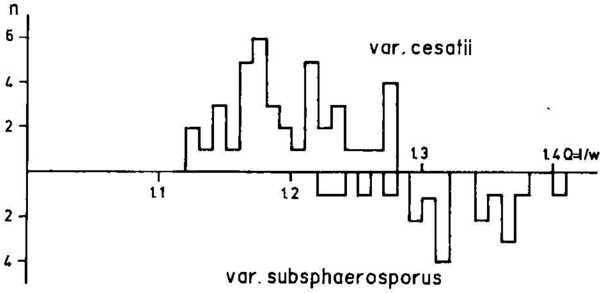


Fig. 37. *Crepidotus cesatii* s.l.: histogram of length/width-ratio (= Q) of collections with a known substrate (upper half: hardwood, lower half: coniferous wood).

Crepidotus crocophyllus, a closely related species, has spore sizes which as seen as a population are distinctly and significantly larger than those of var. *subglobigera*. One sam ple, however, i.e. one collection may well have spores of which the sizes cannot be separated from those of a large-spored collection of var. *subglobigera*. But for identification *C. crocophyllus* is characterized by several other morphological characters (see below).

5.2.3. Crepidotus cesatii-group — Fig. 37; Table VI

Within the *C. cesatii*-group the spore size varies considerably, which probably indicates a genetic polymorphism. But a clear correlation of spore volumes with other characters could not be found.

However, spore shape expressed by means of the length-width ratio allows the distinction of two populations: one on hardwood and one on coniferous wood. Norstein (1990) was the first to pay attention to this fact, which he was able to prove statistically on the basis of Norwegian material. He even found a significant correlation with a morphological character, viz. the degree of coiling of the hyphae of the pileipellis.

Table VI: *Crepidotus cesatii* s.l.: data on length-width ratio of spores.

sd = standard deviation, n = number of collections

species	mean	sd	median	max.	min.	n
on coniferous wood	1.311	0.051	1.30	1.22	1.40	19
on hardwood	1.192	0.043	1.13	1.12	1.27	41

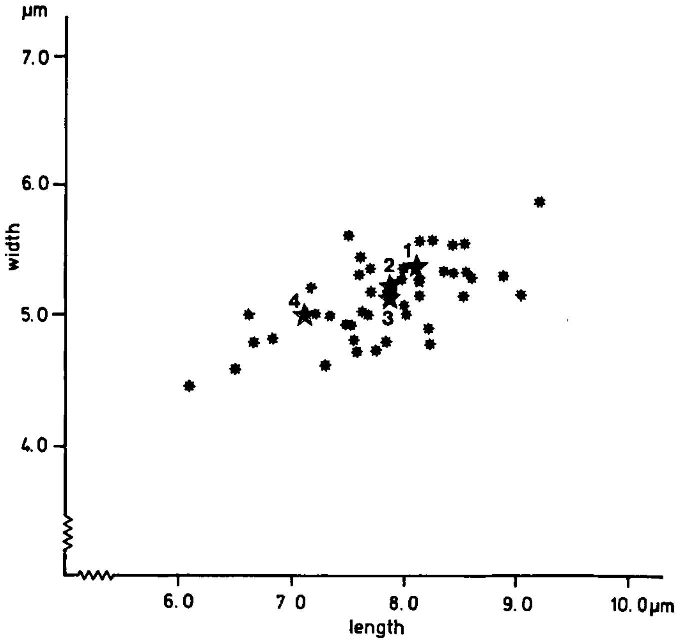


Fig. 38. *Crepidotus lundellii:* scatter diagram of basidiospore sizes (means per sample). 1 = *C. lundellii* (type), 2 = *C. subtilis* (type), 3 = *C. amygdalosporus* (type), 4 = *C. lundellii* var. *subglobisporus* (type).

Fig. 37 illustrates the differences in spore shape between collections from hardwood and from coniferous wood. Statistical tests (Wilcoxon-Mann-Whitney test, t-test) underline this observation. However, I failed to prove a close correlation between spore shape and the presence or absence of coiled hyphae in the pileipellis; I observed but a faint tendency to such a correlation.

5.2.4. Crepidotus lundellii-group — Fig. 38

With *C. amygdalosporus*, *C. subtilis* and *C. lundellii* var. *subglobisporus* taxa are described, that in many respects come very close to *C. lundellii* var. *lundellii*. In these cases spore size has often been considered conclusive, but the original descriptions give the spore sizes as follows:

C. lundellii	6.5–8 × 4–5 µm
C. lundellii var. *subglobisporus*	6–7.5 × 4.5 µm
C. amygdalosporus	7–9 × 4.5–5 µm
C. subtilis	7–10 × 5–6 µm

In Fig. 38 the mean values of the lengths and widths of the samples of all collections of this species complex examined are displayed. From a statistical point of view it is obvious that it is impossible to distinguish more than one population within the cluster of spots produced. In fact, even the four collections with the smallest spores, which stand somewhat isolated, cannot be separated on spore size alone. As in most *Crepidotus* species a positive linear correlation between length and width exists.

5.3. *Infrageneric classification*

5.3.1. *Infrageneric classifications proposed so far*

There are two valuable propositions for an infrageneric classification, viz. by Singer (1947) and by Hesler & Smith (1965).

Singer (1947) gave the following synopsis:

- Sect. *Echinosporae* Pilát (1929) – Spores ornamented.
  - Subsect. *Porpophorini* Sing. (1947) – Clamp-connections present.
  - Subsect. *Aporpini* Sing. (1947) – Clamp-connections absent.
- Sect. *Laevisporae* Pilát (1929) – Spores smooth.
  - Subsect. *Fibulatini* Sing. (1947) – Clamp-connections present.
  - Subsect. *Defibulatini* Sing. (1947) – Clamp-connections absent.

Also in the latest edition of his 'Agaricales in Modern Taxonomy' (Singer, 1986) this classification is maintained, but in 1962 for nomenclatural reasons Singer changed section *Laevisporae* to section *Crepidotus.*

Hesler & Smith (1965) proposed a different classification, introducing the presence or absence of clamp-connections in combination with the shape of the spores as the most important characters on subgeneric level.

- Subg. *Crepidotus* – Clamp-connections absent.
  - Sect. *Cinnabarini* Hesler & Smith (1 species also present in Europe).
  - Sect. *Tubariopsis* Hesler & Smith (1 species also present in Europe).
  - Sect. *Stratosi* Hesler & Smith – not in Europe.
  - Sect. *Parvuli* Hesler & Smith – not in Europe.
  - Sect. *Crepidotus* (9 species / 2 in Europe).
  - Sect. *Versuti* Hesler & Smith (4 species / 2 in Europe).
- Subg. *Sphaerula* Hesler & Smith – Spores globose to subglobose, clamp-connections present.
  - Sect. *Nyssicolae* (Sing.) Hesler & Smith – not in Europe
  - Sect. *Sphaerula* (41 species / 2 in Europe).
    - Subsect. *Sphaeruli* (18 species / 1 in Europe).
    - Subsect. *Colorantes* Hesler & Smith – not in Europe.
    - Subsect. *Fulvofibrillosi* Hesler & Smith (8 species / 1 in Europe).
- Subg. *Dochmiopus* (Pat.) Pilát – Spores typically longer than broad, clamp-connections present.
  - Sect. *Cystidiosi* Hesler & Smith (7 species / 2 in Europe).
  - Sect. *Fulvidi* Hesler & Smith – not in Europe.
  - Sect. *Phaseoli* Hesler & Smith – not in Europe.
  - Sect. *Fusisporae* Hesler & Smith – not in Europe (but represented on Greenland, see Senn-Irlet 1992b).
  - Sect. *Betulae* Hesler & Smith – (10 species / 1 in Europe).
  - Sect. *Dochmiopus* (Pat.) Pilát (3 species / 2 in Europe).
  - Sect. *Crepidotellae* Hesler & Smith (32 species / 6 in Europe).

5.3.2. Phenetic classification based on taxometrics

Numerical taxonomy offers new methods of organizing data and obtaining from them a classification, which were unknown until the 1960's and gained much attention with the increasing use of computers. Aims and principles are to be found in Sneath & Sokal (1973).

In order to arrive at a phenetic classification of *Crepidotus* with every character a priori equally weighted, the following characters for species separation were chosen for the data-matrix (OTU) in Table VII:

a. Presence of clamp-connectionss (1 = present, 0 = absent).
b. Scales on the pileus (1 = present, 0 = absent).
c. Gelatinous layer in the pileus (1 = present, 0 = absent).
d. Lower part of pileitrama short-celled and interwoven (resembling a jigsaw puzzle) (1 = this type of tissue present, 0 = this type absent).
e. Cap hygrophanous (1), sometimes hygrophanous (½) or not (0).
f–h. Cap colour white (f), yellow or brownish (g), red (h), ½ = pigment not in all collections present.
i–k. Spore shape globose, Q = 1.0–1.25 (i); ellipsoid, Q = 1.3–2.0 (j); cylindric, Q > 2.1 (k).
l–o. Spore ornamentation absent (l), rugulose (m), baculate/verruculose (n), echinulate (o).
p. Coloration of spore wall (1 = very weakly coloured, 0 = distinctly coloured).

The analyses were computed using the statistical packages SYSTAT (Wilkinson, 1990) and a program written by H. Clémençon after Sneath & Sokal (1973).

Table VII. Data-matrix for 15 European species of *Crepidotus*.

	a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p
applanatus	1	0	0	0	1	1	0	0	1	0	0	0	0	1	0	0
autochthonus	1	1	0	0	0	1	0	0	0	1	0	1	0	0	0	0
calolepis	0	1	1	1	0	0	1	0	0	1	0	1	0	0	0	0
carpaticus	1	0	0	0	0	1	½	0	1	0	0	0	0	1	0	0
cesatii	1	0	0	0	0	1	0	0	1	1	0	0	0	0	1	0
cinnabarinus	0	0	0	0	0	0	0	1	1	0	0	0	0	1	0	0
crocophyllus	1	1	0	0	0	0	1	0	1	0	0	0	0	1	0	0
epibryus	0	0	0	0	0	1	0	0	0	0	1	1	0	0	0	1
lundellii	1	0	0	0	0	1	½	0	0	1	0	0	1	0	0	1
luteolus	1	0	0	0	0	1	1	0	0	1	1	0	1	0	0	0
mollis	0	0	1	1	½	1	½	0	0	1	0	1	0	0	0	0
roseoornatus	1	0	0	0	0	0	0	1	1	1	0	0	0	1	0	0
subverrucisporus	1	0	0	0	0	1	½	0	0	1	0	0	1	0	0	0
variabilis	1	0	0	0	0	1	0	0	0	1	1	0	0	1	0	0
versutus	0	0	0	0	0	1	0	0	0	1	1	0	1	0	0	1

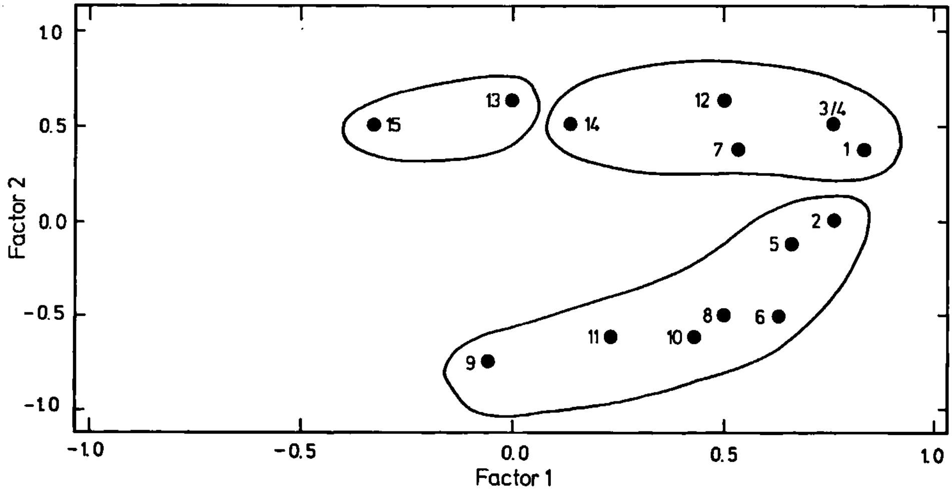


Fig. 39. Ordination diagram from principle component analysis. The diagram shows the position of the species on the first two axes (factors). 1 = *subverrucisporus*, 2 = *variabilis*, 3 = *lundellii*, 4 = *luteolus*, 5 = *cesatii*, 6 = *carpaticus*, 7 = *autochthonus*, 8 = *applanatus*, 9 = *cinnabarinus*, 10 = *roseoornatus*, 11 = *crocophyllus*, 12 = *versutus*, 13 = *mollis*, 14 = *epibryus*, 15 = *calolepis*.

Figure 39, displaying an ordination diagram from principle component analysis, gives a good impression of a possible delimitation of three distinct groups within the genus *Crepidotus*.

Figs. 40 and 41 display the two main phenogram types obtained by other methods, i.e. 1-Pearson, Euclidean, Gower, and Canberra as distance metrics and Average Linkage, Single Linkage, Complete Linkage, UPGMA (unweighted pair group method using arithmetic averages, see Sneath & Sokal, 1973), sums of squares as cluster algorithms. They all indicate the same important results as also Fig. 39: the genus can be divided into three main groups as the phenograms clearly display the following subdivisions:

(i) the group with a gelatinous layer, and a short-celled trama: *Crepidotus mollis*-group (subgenus *Crepidotus* sensu Hesler & Smith);

(ii) the group with ellipsoid, smooth or rugulose spores (subgenus *Dochmiopus* sensu Hesler & Smith);

(iii) the group with globose, baculate or echinulate spores (subgenus *Sphaerula* Hesler & Smith).

Broadly outlined the phenogram of Fig. 40 reflects the divisions proposed by Hesler & Smith (1965). In detail, however, it reveals some important differences. While Hesler & Smith accentuate one single character – the missing clamp-connections – as the main reason for separating subgenus *Crepidotus*, the phenogram based on an overall similarity of chosen characters, distinguishes this subgenus on a combination of various characters. For the group around *C. mollis* at least two characters unique within the genus are observed: it is the gelatinous upper layer and the type of structure of the lower trama of the pileus. The other members of subgenus *Crepidotus* sensu Hesler & Smith should therefore be placed in other subgenera, which means that the absence or presence of clamp-connections is not a very important character in *Crepidotus*.

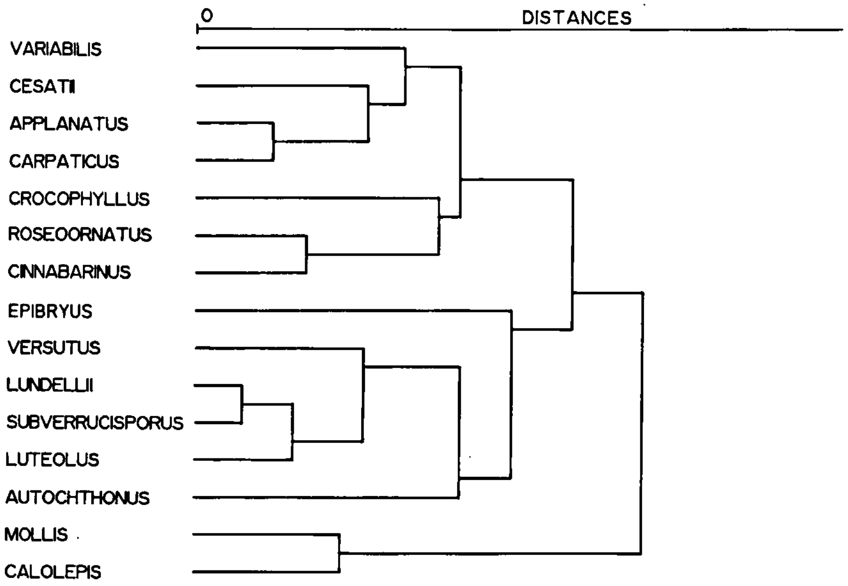


Fig. 40. Phenogram of an Average Linkage clustering based on 1-Pearson correlation coefficient for 15 *Crepidotus* species.

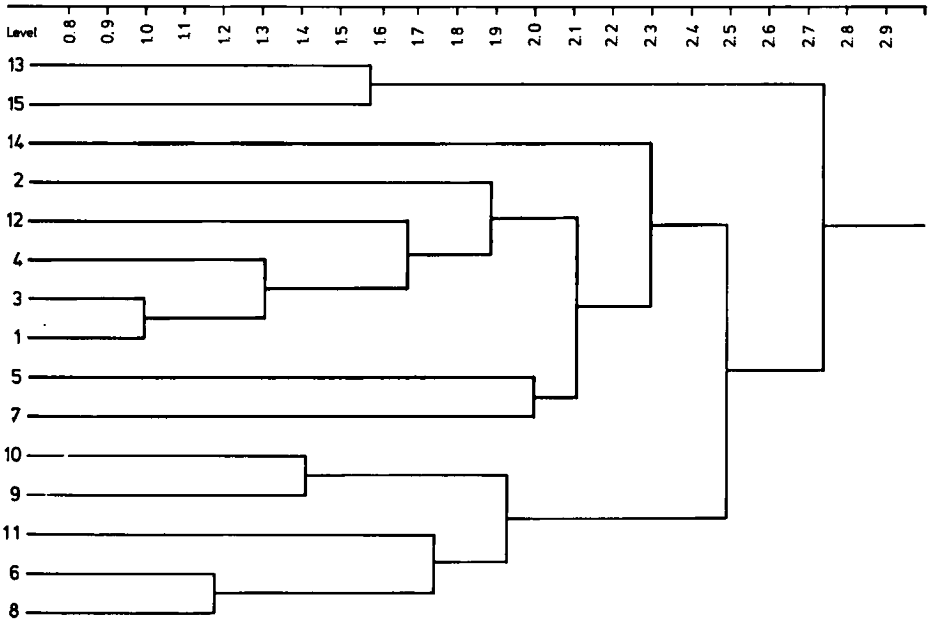


Fig. 41. Phenogram of an UPGMA clustering based on Euclidean distances for 15 *Crepidotus* species (cophenetic correlation coefficient: 0.820; degree of freedom D.F. = 103). Numbers refer to those in Fig. 39.

The taxonomic importance of clamp-connections has been discussed before. Horak (1964) attaches no importance at all to this feature in *Crepidotus*.

Important characters for an infrageneric classification of *Crepidotus* apparently are the shape and the ornamentation of the spores. Both Singer (1947) and Hesler & Smith (1965) used these characters but in different ways: Singer considered the character of the spore ornamentation as more important than the shape, whereas Hesler & Smith found the latter character more important. In the phenograms presented here the subdivision is based on a combination of these characters.

Analysing the differences in the various phenograms obtained, of which in Figs. 40 and 41 two are shown, one can observe that two species, i.e. *Crepidotus variabilis* and *C. cesatii* change their position within the three large groups. On the one hand these species are attached in all UPGMA clustering to the group with *C. lundellii* and *C. luteolus*, on the other hand they are put together with *C. applanatus* and *C. crocophyllus* in Fig. 40 using Pearson's correlation coefficient. In other words the positions of these species are weak and the final attachment to one group remains to a certain degree a personal decision of the taxonomist, as at least two solutions are supported by numerical analyses.

I conclude that, based on European species, the genus *Crepidotus* is best devided into two subgenera, i.e. subgenus *Crepidotus* and subgenus *Dochmiopus*, and the latter subgenus into two section (section *Dochmiopus* and section *Crepidotellae*). Mainly judging from the literature, I am convinced that this infrageneric classification will hold out when extra-European species are taken into consideration and will turn out to have predictive value.

B. SPECIAL PART

CREPIDOTUS (Fr.: Fr.) Staude

Agaricus tribus *Crepidotus* Fr., Syst. mycol. 1 (1821) 272. — *Crepidotus* (Fr.) Staude, Schwämme Mitteldeutschl. 25 (1857) 71. — Lectotype (Earle, 1909): *Agaricus mollis* Fr., Syst. mycol. 1 (1821) 274.

Phialocybe P. Karst., Bidr. Känn. Finl. Nat. Folk 32 (1879) xxii, 415. — Lectotype (Earle, 1909): *Crepidotus epibryus* (Fr.: Fr.) Quél.

Dochmiopus Pat., Hymenomyc. Eur. (1887) 113. — Lectotype (Earle, 1909): *Agaricus variabilis* Pers.: Fr.

Pleurotellus Fayod, Ann. Sci. nat. (Bot.) VII, 9 (1889) 339. — Type: *Pleurotellus hypnophilus* (Berk.) Fayod.

Tremellopsis Pat., Enum. Champ. Guadeloupe (1903) 13. — *Tremellastrum* Clem., Gen. Fungi (1909) 105 (superfluous name change). — Type: *Tremellopsis antillarum* Pat.

Conchomyces Over. in Heyne, Bull. Jard. bot. Buitenzorg III, 9 (1927) 19. — Type: *Conchomyces verrucisporus* Over.

Etymology: krepis (Greek): slipper, ous (Greek): ear.

Fruit-bodies pleurotoid, usually lignicolous, more rarely on dead plant debris (culms, leaves, litter), mosses or on soil; pileus white to coloured, fibrillose, tomentose or more or less glabrous; lamellae radiating from a lateral or strongly eccentric point of attachment; spores in deposit brown, clay-colour, snuff-brown, cinnamon; spore wall single and thin or double and thick, smooth or ornamented and then the ornamentation consisting (1) very short rods, warts or spines or (2) structures caused by a wrinkling, rugulose to verruculose exosporium, globose, subglobose or ellipsoid to elongate, without germ-spore; cheilocystidia present and often branched; pileocystidia present in some species. Trama of the pileus subregular, sometimes with a gelatinous layer. Hyphae of the pileipellis either slightly or not at all differentiated, in species with a somewhat tomentose pileus mostly curved to coiled, or sharply differentiated and then repent and sometimes incrusted with brownish ring-like pigments; clamp-connections present or more rarely absent and in the latter case lacking from all tissues. Stipe only visible in young fruit-bodies, short and eccentric, lacking in older fruit-bodies and these sometimes forming a remarkable short and thick stump. Veil none.

Some species, such as *Clitopilus hobsonii*, *Cheimonophyllum candidissimum*, and species of *Panellus*, *Hohenbuehelia* and *Pleuroflammula* have often been mistaken for *Crepidotus* species. Of these only the representatives of the last genus have brown coloured spores, which, however, are ferruginous-fulvous and distinctly more strongly coloured than those in any *Crepidotus*. For further characters of the genus *Pleuroflammula* see Horak (1978). The rest have hyaline spores, when seen under the light microscope. Spores of *Clitopilus* are recognized by their longitudinal ribs and are angular in polar view.

Crepidotus haustellaris sensu Pilát is not a member of the genus *Crepidotus*. It is much better placed in *Simocybe* on account of the colour of its spore print with distinct olivaceous tints, the shape of the spores, the presence of a germ-pore and the structure of the pileipellis which is a turf of pileocystidia and exudations.

KEY TO THE EUROPEAN SPECIES

(Note: excellent optical equipment is crucial for identification!)

1a. All hyphae of fruit-body without clamp-connections 2

b. All hyphae of fruit-body with clamp-connections 6

2a. Spores ornamented (sometimes very faintly; oil immersion!) 3

b. Spores absolutely smooth, never ornamented 4

3a. Spores globose to broadly ellipsoid (Q = 1.0–1.3), minutely warty, punctate under the light microscope, 6–8 × 5.5–6.5 µm, with moderately coloured walls; fruit-body red .... 8. *C. cinnabarinus*

b. Spores ellipsoid to oblong-subcylindrical (Q = 1.6–2.1), minutely rugulose to almost smooth, 8.5–12 × 5–6.5 µm, with faintly coloured walls; fruit-body white 17. *C. versutus*

4a. Spores broadly ellipsoid to ellipsoid (Q < 1.7), 7–10 × 5–7 µm, in side view often amygdaliform, with strongly coloured walls; trama of pileus with gelatinous layer; cheilocystidia narrowly utriform to cylindrical 5

b. Spores cylindrical, fusoid to pip-shaped (Q = 2.1–3.2), 6.5–9.5 × 2.5–3.5 µm, with weakly coloured walls; trama of pileus without gelatinous layer; cheilocystidia whip-like, filiform .... 16. *C. epibryus*

5a. Fruit-body with macroscopically recognizable ferruginous scales; spores 7–10 × 5–7 µm (Q = 1.3–1.7) .... 2. *C. calolepis*

b. Fruit-body without macroscopically recognizable scales, cream, yellowish, pale brown; spores 7–10 × 5–6.5 µm (Q = 1.3–1.7) .... 1. *C. mollis*

6a. Spores globose to broadly ellipsoid (mean Q < 1.35), echinulate, spiny or punctate under the light microscope 7

b. Spores ellipsoid, in side view sometimes amygdaliform (mean Q > 1.4), never echinulate but verruculose or rugulose, warty or smooth under the light microscope .. 13

7a. Cheilocystidia with short finger-like protuberances, small, < 30 µm long 8

b. Cheilocystidia without finger-like protuberances, > 30 µm long 9

8a. Spores 6–8 × 5–7 µm (Q = 1.2–1.5), fruit-body pinkish red .. 7. *C. roseoornatus*

b. Spores 5–6.5 × 4.5–6 µm (Q = 1–1.2), fruit-body white or yellow when young 6. *C. carpaticus*

9a. Spores 4.5–7.5 × 5–7 µm, distinctly punctate-warty, baculate, moderately thick-walled; cheilocystidia never exclusively antler-like, mostly clavate or cylindrical, flexuous and often branched; lamellae never pink, crowded 11

b. Spores 6–9 × 4.5–7.5 µm, minutely spiny, echinulate, or punctate-warty, rather thin-walled; cheilocystidia narrowly lageniform, rarely clavate, branched and often antler-like; lamellae sometimes pinkish, fairly crowded to distant 10

10a. Spores 6–9 × 5.5–7.5 µm (Q = 1.1–1.35), echinulate; fruit-body < 30 mm, thin; young lamellae often pinkish, subdistant to distant .... 10. *C. cesatii*

b. Spores 6–8 × 4.5–6 µm (Q = 1.25–1.5), punctate-warty; fruit-body > 30 mm, fleshy; lamellae crowded, never pinkish .... 9. *C. macedonicus*

11a. Pileus densely covered with orange-fulvous scales, never distinctly hygrophanous 4. *C. crocophyllus*

b. Pileus without scales, often distinctly hygrophanous 12

12a. Cheilocystidia cylindrical, flexuous, often branched; pileipellis a true trichoderm; pileus rounded flabelliform, semicircular, light orange to melon-yellow; young lamellae pale orange .... 5. *C. ehrendorferi*

b. Cheilocystidia clavate or lageniform, never flexuous, very rarely mixed with some apically branched ones; pileipellis a cutis with scattered clusters of pileocystidia; pileus often spathuliform, cream to greyish brown; young lamellae cream to clay 3. *C. applanatus*

13a. Spores faintly rugulose or completely smooth; lamellae never pink 14

b. Spores distinctly rugulose or verruculose; lamellae occasionally pinkish or yellow when young 15

14a. Spores completely smooth, 7–9 x 5–6 µm (Q = 1.3–1.7), with strongly coloured, thick walls; fruit-body often fan-shaped, terrestrial .... 15. *C. autochthonus*

b. Spores faintly rugulose, 6.5–9.5 x 4.5–6 µm (Q = 1.4–1.7), with moderately to faintly coloured walls; fruit-body semicircular, lignicolous .... 12. *C. lundellii*

15a. Spores ellipsoid to amygdaliform, rugulose, 7.5–10.5 x 5–6.5 µm (Q = 1.4–1.7); cheilocystidia narrowly lageniform .... 14. *C. subverrucisporus*

b. Spores elongate to cylindrical (mean Q > 1.7); cheilocystidia cylindrical, flexuous or clavate, obpyriform, sometimes branched.................................. 16

16a. Spores subcylindrical, fusiform, 8–10 x 4–5 µm (Q = 1.8–2.1); cheilocystidia narrowly cylindrical, flexuous, sometimes branched; fruit-body either fresh or dried lemon-yellow, rarely cream-white, margin rarely lobed .... 13. *C. luteolus*

b. Spores cylindrical, 6–9 x 3–4.5 µm (Q = 1.6–2.2); fruit-body white, margin often lobed to crenate .... 11. *C. variabilis*

Crepidotus subgenus **Crepidotus**

Type: *C. mollis* (Schaeff.: Fr.) Staude.
Crepidotus subg. *Gelocutis* Pilát, Atl. Champ. Eur. 6 (1948) 11 (not val., no Lat.).
Crepidotus sect. *Laevisporae* Pilát, Hedwigia 69 (1929) 143.
Crepidotus subsect. *Defibulatini* Sing., Lilloa 13 (1947) 94.

Spores smooth; trama of pileus made up of multi-branched, short-celled hyphae and a gelatinous layer; clamp-connections lacking.

1. **Crepidotus mollis** (Schaeff.: Fr.) Staude — Fig. 42, Plate 1a, b

Agaricus mollis Schaeff., Fung. Bavar. Palat. nasc. 4 (1774) 49. — *Agaricus mollis* Schaeff.: Fr., Syst. mycol. 1 (1821) 274. — *Crepidotus mollis* (Schaeff.: Fr.) Staude, Schwämme Mitteldeutschl. 25 (1857) 71. — *Derminus mollis* (Schaeff.: Fr.) J. Schroet., Pilze Schlesiens (1889) 578. — Neotype (designated here): Netherlands, prov. Noord-Holland, Vogelenzang, 8.XI.1954, on dead *Populus*, *Maas Geesteranus 10225* (L 954.292-024).

Agaricus alveolus Lasch, Linnaea 4 (1829) 547 (no type). — *Crepidotus alveolus* (Lasch) P. Karst., Ryssl., Finl. Skand. Halföns Hattsvamp. (1879) 414.

Agaricus chimonophilus B. & Br., Outl. Brit. Fungol. (1860) 164 (fide Pilát, 1948; type: K).

Agaricus (Crepidotus) ralfsii B. & Br., Ann. Mag. nat. Hist. 5 (1893) 12 (fide Pilát, 1948; type: K).

Crepidotus alabamenis Murr., N. Amer. Fl. 10 (1917) 150 (type: NY).

Crepidotus fraxinicola Murr., N. Amer. Fl. 10 (1917) 150 (type: NY).

Table VIII. Main differences between the taxa studied.

	aut	cal	car	ces	cin	cro	epi	ehr	lun	lut	mac	mol	ros	sub	var	ver
app	ef	abc defg	fh	f	adf	bdf	aef h	dh	fg (d)	dfg h	gh	ace g	dfh	fg	fgh	afg
aut	–	abc	eg h(d)	eg h	ade g	bde g	a h	deg h	e (d)	ed h	eh	acf	deg h	e	e h	ae
cal		–	abc deh	abc deh	bcd eg	ace g	bcd h	abc dehg	abc de	abc deh	cde h	bdf	abc degh	abc de	abc eh	cde
car			–	(d)	ad h	bd h	aeg	f	g h	dg	g	ace fgh	d	g h	g	ag h
ces				–	adh	bdh	aeg	df	gh (d)	dg	(g)	ace fg	d	gh	g	agh
cin					–	abd	deg h	adf h	adg	adg h	adh	cde fg	ah	adg	adg h	dg
cro						–	ade gh	bh	dg	dgh	bdg h	acd efg	dh	dg	dgh	adg
epi							–	ade g	aeh	ade	a	cfh	ade g	aeh	ae	eh
ehr								–	gh	d	g	ace gh	d	gh	g	adg h
lun									–	dh	(h)	ace f	dgh	–	h	a
lut										–	acd efh	d	d	dh	d	ad
mac											–	ace h	d	h	–	ah
mol												–	ade gh	ace f	aef h	ef
ros													–	dhg	dg	adg h
sub														–	h	a
var															–	ah

Characters: a = clamp-connections, b = scales, c = gelatinous layer, d = pileus colour, e = smooth spores, f = pileus hygrophanous, g = spores globose to broadly ellipsoid (Q = 1–1.3), h = cheilocystidia branched. Species: app = *applanatus*, aut = *autochthonus*, cal = *calolepis*; car = *carpaticus*, ces = *cesatii*, cin = *cinnabarinus*, cro = *crocophyllus*, epi = *epibryus*, ehr = *ehrendorferi*, lun = *lundellii*, lut = *luteolus*; mac = *macedonicus*, mol = *mollis*, ros = *roseoornatus*, sub = *subverrucisporus*, var = *variabilis*, ver = *versutus*.

Excluded. Crepidotus mollis var. *mollis* sensu Hesler & Smith, N. Amer. Spec. Crepidotus (1965) 31.
Selected icones. Sow., Col. Figs. Engl. Fungi 1 (1797) pl. 98; Konr. & M., Ic. sel. Fung: pl. 303. 1.
Selected description. Horak, Syn. Gen. Agar. (1968) 194.

Pileus 3–50(–80) mm, semicircular, rounded flabelliform, reniform or spathuliform, young campanulate to ungulate, later convex to plano-convex, sometimes with low umbo around point of attachment, with inflexed margin, becoming straight and striatulate with age, hygrophanous only in very old fruit-bodies, smooth, glabrous or with scattered innate fibrils sometimes forming indistinct pale scales towards centre, at first not viscid, at maturity distinctly viscid, cream, pale orange-yellow, buff-yellow, ochraceous-buff or pale honey (M 7.5 YR 4/4, 5/6–5/8, 10 YR 4/4, 5/6, 7/4–7/8), at point of attachment often whitish cream, villose; in dried specimens surface wrinkled. Lamellae L = 12–28, l = 1–4, crowded, narrow, up to 4 mm broad, subventricose to linear, narrowly adnexed to free, whitish cream, chamois to snuff-brown (M 7.5 YR 5/6); edge even, sometimes paler. Stipe often none; sometimes present as an eccentric, short, white, tomentose, thick stump. Flesh moderately thick at point of attachment, elastic, olive-buff, cream; gelatinous layer in the upper part thin to rather thick, ratio to the non-gelatinous layer from 1 : 1 to 1 : 13; taste mild or bitterish, odour none. Spore print snuff-brown (M 7.5 YR 4/4).

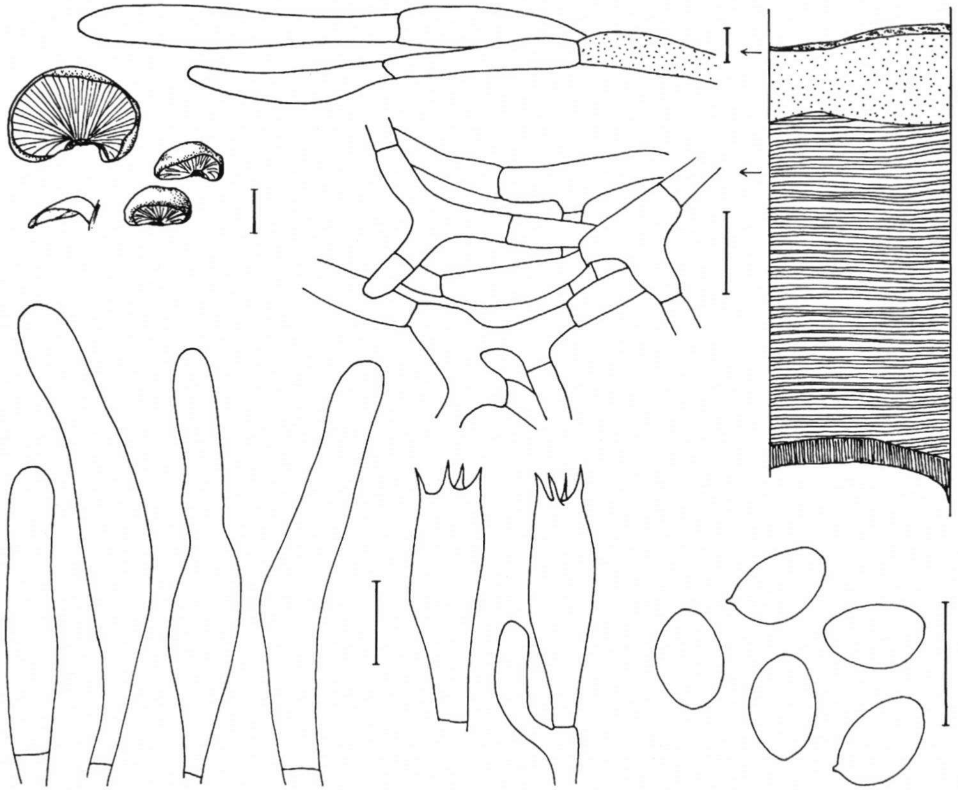


Fig. 42. *Crepidotus mollis*: fruit-body, pileitrama, cheilocystidia, basidia, spores.

Spores 7–10 × 5–6.5 µm, Q = 1.3–1.7, mean volume 134 μm^3, ellipsoid, slightly inequilateral in side view, smooth; walls strongly coloured, thick. Basidia 18–30 × 6–9 µm, four-spored, clampless. Cheilocystidia 22–55(–74) × 4–10 µm, narrowly utriform, lageniform, cylindrical, hymenial and tramal. Pileipellis a cutis of radially arranged, 4–10 µm wide, sometimes minutely incrusted hyphae; terminal cells undifferentiated. Pileitrama of short-celled, multibranched, hyaline, 6–14 µm wide hyphae; gelatinous layer of 3–5 µm wide, filiform hyphae, 200–400 µm wide. Pigment absent. Clamp-connections absent from all tissues.

Habitat & Distribution – On logs or trunks of various hardwood or in cracks of living frondose trees (*Fraxinus, Fagus*), rarely on worked wood, from the lowlands up to the montane zone (uppermost record 1030 m). Widespread and frequent. June–December.

Collections examined. AUSTRIA: Niederösterreich, Kranichberg, Syhrnlucke, 9 Dec. 1977, *Passauer* (W 06244); Hainburg, 4 May 1980, *Hausknecht* (WU 0235). — BULGARIA: Silistra, Alfatar, Kora-kuz, 12 Nov. 1957, *Hinkova* (SOM 344). — ESTONIA: Tallinn, 21 Aug. 1989, *Senn-Irlet 89/135* (BERN). — FRANCE: dpt Maine-et-Loire, Chaudefond, Layon, 25 May 1980, *Mornand 8015B1* (herb. Mornand); dpt Pas-de-Calais, Forêt de Guines, 13 Oct. 1991, *Senn-Irlet 91/216* (BERN); Bois de Boulogne, 15 Oct. 1991, *Senn-Irlet 91/229* (BERN). — GERMANY: Baden-Württemberg, Friedrichshafen, 19 Aug. 1970, *Winterhoff* (herb. Winterhoff). — GREAT BRITAIN: England, Clanton heath, Surrey, 18 Oct. 1953, *Decherain* (L). — JUGOSLAVIA: Neuhaus, Aug. 1937, *Porsch 8169* (W). — NETHERLANDS: prov. Noord-Holland, Vogelenzang, 8 Nov. 1954, *Maas Geesteranus 10225* (L); prov. Utrecht, Linschoten, 15 Nov. 1951, *van der Voo* (L). — LICHTENSTEIN: Balzers, May 1989, *Prongué 8931* (herb. Prongué). — SWITZERLAND: Kt. Bern, bei Bern, Oct. 1849, *Trog* (BERN); Bern-Bremgartenwald, 19 Dec. 1982, *Irlet 80/352* (BERN); Bern-Dählhölzli, 13 June 1982, *Irlet 82/32* (BERN); Bremgarten, Oct. 1853, *Fischer* (BERN), Thun, an der Zulg, June 1850, *Trog* (BERN); Brienz, Birchetal, 25 Sept. 1991, *Senn-Irlet 91/149* (BERN); Brienz, Giessbach, 21 June 1992, *Senn-Irlet 92/57* (BERN); ct. Jura: Develier, La Vache, 28 Sept. 1989, *Senn-Irlet 89/200, 89/195** (BERN); Kt. Luzern: Horw, Birreggwald, 12 Sept. 1976, *Richoz 1209-76-R* (NMLU); Sins, 10 June 1973, *Bächler 1006-73-BA9* (NMLU); Hasle, Sandboden, 30 Sept. 1988, *Senn-Irlet 88/421* (BERN); Kt. Schwyz: Steinen, 2 Oct. 1991, *Senn-Irlet 91/165* (BERN); ct. Vaud, Lausanne, Stade de Vidy, 15 Nov. 1972, *Clémençon 72/127* (LAU); Kt. St. Gallen, Quinten, 29 June 1988, *Bächler 2006-88-Ba3* (NMLU); cte Ticino, Someo, 17 Sept. 1989, *Senn-Irlet 89/176* (BERN); Dalpe, 20 Aug. 1981, *Riva* (Lugano 1778); Meride, Murgala, 3 Oct. 1981, *Lucchini* (Lugano 1958).

Due to its gelatinous layer, which makes the whole fruit-body elastic, *Crepidotus mollis* is easily identified. It seems to be the only species fruiting in cracks of living trees and therefore probably has parasitic capacities.

There exist forms with some coloured innate fibrils or even scale-like fibrils, which may be confounded with *Crepidotus calolepis*. In such cases the spore forms have to be examined carefully, *C. mollis* is characterized by narrower spores and hyphae of the pileipellis which are never heavily incrusted.

2. **Crepidotus calolepis** (Fr.) P. Karst. — Fig. 43

Agaricus calolepis Fr., Öfvers. K. Vetensk.-Akad. Förh. 30 (5) (1873) 5. — *Crepidotus calolepis* (Fr.) P. Karst. in Bidr. Känn. Finl. Nat. Folk 32 (1879) 414. — *Crepidotus mollis* var. *calolepis* (Fr.) Pilát, Acta Mus. nat. Prag. 2B (1940) 74. — *Crepidotus mollis* subsp. *calolepis* (Fr.) Norstein, Syn. Fung. 2 (1990) 67.

Crepidotus fulvotomentosus Peck, Annu. Rep. N.Y. State Mus. nat. Hist. 26 (1874) 57 (fide Singer 1947, type: NY).

Crepidotus calolepidoides Murr., Mycologia 5 (1917) 30 (type: NY).

KEY TO THE VARIETIES

1a. Spores 7–10 µm long, scale-forming hyphae up to 15 µm wide .... a. var. *calolepis*
b. Spores larger, 8–12 µm long, scale-forming hyphae up to 22 µm wide
b. var. *squamulosus*

2a. Crepidotus calolepis var. calolepis

Agaricus calolepis Fr. — *Crepidotus calolepis* (Fr.) P. Karst. — Neotype (designated here): Estonia, Kothla-Järve, in deciduous forest on bark, 5.VIII.1961, *Kalamees* (TAA 72403, isotype: L).

Misapplied name. Crepidotus mollis (Fr.) Staude var. *mollis* sensu Hesler & Smith, 1965.

Selected icones. Fries, Ic. sel. Hymenomyc. 2 (1878) pl. 129, fig. 4; Ryman & Holmåsen, Svampar (1984) 468.

Pileus 16–55(–100) mm, semicircular, reniform, orbicular, rounded flabelliform, young campanulate, later convex to plano-convex, with margin initially distinctly inflexed, sessile, mostly laterally attached, on sordid or pallid ground densely tomentose at first, later appressed fibrillose-scaly, with tomentum and the scales sayal-brown, ochraceous-ferruginous, ochraceous-tawny (M 5 YR 4/6, 5/8, 10 YR 5/6–5/8), later pigmented layer often partly washed off and the pileus becoming hygrophanous, sticky and pale ochraceous to light ochraceous-tawny; at point of attachment sometimes tomentose-villose, white to cream. Lamellae L = 14–18, l = 2–3, fairly crowded, narrow, up to 3 mm wide, arcuate to subventricose, narrowly adnexed, cream, light buff, light ochraceous-buff to cinnamon; edge minutely fimbriate, whitish, later even. Stipe only recognizable in very young fruit-bodies, central at first, later eccentric, lateral and reduced. Flesh moderately thick below point of attachment, elastic, cream to olive-buff; gelatinous

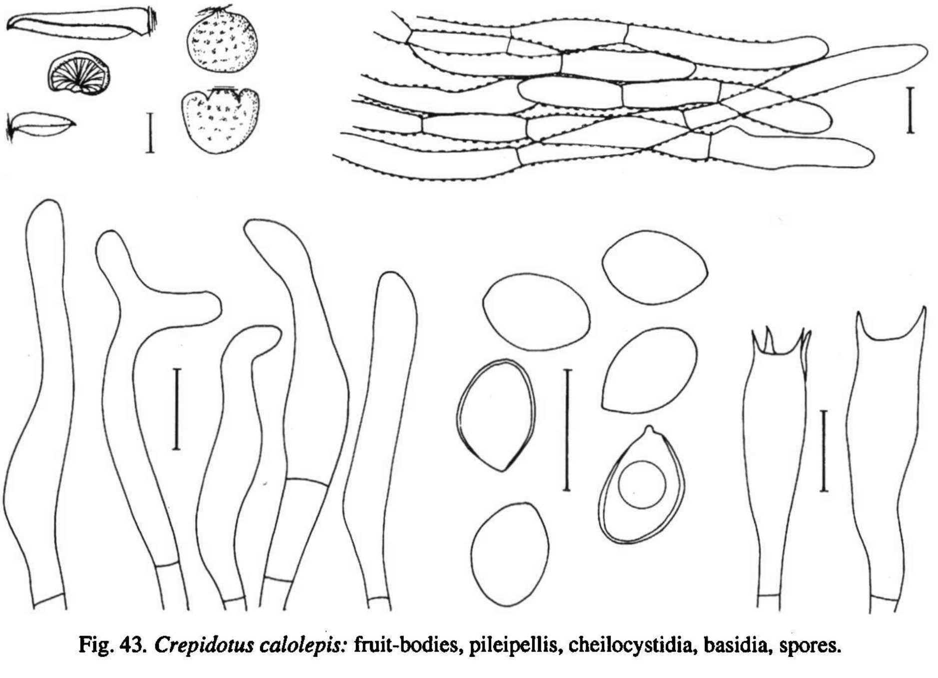


Fig. 43. *Crepidotus calolepis:* fruit-bodies, pileipellis, cheilocystidia, basidia, spores.

layer narrow to broad, occupying 1/4 to 1/10 of the pileus-trama; taste mild or bitterish; odour none. In dried specimen pigmented scales remaining clearly recognizable.

Spores 7.5–10 × 5–7 µm, Q = 1.3–1.7, mean volume 173 μm^3 ellipsoid, slightly inaequilateral to amygdaliform in side view, smooth, strongly coloured, walls moderately thick. Basidia 22–37 × 6–10 µm, four-spored, rarely mixed with two-spored, clampless. Cheilocystidia (26–)32–52(–76) × 5–8 µm, cylindrical, narrowly utriform, lageniform, rarely clavate and septate, hyaline, arising from trama as well as from hymenium. Pileipellis a cutis of radially arranged, 3–5 µm wide hyphae. Scales formed by bundles of 6–14 µm wide hyphae composed of botuliform short cells; terminal cells often slightly thick-walled, undifferentiated. Oleiferous hyphae sometimes present in upper pileitrama. Pigment brown, incrusting scale-forming cells of pileipellis. Clamp-connections absent from all tissues.

Habitat & Distribution – On hardwood, mainly *Populus* (Norstein, 1990) in boreal Europe, southwards already very rare in Denmark (J. Lange, 1938), on hardwood of various kinds in the mediterranean region, lacking (or very rare?) in temperate Europe. Frequent in greater parts of its area of distribution. June–February.

Collections examined. ESTONIA: Haapsalu, Reserv. Matsalu, 4 Aug. 1979, *Kalamees* (TAA 120729); Valga, Lullemae, 24 Aug. 1982, *Veldre* (TAA 144861); Harju, Lahemaa National Park, 18 Oct. 1975, *Kalamees* (TAA 94708), 22 Aug. 1989, *Senn-Irlet 891136* (BERN), 18 Oct. 1975, *Kalamees* (TAA 94708); Pärnu: Surju, 27 Aug. 1989, *Kollom* (TAA 127668); Rakvere, Maasikarn, 12 Aug. 1958, *Kalamees* (TAA 71000); neotype (designated here): Kothla-Järve, in deciduous forest on bark, 5 Aug. 1961, *Kalamees* (TAA 72403) — PORTUGAL: June 1964 (K). — SPAIN: Cuenca, March 1975, *Moreno 478* (GDAC); Islas Canarias, Gomera, Meseta Vallehermoto, Feb. 1982, *Bañares 1998* (herb. La Laguna). — SWEDEN: Uppland: Rasbo, Grän, 31 July 1990, *Gahne* 90-30 (BERN).

ALGERIA: 25 Nov. 1932, *Kühner* (G 18444). — MAROCCO: Volubilis, 27 Nov. 1989, *Hausknecht* (WU-S/1925).

CANADA: prov. Alberta, Banff, 26 July 1990, *Senn-Irlet 901151, 901154* (BERN); prov. British Columbia, Yahk, 5 Sept. 1989, *Vellinga* (L 984.303-073*). — USA: California, San Mateo Co., San Francisco watershed, 22 Dec. 1963, *Thiers 11188* (NY as *C. fulvotomentosus*); Maine, Piscataquis Co, Boarstone Camp, 12–14 Sept. 1905, *Murrill 246* (NY); Massachusetts, Arlington, 5 Oct. 1907, *Piguet* (K, Reliquiae Farlowiana no. 319 as *C. fulvotomentosus* Peck); Michigan, Mount Morency, 4 Aug. 1967, *Clémençon 670804* (LAU), Pellston Hills, 17 July 1961, *Reid* (K as *C. fulvotomentosus* Peck); New York, Ulster Co, Shandaken, 14 Oct. 1990, *Senn-Irlet 901108* (BERN).

Fries (1878) gives an excellent illustration of this species and despite his remark that *C. calolepis* lacks a gelatinous layer, I consider this illustration as a perfect presentation of his concept of it. An extended study of Scandinavian material (Norstein, 1990) as well as of Moroccan material (Malençon & Bertault, 1975) did not reveal any collection without a gelatinous layer, but this layer may be very thin and therefore may have escaped Fries' observation.

I agree with Singer (1973) that *C. calolepis* is very distinct from *C. mollis* on account of its brown scales, which form a dense brownish tomentum in young fruit-bodies never found in *C. mollis.*

Fig. 35 illustrates the differences in spore size between *C. calolepis* var. *calolepis*, *C. calolepis* var. *squamulosus* and *C. mollis*, respectively.

I am convinced that *C. calolepis* with its brown scales and its somewhat wider spores deserves autonomous status at species level.

Crepidotus calolepis seems to be very common in North America.

2b. **Crepidotus calolepis** var. **squamulosus** (P. Coutinho), *comb. nov.*

Basionym. Crepidotus mollis var. *squamulosus* P. Coutinho, Bolm Soc. broteriana IX (1934) 211. — Neotype (designated here): Canary Islands, Tenerife, Vuelta de Taganana, macrophyllous evergreen forest, on fallen hardwood branch, III.1989, *Lussi & Senn-Irlet 89/9* (G).

Pileus 5–45 mm, rounded flabelliform, semicircular, spathulate, convex with low umbo at point of attachment sessile, laterally attached, with initially broadly inflexed margin, young completely and densely villose, later appressedly fibrillose-scaly on sordid or pale yellow ground with tomentum or scales always more densely towards point of attachment, and sayal-brown, ochraceous-ferruginous, ochraceous-tawny (M 5 YR 4/8, 10 YR 7/8), becoming hygrophanous, at point of attachment cream tomentose, in dried specimen becoming ochre or remaining yellowish with scales remaining clearly recognizable. Lamellae L = 12–24, l = 1–3, narrow, crowded, arcuate to subventricose, narrowly adnexed, cream, light buff, light ochraceous-buff to cinnamon, with minutely fimbriate, later even edge. Stipe only visible in very young fruit-bodies (< 1 mm) first central, soon eccentric, later lateral, reduced or lacking. Flesh moderately thick, especially below point of attachment, elastic, whitish to cream; gelatinous layer thick, up to half as thick as pileus.

Spores 8.5–12 × 6–7.5 µm, Q = 1.3–1.7, mean volume 247 μm^3, ellipsoid, slightly inaequilateral to amygdaliform in side view, smooth, strongly coloured; walls moderately thick. Basidia 25–33 × 6–8 µm, four-spored, without clamps. Cheilocystidia 31–87 × 4–40 µm, cylindrical and flexuous, sometimes subcapitate or narrowly lageniform or septate, hyaline, rarely some with yellowish contents, arising from trama as well as from hymenium. Pileipellis a cutis of repent, radially arranged, 2.5–5 µm wide, hyaline hyphae; scales formed by bundles of 8–15(–22) µm wide, made up of botuliform, short cells. Pigment brown, heavily and densely incrusting scale-forming hyphae of pileipellis. Clamp-connections absent from all tissues.

Habitat & Distribution – On hardwood in meridional regions. Scattered. November–March.

Collections examined. ITALY: Sicily, Forte Campone, 17 Nov. 1988, *Bellu 82/271* (herb. Bellu). — SPAIN: Islas Canarias, Tenerife, Mte Aguirre, Oct. 1979, *Bañares 1668* (herb. La Laguna), Vuelta de Taganana, 15 March 1989, *Lussi & Senn-Irlet 89/9** (G).

USA: California, Berkeley University Campus, 20 Jan. 1978, *Tavares 2528* (G).

As the spores of var. *squamulosus* are somewhat longer as well as somewhat wider than those of var. *calolepis*, the differences in spore size are best expressed in spore volumes (see Fig. 35). As these varieties occur sympatrically in southwestern mediterranean areas, this species complex seems favourable for investigations with molecular techniques to reveal the speciation process.

Crepidotus subgenus **Dochmiopus** (Pat.) Pilát

Dochmiopus Pat., Hyménomyc. Eur. (1887) 113. — *Crepidotus* subg. *Dochmiopus* (Pat.) Pilát, Atl. Champ. Eur. 6 (1948) 12 (type: *C. variabilis* (Pers.: Fr.) Kumm.).

Crepidotus subg. *Sphaerocrepidotus* Pilát, Atl. Champ. Eur. 6 (1948) 11 (not val., no Lat.).

Crepidotus subg. *Geophila* Pilát, Atl. Champ. Eur. 6 (1948) 12 (not val., no Lat.).

Crepidotus subg. *Nebulosi* Pilát, Atl. Champ. Eur. 6 (1948) 12 (not val., no Lat.).

Crepidotus subg. *Muscicoli* Pilát, Atl. Champ. Eur. 6 (1948) 12 (not val., no Lat.).

Crepidotus subg. *Colorati* Pilát, Atl. Champ. Eur. 6 (1948) 12 (not val., no Lat.).

Crepidotus subg. *Sphaerula* Hesler & Smith, N. Amer. Spec. Crepidotus (1965) 38 (type: *C. applanatus* (Pers.) Kumm. sensu Joss.).

Trama without gelatinous layer, trama of pileus not made up of short-celled, multibranched hyphae. Spores mostly ornamented, rarely smooth. Clamp-connections present or absent.

Section **Dochmiopus**

Sect. *Sphaerula* Hesler & Smith, N. Amer. Spec. Crepidotus (1965) 40 (type: *C. applanatus* (Fr.) Kumm.).

Sect. *Cinnabarini* Hesler & Smith, N. Amer. Spec. Crepidotus (1965) 20 (type: *C. cinnabarinus* Peck.).

Spores mainly globose or rarely oblong-ellipsoid, verruculose, tuberculose, baculate or echinulate, fruit-body white or red.

3. **Crepidotus applanatus** (Pers.) Kumm.

Agaricus applanatus Pers., Observ. mycol. 1 (1796) 8. — *Crepidotus applanatus* (Pers.) Kumm., Führ. Pilzk. (1871) 74. — Neotype (designated here): Scotland, Loch Lomond, on hardwood stump, 27.VIII. 1963, *E. Kits van Waveren* (L 986.062-019).

Agaricus putrigenus B. & C., Ann. Mag. nat. Hist., ser. 3, 4 (1859) 292 (type: K). — *Crepidotus putrigenus* (B. & C.) Sacc., Syll. Fung. 5 (1887) 883.

Misapplied name. Crepidotus applanatus var. *fulvifibrillosus* (Murr.) Pilát sensu Pilát, Atl. Champ. Eur. 6 (1948) 35.

KEY TO THE VARIETIES

1a. Cheilocystidia clavate, capitate; spores 4.5–7 µm long; mainly on hardwood
a. var. *applanatus*

b. Cheilocystidia cylindrical, lageniform; spores 5.0–7.5 µm long; on coniferous wood
b. var. *subglobiger*

Crepidotus applanatus belongs to a species complex that is especially rich in North America, comprising almost all taxa described by Hesler & Smith (1965: 40, 71) in subsections *Sphaeruli* and *Fulvifibrillosi*, i.e. a total of at least 27 taxa. These taxa are distinguished mainly by spore size, nature of the covering of the pileus, and colour of the fruit-bodies.

Within *C. applanatus* two of the variants accepted by Hesler & Smith (1965) exist in Europe. As shown above (see Table V, Fig. 36) spore size is a separating character on population level but not always on sample level. However, a clear correlation exists between the shape of the cheilocystidia and the substrate which allows for taxonomic separation on an infraspecific level.

3a. **Crepidotus applanatus** var. **applanatus** — Figs. 19, 44a, Plate 3a

Selected icon. Mos. & Jül., Farbatl. Basidiomyc. 3 (1986) III Crepidotus 1.

Selected description. Josserand, Bull. trimest. Soc. mycol. Fr. 53 (1937) 219–222.

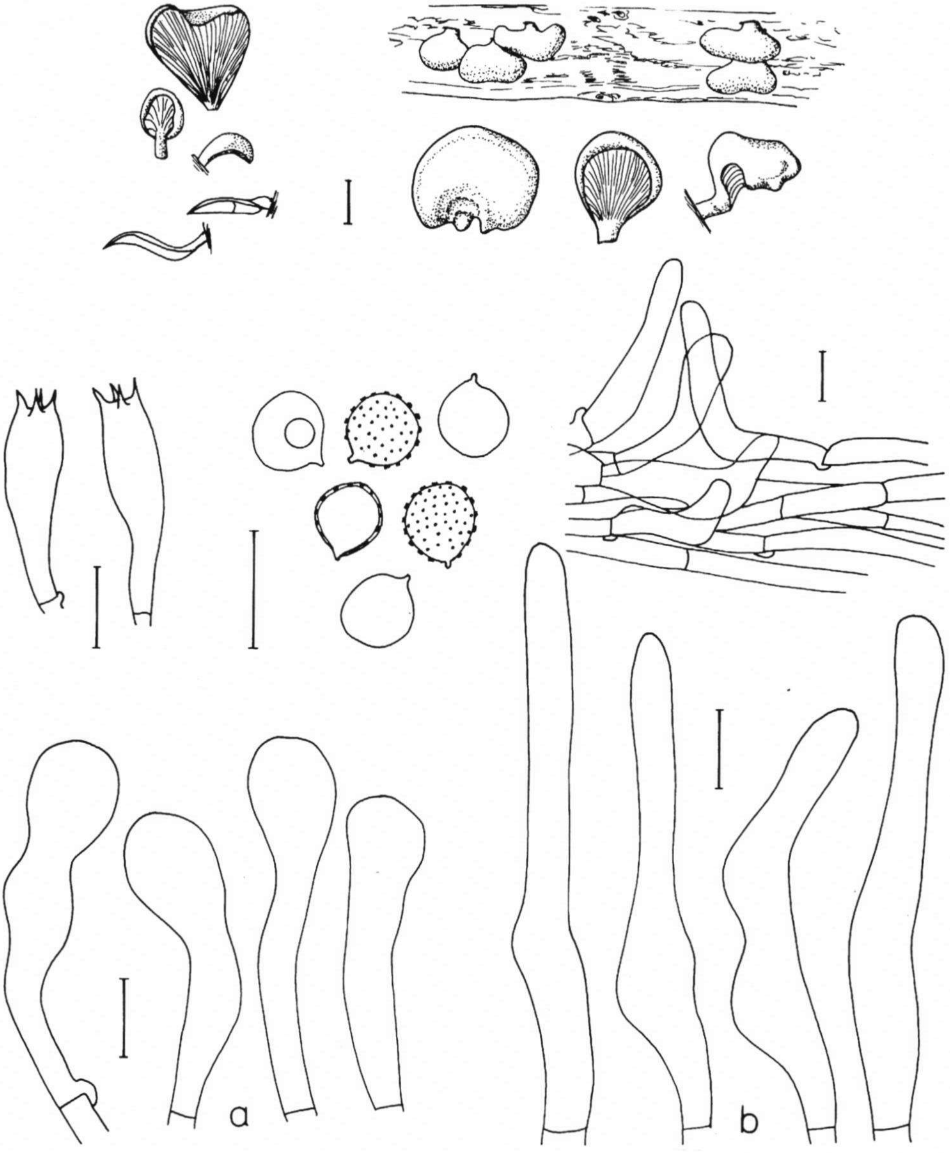


Fig. 44. *Crepidotus applanatus* s.l.: fruit-bodies, basidia, spores, pileipellis, cheilocystidia, (a) var. *applanatus*, (b) var. *subglobiger*.

Pileus 5–50 mm, spatuliform, petaloid, flabelliform, rounded flabelliform, semicircular to circular, convex becoming plano-convex or applanate, with margin narrowly inflexed, soon becoming straight, hygrophanous, translucently striate at margin especially when wet, smooth, white or pale grey, becoming whitish cream, dingy cream to avellanous (M 2.5 Y 8/3–7/3–7/6, 7.5 YR 6/4, 7.5 YR 7/4–7/6), in dried specimen ochre-yellow or cream; point of attachment lateral or sometimes dorsal, felted or distinctly fibrillose-villose, white to cream. Lamellae, L = 12–18, l = 1–5, close to crowded, narrow, up to 2(–3) mm broad, arcuate, subventricose to linear, in younger stages distinctly decurrent, then narrowly adnate, white, later cinnamon, sayal-brown to snuff-brown (M 7.5 YR 5/6–5/8, 6/8, 7/8, 10 YR 6/8–7/8); edge even. A short and rather thick stipe at times present, white, tomentose. Flesh thin, white when faded, watery when fresh, not very fragile. Odour none. Taste mild. Spore print ochraceous-tawny to snuff-brown (M 7.5 YR 4/4, 10 YR 5/6).

Spores 4.5–7.0 × 4.5–6.5 µm, Q = 1.0–1.12, mean volume 96 µm^3, globose to subglobose, contracted towards apiculus, warty-punctate, but almost smooth in optical section, with perispore, distinctly coloured. Basidia 18–29 × 5–9 µm, four-spored, clamped. Cheilocystidia 23–68 × 3–10 × 11–16 µm, clavate, capitate, more rarely flexuous, angled or slightly branched, hyaline. Pileipellis a cutis of repent 3.5–6(–10) µm wide, hyaline, cylindrical hyphae. Pileocystidia 30–65 × 5–9 µm, narrowly utriform, subcapitate, in clusters. Pigment lacking. Clamp-connections present in all tissues.

Habitat & Distribution – On logs and stumps of hardwood (*Fagus, Acer, Fraxinus*), exceptionally on coniferous wood. Submeridional to temperate. August–October.

Collections examined. AUSTRIA: Salzburg, Flachgau, bei Fürstenbrunn, 27 July 1990, *Rücker 96-90* (BERN). — BULGARIA: Zavoda, Rebarclza, 30 Aug. 1971, *Varev* (K). — CZECHOSLOVAKIA: Moravia, Ranspuk, 1 Aug. 1967, *Lazebnicek* (BRNM 313000); Zakova hora, 5 Sept. 1967, *Smardova* (BRNM 313044); Vihorlat, 2 Oct. 1967, *Koncerova & Kriz* (BRNM 266957). — FRANCE: dpt Vosges, Laxeuil, 8 July 1935, *Josserand* (herb. Josserand). — GERMANY: Bayern, Bayerischer Wald, Lärchenberg, 30 Sept. 1986, *Luschka* 47 (herb. Luschka); Bayerischer Wald, Ruchelbachufer, 26 Sept. 1988, *Luschka 460* (herb. Luschka). — GREAT BRITAIN: Scotland, Loch Lomond, 27 Aug. 1963, *Kits van Waveren* (neotype: L 986.062-019); Wales, Lake Vyrnwy, 31 Aug. 1964, *Kits van Waveren* (L 985.109-096). — ITALY: prov. Vercelli, Fabell, 28 Sept. 1983, *Cavallera 83/572* (IB). — LATVIA: Talsi, reserv. Slitere, 22 Sept. 1982, *Kalamees* (TAA 122536). — NETHERLANDS: prov. Noord-Brabant, Oisterwijk, 20 Sept. 1962, *Donk* (L 962.24-019); prov. Gelderland, S. Hilversum, 1 Sept. 1951, *de Wit* (L 951.115-137); prov. Utrecht, Soest-Pijnenburgse bos, 19 Aug. 1972, *de Kleuver* (L 984.37-220). — RUSSIA: Krasnodar, Reservatum Caucasicum, Psekis, 9 Sept. 1975, *Kalamees* (TAA 94494), Guzeripl, 13 Aug. 1974, *Kalamees* (TAA 94031, 94041), Kraswaja-Poljawa, 27 Aug. 1974, *Kalamees* (TAA 94195). — SWITZERLAND: Ct. Jura, Bassecourt, La Caquerelle, 28 Sept. 1989, *Senn-Irlet 89/197** (BERN); Boécourt, 26 Sept. 1989, *Chételat* (BERN); Kt. Luzern, Weggis-Lützelau, 5 Sept. 1981, *Müller 0509-81* (NMLU). — TURKEY: Bolu, Aug. 1979, *Sümer 126* (K).

Crepidotus applanatus unites several characteristic features, which makes it easy to recognize: pileus spatulate, distinctly hygrophanous, smooth; margin translucently striate; lamellae long remaining white; occurring on decayed logs; pileipellis a cutis with scattered but distinct pileocystidia. The spores are more globose, darker coloured and with a thicker spore-wall than in *C. cesatii*.

Two collections (TAA 122536, TAA 94195) exhibit very large spores (6.1–7.6 × 6.0–7.6 µm, see Fig. 36) which fall beyond the range of *C. applanatus* var. *subglobiger*, but on account of the shape of the cheilocystidia and the substrate they must be interpreted as a macrosporous (polyploid?) form of var. *applanatus* or an undescribed and badly known taxon from Eastern Europe.

3b. **Crepidotus applanatus** var. **subglobiger** Sing. — Fig. 44b

Crepidotus applanatus var. *subglobiger* Sing., Beih. Nova Hedwigia 44 (1973) 478. — Holotype: Mexico, Oaxaca, *Singer M8400* (F, not seen).

Misapplied name. Crepidotus applanatus var. *globiger* (Berk.) Pilát sensu Pilát, Atl. Champ. Eur. 6 (1948) 36, sensu Hesler & Smith, N. Amer. Spec. Crepidotus (1965) 50.

Pileus 5–45 mm, spatuliform, petaloid, flabelliform, rounded flabelliform, semicircular to circular, convex becoming plano-convex or applanate, with margin narrowly inflexed, soon becoming straight, hygrophanous, translucently striate at margin especially when wet, smooth, white or pale grey, becoming whitish cream to dingy cream to avellanous (M 2.5 Y 8.3–7/3–7/6, 7.5 YR 6/4, 7.5 YR 7/6); point of attachment lateral or sometimes dorsal, white to cream felted or distinctly fibrillose-villose. Lamellae, L = 10–16, l = 1–3, close to crowded, narrow, up to 2–3 mm broad, arcuate, subventricose to linear, in younger stages distinctly decurrent, then narrowly adnate, white, later cinnamon, sayal-brown to snuff-brown (M 7.5 YR 4/6–5/6); edge even. A rather thick and short stipe at times present, white, tomentose. Flesh thin, white when faded, watery when fresh, not very fragile. Odour none. Taste mild. Spore print ochraceous-tawny to snuff-brown (M 7.5 YR 4/4, 10 YR 5/6).

Spores 5.0–7.5 × 5.0–7.0, Q = 1–1.2, mean volume 109 μm^3, globose to subglobose, contracted towards apiculus, warty-punctate, almost smooth in optical section, baculate, with a perispore, distinctly coloured. Basidia 22–33 × 6–11 µm, four-spored, clamped. Cheilocystidia (20–)30–75(–90) × 5–10 µm, cylindrical, narrowly lageniform or narrowly utriform, mixed with some flexuous, angled or forked ones, rarely some subcapitate, hyaline. Pileipellis a cutis of repent, 4–9 µm, hyaline, cylindrical, sometimes minutely incrusted hyphae and scattered, narrowly lageniform pileocystidia, 35–67(–92) × 7.5–13 µm. Pigment lacking. Clamp-connections present in all tissues.

Habitat & Distribution – On logs and stumps of coniferous wood (*Picea, Pinus*). Submeridional to temperate. Mainly in mountainous regions, from the lowlands up to the subalpine zone (uppermost record 1550 m). Scattered to frequent. August–November.

Collections examined. CZECHOSLOVAKIA: Teleci, 27 Sept. 1963, *Hornicek* (BRNM 333 558). — FRANCE: dpt Maine-et-Loire, Foret de Chaudelay, 2 Nov. 1976, *Mornand 76192* (herb. Mornand); ex herb. Kühner sub nomen *C. subscalaris* (G 18434). — GERMANY: Bayern, Regensburg, Painter Forst, 13 Sept. 1972, *Clémençon 72168* (LAU). — ITALY: prov. Bolzano, Selva dei Molini, 26 Aug. 1986, *Bellu 86/98** (herb. Bellu). — NETHERLANDS: prov. Gelderland, Harderwijk, 27 Sept. 1988, *de Vries 5282* (WAG-W). — SPAIN: Madrid, Rasafria, 11 Nov. 1975, *Rollan* (GDAC 473); Segovia, Boca del Amo, 13 Nov. 1978, *Soc. Mic. Cast.* (GDAC 5171). — SWITZERLAND: Kt. Graubünden, Zernez, Las Vallainas, 22 July 1942, *Favre* (G 13806); ct. Vaud, Pont de Nant, 26 Aug. 1976, *Clémençon 79170* (LAU).

The shape of the cheilocystidia is a good distinctive character of var. *subglobiger*. In the examined annotated collections on or still attached to pieces of wood I found only coniferous wood, which leads me to the supposition that var. *subglobiger* may be an ecotype on coniferous wood.

As shown in Table V and Fig. 36 the spores of var. *subglobiger* are somewhat larger than in var. *applanatus* but have a very large range which hampers an identification based on spore size alone.

Two collections from *Pinus* (*WAG-W 5283, GDAC 473*) show finely incrusted hyphae in the pileipellis, which, however, do not form macroscopically recognizable scales. Yet, Norstein (1990: 88) reports even macroscopically recognizable, brown, innate fibrils for some collections. These mostly colourless-incrusted hyphae can hardly be compared with the yellow-brown hyphae with thick-walled terminal cells forming the distinct scales in *C. crocophyllus*. But they may indicate a certain relationship between these two species.

4. **Crepidotus crocophyllus** (Berk.) Sacc. — Figs. 20, 21, 45

Agaricus crocophyllus Berk., Lond. Bot. 6 (1847) 313. — *Crepidotus crocophyllus* (Berk.) Sacc., Syll. Fung. 5 (1887) 886. — Holotype: USA, Ohio, Waynesville, 4.IX.1844, *Lea* (K).

Crepidotus applanatus var. *crocophyllus* (Berk.) Pilát, Atl. Champ. Eur. 6 (1948) 35.

Crepidotus fulvifibrillosus Murr., N. Amer. Fl. 10 (1917) 153 (type: NYS, not seen). — *Crepidotus applanatus* var. *fulvifibrillosus* (Murr.) Pilát, Atl. Champ. Eur. 6 (1948) 35.

Agaricus dorsalis Peck, Ann. Rep. N.Y. St. Mus. 24 (1872) 69 (type: NY). — *Crepidotus dorsalis* (Peck) Sacc., Syll. Fung. 5 (1887) 883 (fide Singer, 1947, and Hesler & Smith, 1965).

Selected icones. Dermek, Fung. rar. Ic. col. 17 (1987) 19. — Mos. & Jül., Farbatl. Basidiomyc. 3 (1986) III Crepidotus 2. — Ricek, Z. Pilzk. 36 (1970) 207.

Pileus 10–35(–55) mm, first spathulate, later rounded-flabelliform, reniform to semicircular, suborbicular, with inflexed, later straight, not-sulcate margin, young densely squamulose, later subsquamulose to fibrillose, with orange-rufous or ferruginous to chestnut scales (M 7.5 YR 5/6, 6/6–6/8) on pallid, yellowish to tawny ground; point of attachment lateral or dorsal, tomentose to villose, ferruginous or orange; when dried ferruginous and very brittle. Lamellae, L = 10–20, l = 1–3, crowded, more or less narrow, subventricose, narrowly adnate, capucine-yellow or salmon-orange to apricot-orange or orange-rufous to cinnamon (M 7.5 YR 5/6–5/8, 6/8); edge fimbriate, whitish. Stipe absent. Flesh thin, white. Odour none, Taste mild to bitterish. Spore print ochraceous-tawny to cinnamon (M 7.5 YR 5/6–10 YR 5/6).

Spores 5.5–7 x 5.5–7 µm, Q = 1–1.1, mean volume 138 μm^3, globose to subglobose, contracted towards apiculus, warty-punctate, but almost smooth in optical section, baculate, with perispore, distinctly coloured. Basidia 26–36 x 5–8 µm, four-spored, clamped. Cheilocystidia 26–60 x 5–12(–15) µm, clavate, narrowly lageniform, sometimes almost cylindrical, (sub)capitate, flexuous, very rarely somewhat branched, often eroded. Pileipellis a cutis of repent, 4–6 µm wide, hyaline hyphae mixed with bundles of ascending 10–22 µm wide, finely incrusted, coloured hyphae; terminal cells of scale-forming hyphae conical or cylindrical, sometimes slightly flexuous, often thick-walled and without incrustations. Pigment yellow-brown in KOH, intracellular and incrusting in hyphae of squamules on pileus. Clamp-connections present in all tissues.

Habitat & Distribution – On hardwood (*Ulmus, Fraxinus, Fagus, Carpinus*). Submeridional to temperate. In Europe only known from central and southeastern parts. Rare. June–October.

Collections examined. AUSTRIA: Niederösterreich, Marchegg, March-Auen, 13 Sept. 1990, *Forstinger** (WU 8833); Oberösterreich, Molln, Inner-Breitenau, 21 Sept. 1986, *Forstinger* (WU 5628). — BULGARIA: Ropotamo, Sozopol, 16 June 1976 (L 978.330-130). — CZECHOSLOVAKIA: Moravia, Cahov, Lanzhot, 6 Oct. 1967, *Koncerova, Lazebnicek & Vagner* (BRNM 313035, 313030); 9 Aug. 1968, *Stankovicora* (BRNM 266935). — RUSSIA: Caucasus, Saken, 1928, *Singer* (W); Umpor reservate, 11 Aug. 1976, *Varasma* (TAA 95084).

CANADA: Ontario, Bismarck, 24 Sept. 1984, *Moser 84/236* (IB). — USA: Ohio, Waynesville, 4 Sept. 1844, *Lea* (K, type).

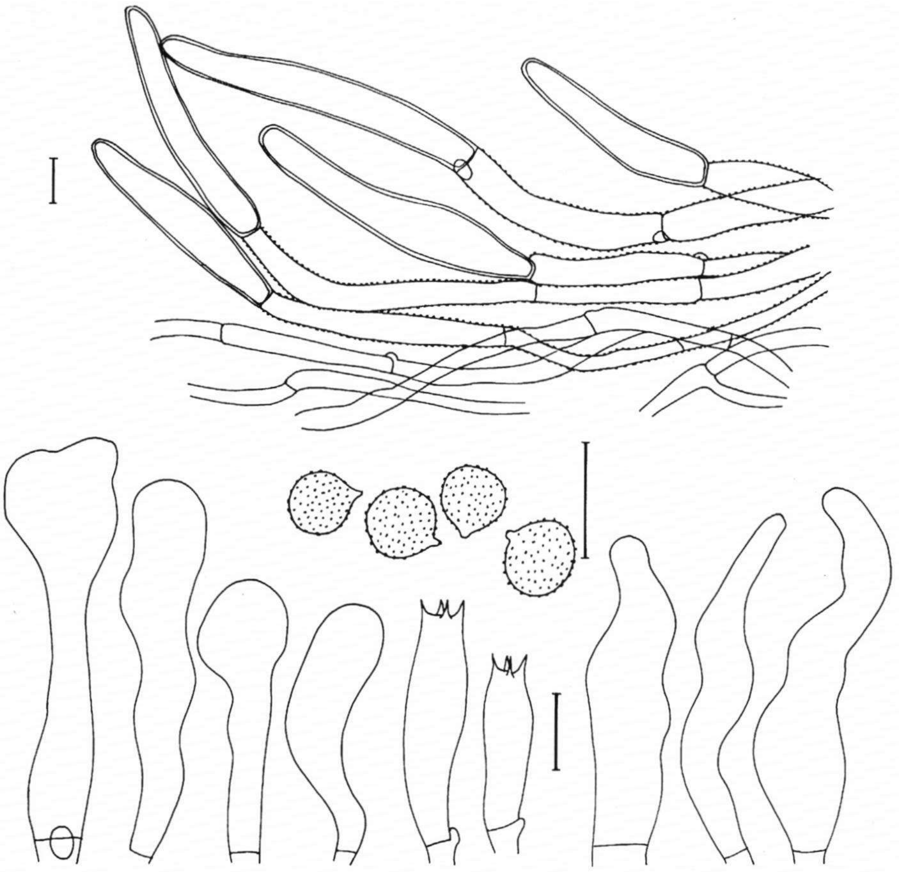


Fig. 45. *Crepidotus crocophyllus:* pileipellis, cheilocystidia (a) from coll. BRM 266935, (b) from coll. WU5628, basidia, spores.

Easily recognized because of the squamulose pileus, the salmon-orange lamellae, and the pileus which lacks any gelatinous layer. The spores, however, are in all features the same as in *C. applanatus* as can be seen in SEM: they exhibit the same type of ornamentation. Pilát (1948) has treated this species as a simple variety of *C. applanatus*, including also several other species described from North America.

I regard the presence of scales, the pigments and the spore size (see Table V, Fig. 36) as three independent characters and therefore I consider *C. crocophyllus* an autonomous species. The closely related American taxa need further critical investigation.

5. **Crepidotus ehrendorferi** Hauskn. & Krisai — Figs. 22, 46

Crepidotus ehrendorferi Hauskn. & Krisai, Pl. Syst. Evol. 161 (1988) 183. — Holotype: Austria, Wien, Lainzer Tiergarten, 1.IX.1986, *Mrazek* (WU 6554).

Selected icon. Hauskn. & Krisai, Pl. Syst. Evol. 161 (1988) 184.

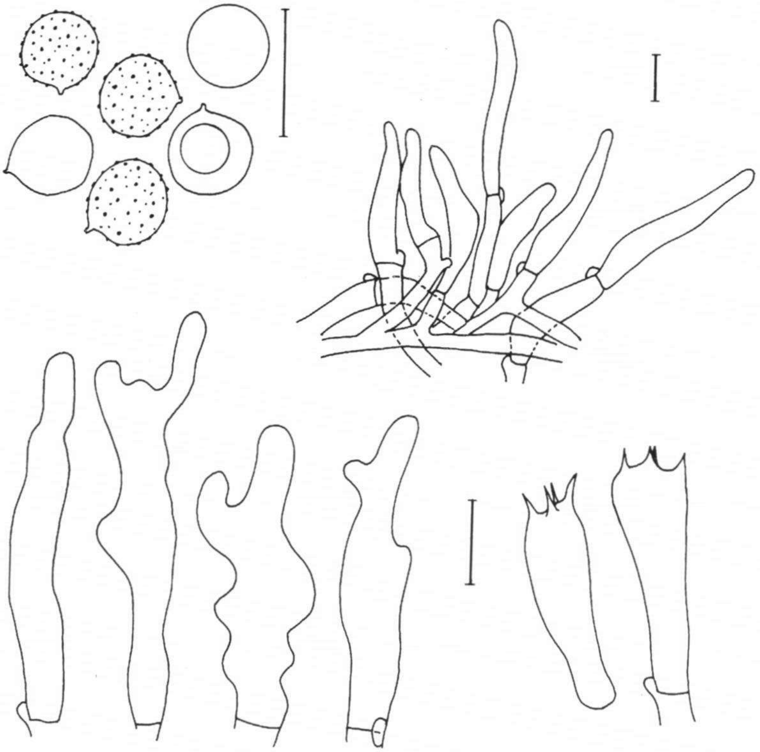


Fig. 46. *Crepidotus ehrendorferi:* spores, pileipellis, cheilocystidia, basidia.

Pileus 1.5–5.5 cm, semicircular, rounded flabelliform, soon irregularly conchate, young convex, later plano-convex, first with inflexed margin later becoming straight, indistinctly hygrophanous, tomentose, greyish orange to melon-yellow, light yellow with a distinct apricot hue when drying (M 7.5 YR 7/6-8/6), cream to pale orange when dried; strigose-fibrillose at point of attachment. Lamellae, L = 13–16, l = 2–3, crowded, subventricose to ventricose, when young pale orange, later becoming darker orange, salmon-red, light yellow and finally clay to grey-brown (M 7.5 YR 6/8); edge fimbriate and whitish. Stipe visible only in very young fruit-bodies, up to 3 mm long, subcentral, later eccentric. Flesh thin, distinctly orange below point of attachment, otherwise whitish-hyaline with slightly greyish tinge. Taste somewhat bitter-adstringent, grating. Smell none. Spore print clay to grey-brown (K & W 5D4–5).

Spores 5.5–7.0 x 5.5–7.0 µm, Q = 1–1.1, mean volume 134 μm^3, globose, punctate-spiny; walls moderately coloured. Basidia 25–35 x 5.5–7 µm, four-spored, clamped. Cheilocystidia 28–50 x 5–11 µm, cylindrical, narrowly utriform, flexuous, many with branching uppermost part, hyaline, thin-walled. Pileipellis a distinct trichoderm of 4–6 µm wide hyphae; terminal cells narrowly conical or cylindrical, occasionally branched or somewhat mucronate. Clamp-connections present in all tissues.

Habitat & Distribution – On hardwood *(Fagus)*. Temperate. Only known from type locality in Austria. June–October.

Collection examined. AUSTRIA: Wien, Lainzer Tiergarten, 25 July 1981, *Schnitz & Hausknecht** (WU 6653, topotype material).

The macroscopic description has been mainly copied from the original description. *Crepidotus ehrendorferi* is in respect to several characters an intermediate between *C. applanatus* and *C. crocophyllus*: (i) It shares with both the type of spore ornamentation as seen in SEM (see Fig. 22). (ii) The pileus exhibits distinct orange colours, yet is paler than in *C. crocophyllus*. (iii) The shape of the terminal cells resembles that of those cells of *C. crocophyllus*. (iv) It was found in an area where both *C. applanatus* and *C. crocophyllus* occur.

The pileipellis consists of a striking turf of erect hyphae, which is found neither in *C. applanatus* nor in *C. crocophyllus*, and is a unique character of *C. ehrendorferi*.

6. **Crepidotus carpaticus** Pilát — Figs. 16, 17, 47

Crepidotus carpaticus Pilát, Hedwigia 69 (1929) 140. — Holotype: Ucrainia, Corá Hora Mountains, Bogdan, VIII.1929, *A. Pilát* (PRM 23470).

Crepidotus wakefieldiae Pilát, Studia bot. cech. 10 (4) (1949) 152 (type: K).

Crepidotus harperi Sing., Mycologia 51 (1959, '1960') 586 (type: F).

Misapplied name. Crepidotus larsenii Pilát sensu Mornand & Bon, Bull. soc. Et. sci. Anjou 12 (1986) 37–51.

Selected descriptions. Reid, Trans. Brit. mycol. Soc. 48 (1965) 515, 517–518 (as *C. wakefieldiae*). Joss., Bull. trimest. Soc. mycol. Fr. 81 (1965) 542–546 (as *C. wakefieldiae*). Sing., Beih. Nova Hedwigia 44 (1973) 477 (as *C. carpaticus*).

Pileus 2–8 mm, rounded flabelliform, semicircular, multi-angled shell-shaped, convex to applanate, with narrowly inflexed margin when young, later with straight margin, often lobed, mat, felted-tomentose, in old specimen fibrillose and furrowed, never distinctly hygrophanous, cream-buff to colonial-buff or pale yellowish (M 10 YR 8/4–8/6), when

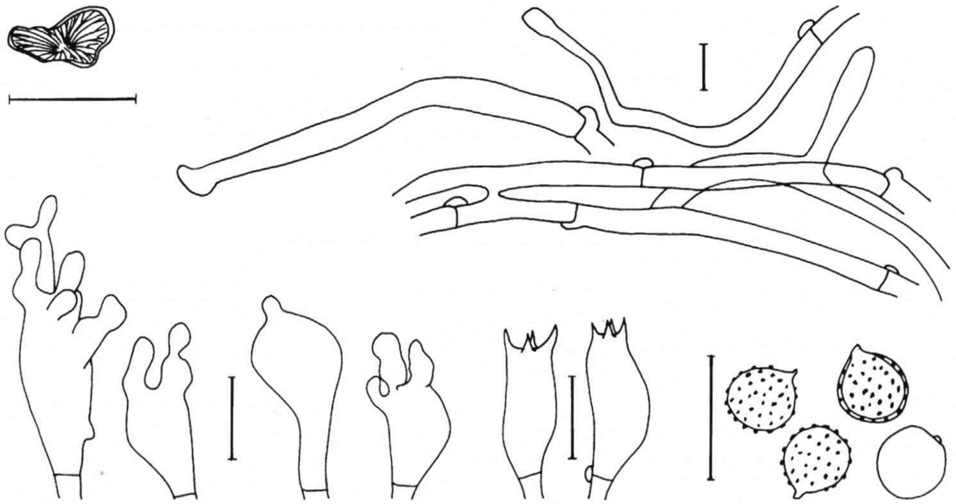


Fig. 47. *Crepidotus carpaticus:* fruit-body, pileipellis, cheilocystidia, basidia, spores.

dried cream to light ochraceous-buff; at point of attachment tomentose or villose. Lamellae, L = 8–16, l = 1–3, moderately close to subdistant, arcuate to subventricose, young decurrent then narrowly adnate, ferruginous, chestnut (M 5 YR 4/6–5/6); edge fimbriate, whitish. Flesh thin, brittle, cream when dry. Taste and odour none.

Spores 5–6.5 × 4.5–6 µm, Q = 1–1.2, mean volume 85 µm^3, globose, distinctly punctate, indistinctly warty in optical section, with perispore, moderately coloured; in dried specimen always a certain amount of collapsed and broken spores present. Basidia 17–26 × 5–10 µm, four-spored, clamped. Cheilocystidia 17–26 × 6–10 µm (including outgrowths), clavate, narrowly utriform, with short finger-like up to 3 µm wide protuberances, which may be branched, angled or flexuous. Pileipellis a transition between a trichoderm and a cutis with straight or slightly crooked to coiled, 3–6 µm wide, hyaline hyphae, with terminal cells ascending, cylindrical, often angled; near pileus margin some pileocystidia present. Pigment absent. Clamp-connections present in all tissues.

A type study of this species has been recently published (Senn-Irlet, 1992c).

Habitat & Distribution – On hardly decomposed bark of different hardwoods *(Acer, Alnus, Fraxinus, Quercus)*, according to literature also on stumps. Temperate. From lowlands up to subalpine zone. Rare. August–September.

Collections examined. FRANCE: dpt Vosges, Plombières, 22 Aug. 1939, *Josserand* (K); dpt Maine-et-Loire, Forêt de Longuenée, 3 Oct. 1981, *Mornand 8151B1* (herb. Mornand). — GREAT BRITAIN: Warwickshire, Moseley Bog, 13 Oct. 1985, *AWB 982* (K); Morayshire, Culbin, 9 Sept. 1963, *Reid* (L 982. 38-426). — IRELAND: Kylemore, West Galway, 13 Sept. 1985, *Scannell* (K). — SWITZERLAND: Kt. Bern, Brienz, Axalp, 9 Sept. 1972, *Candousseau* (herb. Bon). — UCRAINA: Corá Hora Mountains, Aug. 1928, *Pilát* (PRM 23470, holotype of *C. carpaticus*).

USA: Virginia, Bedford, May 1919, *Harper 1177* (F 1178, holotype of *C. harperi*).

The shape of the cheilocystidia makes *C. carpaticus* easy to distinguish from *C. applanatus*. It is interesting to note that young fruit-bodies may be yellow. Yellow pigments apparently occur in many different species of *Crepidotus* and are not restricted to *C. luteolus*.

This rare species is very well documented in literature (Pearson, 1952; Pilát, 1948; Reid, 1965; Josserand, 1965; Mornand & Bon, 1984 as *C. larsenii*).

Under the light microscope the spores of *C. carpaticus* do not differ from those of *C. applanatus*. SEM pictures, however, show differences in spore ornamentation. While *C. applanatus* always exhibits typical baculate spores, the ornamentation within *C. carpaticus* shows considerable variation, probably mainly dependent on the maturation process, as was demonstrated by Bigelow (1980) for *C. nyssicola* (Murr.) Sing. The spores of *C. carpaticus* are verruculose-truncate without or with small protuberances at the apex of warts. These protuberances were first observed by Pegler & Young (1972).

7. **Crepidotus roseoornatus** Pöder & Ferrari — Fig. 48

Crepidotus roseoornatus Pöder & Ferrari, Sydowia 37 (1984) 242. — Holotype: Italy, Novarra, Parco Naturale Lagoni di Mercurago, 30.VII.1983, *Ferrari* (IB 83/580).

Selected icones. Mos. & Jül., Farbatl. Basidiomyc. 3 (1986) III Crepidotus 4 (below).

Pileus 4–8 mm, semicircular, rounded flabelliform, convex, with strongly inflexed margin, tomentose, pale red, Venetian-red, pastel-red (K & W 10A3, 10A4); around point of attachment white tomentose-villose. Lamellae, L = 8–14, l = 1–3, narrow, up to 1 mm,

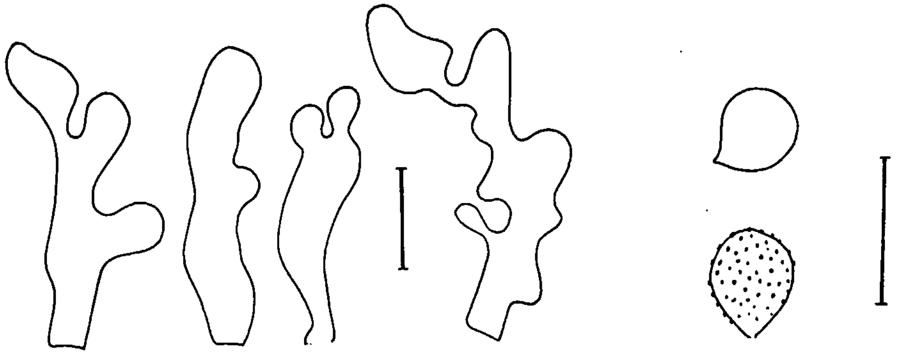


Fig. 48. *Crepidotus roseoornatus:* spores, cheilocystidia.

thickish, arcuate to subventricose, rarely furcate, pink to pale red (M 5 YR 7/6), later brownish from spores; edge fimbriate. Stipe for a long time visible, up to 1.5 mm, curved, white tomentose. Flesh pinkish white, thin. Smell and taste not recorded.

Spores 6–8 x 4.5–6 µm, Q = 1.2–1.5, mean volume 87 µm^3, ellipsoid, sometimes broadly oblong, punctate, verruculose to baculate; walls medium coloured, thin. Basidia 25–30 x 6–7 µm, four-spored, clamped. Cheilocystidia 20–38 x 6–12 µm, clavate, cylindrical, flexuous, branched, with finger-like protuberances, sometimes septate. Pileipellis a trichoderm of erect, 3.5–5 µm wide, filiform hyphae. Pigment reddish, intracellular, in basidia and young basidia, hymenophoral trama and pileus trama, sometimes as amorphous bodies.

Habitat & Distribution – On hardwood (*Robinia*) in submediterranean region. Known only from type locality in Italy. July.

Collection examined. ITALY: prov. Novarra, Parco Naturale Lagoni di Mercurago, 30 July 1983, *Ferrari 83/580* (IB).

The macroscopic description has been copied from the original description. However, in the original description cylindrical, flexuous pleurocystidia, 20–30 x 3–7 µm, are mentioned. I could not find such elements. Judging by the description, it seems possible that these elements simply were young basidia.

The description of *Crepidotus roseolus* Sing. (1973: 350) fits *C. roseoornatus* very well. Unfortunately, till now the type material could not be located (LIL, F) and consequently it could not be proved that *C. roseolus* is an older name for the present species.

8. **Crepidotus cinnabarinus** Peck — Figs. 14, 49

Crepidotus cinnabarinus Peck, Bull. Torrey bot. Club 22 (1895) 489. — Holotype: USA, Michigan, Ann Arbor, 24.IX.1894, *Peck* (NYS) (Not seen; studied by Singer, 1947: 68.) — *Crepidotus cinnabarinus* Møll. & Westerg., Friesia 3 (1945) 95 (nom. illeg.).

Crepidotus decurrens States, Bull. Torrey bot. Club 99 (1972) 250 (fide Luther & Redhead, 1981) (type: Northern Arizona University, not seen).

Selected icon. Svampe 11 (1985) 30.

Selected description. Luther & Redhead, Mycotaxon 12 (1981) 417–430.

Pileus 10–25 mm, rounded flabelliform, reniform, in younger specimen sometimes spatulate, convex to plano-convex, with inflexed margin only in younger specimen, mat, first tomentose-villose, later felted-tomentose, red to jasper-red or coral-red, remaining red in dried condition; at point of attachment sometimes red villose. Lamellae, l = 1–2, ventricose, adnexed, moderately crowded, pale brown to tawny (M 5 YR 6/8); edge serrulate, fimbriate, red. Stipe inconspicuous, eccentric, tomentose, red. Flesh thin, whitish. Smell and taste not recorded. Spore print cinnamon (M 7.5 YR 5/6).

Spores 6–8 × 5–6.5 µm, Q = 1–1.3, mean volume 133 μm^3, globose to broadly oblong, punctate, minutely warty in optical section, verruculose; walls faintly coloured. Basidia 20–28 × 5.5–11 µm, four-spored, clampless. Cheilocystidia 60–77 × 8–11 µm, conical, narrowly utriform, hyaline with reddish contents. Pileipellis mainly a trichoderm of loosely interwoven to erect, 4–8 µm wide, filiform hyphae; terminal cells tapering, often mixed with lageniform pileocystidia. Pigment red, soluble in KOH, intracellular in cheilocystidia, pileipellis and stipitipellis. Clamp-connections absent.

Habitat & Distribution – On hardwood (*Tilia, Fagus*). Submeridional to temperate. Rare. June–October.

Collections examined. DENMARK: Bornholm, Døndalens, 12 Oct. 1964, *Donk* (L 964.281-299). — FRANCE: dpt Maine-et-Loire, Vauldenay, *Bon* (herb. Bon); dpt Var, Mt. Baume, 8 Oct. 1960, *Huijsman* (L 960.110-176).

USA: New York, Otsega Co., Cherry Valley, 27 Sept. 1970, *Rogerson 986* and *228* (NY).

With its striking red colour, this species can hardly be confused with any other pleurotoid agaric. Because of the faint ornamentation, the spores have been described as smooth by Møller (1945) or "strongly punctate with heterogeneous wall" by Singer (1947). The SEM reveals the same type of ornamentation as is found in *C. variabilis* with isolated convex warts. The SEM pictures from the type specimen, published by Luther & Redhead (1981) agree perfectly with the material from southern France.

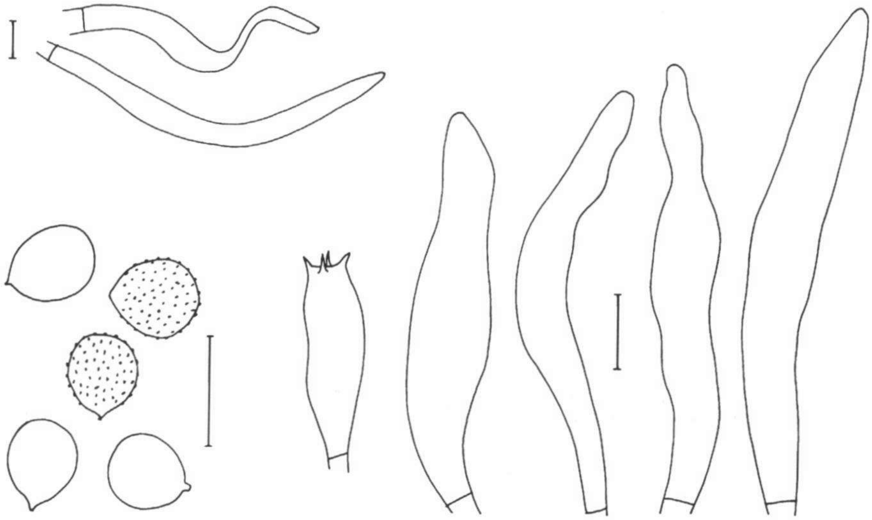


Fig. 49. *Crepidotus cinnabarinus:* pileocystidia, spores, basidium, cheilocystidia.

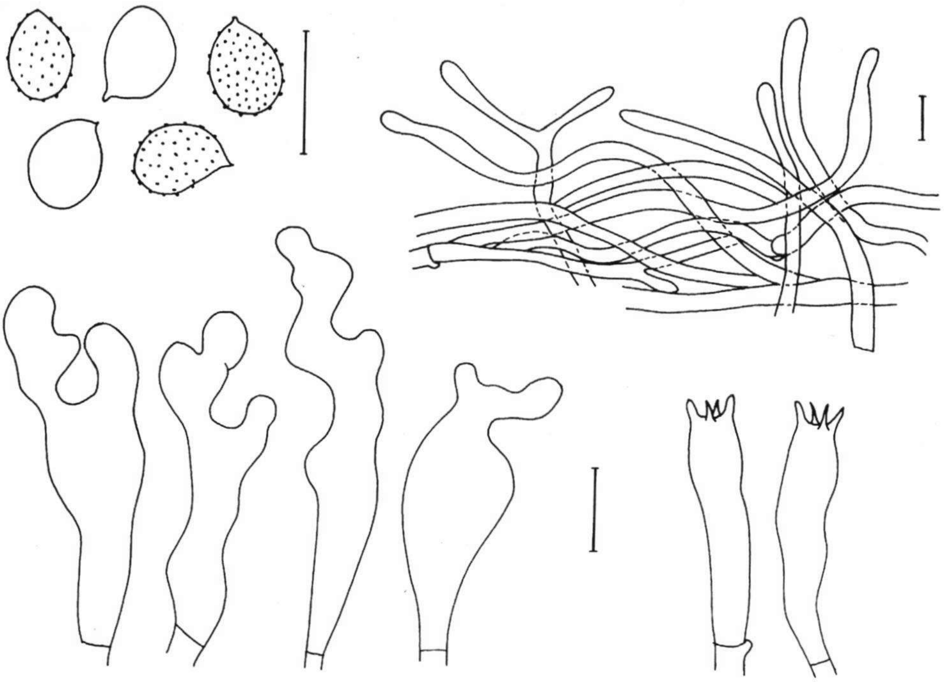


Fig. 50. *Crepidotus macedonicus:* spores, pileipellis, cheilocystidia, basidia.

9. **Crepidotus macedonicus** Pilát — Figs. 18, 50

Crepidotus macedonicus Pilát, Studia bot. cech. 10 (1949) 150. — Holotype: Macedonia, Sar Planina-Crni Kamen, VIII.1937, *Lindtner* (det. A. Pilát; PRM 489031; see Senn-Irlet, 1992c).

Pileus 40–70 mm, irregularly flabelliform, reniform with strongly inflexed, undate margin, not striate, pallid to dirty cream (M 10 YR 7/ 4 – 8 / 4), at point of attachment tomentose. Lamellae crowded, up to 4 mm broad, ventricose, white later orange-rufous, ochraceous-tawny (M 7.5 YR 6/8, 10 YR 6/4); edge fimbriate, concolorous. Stipe not distinct, eccentric, villose-tomentose. Flesh in the pileus remarkably thick, up to 7 mm, whitish, without gelatinous layer. Smell none, taste mild. Spore print colour not recorded.

Spores 6–8 × 4.5–6 µm, Q = 1.2–1.55, mean volume 99 µm^3, broadly oblong in frontal view, slightly inaequilateral in side view, punctate-warty, verruculose, walls moderately to strongly coloured. Basidia 26–33 × 6–7 µm, four-spored, clamped. Cheilocystidia 23–60 × 6–12 µm, narrowly utriform, clavate or cylindrical, in upper part branched, flexuous or angled, hyaline, thin-walled. Pileipellis a transition between a cutis and a trichoderm with 3–5 µm wide cylindrical hyphae; terminal cells straight or slightly bent or angled, undifferentiated. Pigment lacking; clamp-connections abundant.

Habitat & Distribution – On rotten wood of *Fagus* in the montane region. Submeridional. Only known from former Jugoslavia.

Collection examined. JUGOSLAVIA: Serbia, Mitrovatz, Tara Mountains, 11 Oct. 1960, *Horak 63/230* (ZT).

The macroscopic description has been copied and translated from Horak (1964). The fleshy pileus is a striking character of this species. The cheilocystidia and the spores as seen in the light microscope resemble strongly *Crepidotus cesatii*. However, the verruculose type of ornamentation as seen in SEM, the straight terminal cells of the pileipellis and the large, fleshy carpophore form a unique combination of characters of a species, which is only known from its type region.

10. **Crepidotus cesatii** (Rab.) Sacc.

Agaricus cesatii Rab., Flora 36 (1851) 564. — *Crepidotus cesatii* (Rab.) Sacc., Michelia 1 (1877) 2. — Holotype: Rabenhorst, herb. myc. no. 1506, Italy, Vercella, on *Platanus* (B).

Agaricus (Claudopus) variabilis var. *sphaerosporus* Pat., Tab. anal. Fung. (1884) 101. — *Crepidotus variabilis* var. *sphaerosporus* (Pat.) Quél., Enchir. Fung. (1886) 108 (lectotype: Roumeguère-Fungi gallici exsiccati no. 4007 as *Agaricus (Claudopus) sphaerosporus* Pat. sp. nov. (K), chosen here). — *Claudopus sphaerosporus* (Pat.) Sacc., Syll. Fung. 5 (1887) 734. — *Dochmiopus sphaerosporus* (Pat.) Pat., Hyménomyc. Eur. (1887) 113. — *Crepidotus sphaerosporus* (Pat.) J. Lange, Dansk bot. Ark. 9 (6) (1938) 52. — *Crepidotus cesatii* var. *sphaerosporus* (Pat.) Ortega & Buendia, Int. J. Myc. Lichenol. 4 (1989) 96.

Crepidotus variabilis var. *subsphaerosporus* J. Lange, Fl. agar. dan. 5 (1940) IV. — *Crepidotus subsphaerosporus* (J. Lange) Kühn. & Romagn., Fl. anal. Champ. sup. (1953) 76 (not valid); ex Hesler & Smith, N. Amer. Spec. Crepidotus (1965) 121.

Crepidotus kubickae Pilát, Studia bot. cech. 10 (1949) 50 (type: PRM 665290, see Senn-Irlet, 1992c).

Crepidotus subepibryus Pilát, Studia bot. cech. 10 (1949) 53 (type: PRM 14050, see Senn-Irlet, 1993).

KEY TO THE VARIETIES

1a. Spores broadly oblong, Q = 1.25–1.4; on conifers; hyphae of pileipellis mostly straight .... a. var. *subsphaerosporus*

b. Spores subglobose, Q = 1.1–1.25; on hardwood; hyphae of pileipellis often coiled b. var. *cesatii*

These two taxa are regarded as varieties of one species on account of their identical microscopical and macroscopical characters, except spore shape (see also Table VIII and Fig. 36).

10a. **Crepidotus cesatii** var. **cesatii** — Figs. 24, 25, 51, Plate 1c, d

Crepidotus cesatii var. *gothoburgensis* Pilát, Atl. Champ. Eur. 6 (1949) 63 (type: Fungi exs. suec., no. 908, Sweden, Göteborg, on *Lonicera tatarica*, August 1937, *T. Nathorst-Windahl*, PRM 149095; see Senn-Irlet, 1992c).

Agaricus (Claudopus) variabilis var. *sphaerosporus* Pat., Tab. anal. Fung. (1884) 101.

Crepidotus sphaerosporus (Pat.) J. Lange. — *Crepidotus cesatii* var. *sphaerosporus* (Pat.) Ortega & Buendia, Int. J. Mycol. Lichenol. 4 (1989) 96.

Selected descriptions. Mal. & Bert., Fl. Champ. sup. Maroc 2 (1975) 471–472. Stangl et al., Z. Mykol. 57: 126–133 (as *C. cesatii* and *C. sphaerosporus*).

Pileus 6–21 mm, rounded flabelliform, reniform, semicircular, circular, young ungulate, later convex to plano-convex, with distinctly inflexed, rarely crenate margin, mat, felted-tomentose, in older specimen at least at margin tomentose, white, in dried specimen

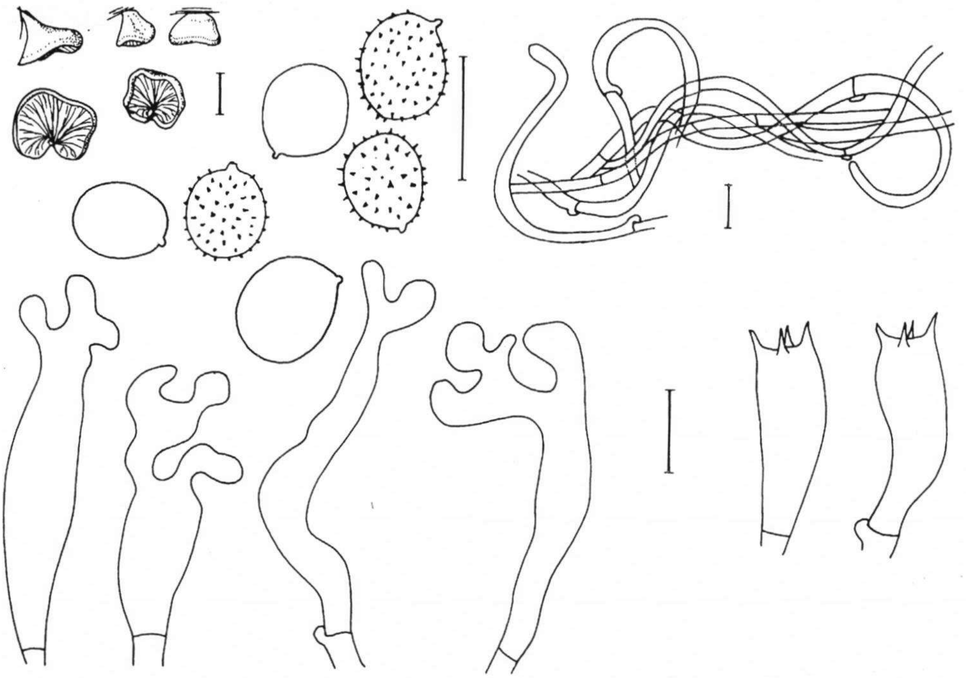


Fig. 51. *Crepidotus cesatii* var. *cesatii:* fruit-bodies, cheilocystidia, basidia, spores, pileipellis.

white to cream; at point of attachment often tomentose-villose. Lamellae, L = 8–14, l = 1–2, ventricose to broadly ventricose, (sub)distant or rarely moderately crowded, narrowly adnate, young white, later cream to salmon or pinkish cinnamon (M 10 YR 8/3–7/4–7/6, 7.5 YR 7/4–7/6–6/6); edge fimbriate and whitish. Flesh thin, white. Smell none, taste bitterish. Spore print vinaceous-buff, pinkish cinnamon or ochraceous-tawny (M 7.5 YR 7/4–6/6).

Spores 6.5–9 × 5.5–7.5 µm, Q = 1–1.3, mean volume 177 µm^3, globose to subglobose, more rarely broadly oblong, punctate-spiny, echinulate, spines clearly visible in optical section; walls moderately to faintly coloured. Basidia 20–30(–39) × 6–10 µm, four-spored, sometimes mixed with two-spored, clamped. Cheilocystidia (18–)24–50 × 5–10(–15) µm, narrowly utriform, cylindrical or clavate, in the upper part mostly branched, often antler-like, sometimes flexuous or angled, rarely septate, hyaline, thin-walled. Pileipellis a transition between a trichoderm and a loose cutis with interwoven, crooked or coiled hyphae; terminal cells undifferentiated, mostly straight, more rarely coiled, 2.5–6 µm wide; some collections with 30–40 µm wide subpellis of very densely packed repent hyphae. Pigment absent. Clamp-connections present in all tissues.

Habitat & Distribution – On twigs of all kinds of hardwood, very rarely on coniferous wood, mosses, in many different vegetation types. Submeridional to temperate. From lowlands up to higher montane zone (uppermost record: 1000 m). Very common. Throughout the year, but mainly in October.

Collections examined. BULGARIA: Petric, Gabrene, 17 Dec. 1958, *Hinkova* (SOM 342). — DENMARK: Løvstrup, Skov, 30 Sept. 1984, *Læssøe & Elborne* (C). — FRANCE: dpt Ht-Rhin, Neuf-Brisach, Ile Vogelgrün, 25 Oct. 1988, *Wilhelm 88/846* (BERN); dpt Maine-et-Loire, Parc de Moulévrier, 26 June 1983, *Mornand 8325B1* (herb. Mornand); dpt Paris, Bois de Vincennes, Nov. 1886, *Gaillard* (Roume guère - Fungi gallici exsiccati no. 4007 as *Agaricus (Claudopus) sphaerosporus* Pat. sp. nov.) (K); dpt Finistère, Crozon, Bronfoz, 20 Aug. 1980, *Mornand 8034B1* (herb. Mornand); Lanvéoc, Bois de Poulnic, 25 July 1983, *Mornand 8308B1* (herb. Mornand); ex herb. Kühner, sub nomen *Dochmiopus arboreus*, July 1927 (G 18418). — GERMANY: Baden-Württemberg, Kaiserstuhlgebiet, Wasenweiler Wald, 26 Oct. 1976, *A.F.M. Reijnders* (herb. Reijnders); Bayern, Herrsching/Ammernsee, 22 Sept. 1989, *Rücker 322-89* (SZU); Bad Mergentheim, 2 Jan. 1989, *Neeser*; Nordrhein-Westfalen, Minden-Porta Westfalica, 18 Oct. 1987, *Bock & Wollweber* (Münster). — ITALY: prov. Parma, Borgo Taro, Santa Donna, 26 Oct. 1982, *Moser 82/470* (IB); Pisa, Nov. 1903, *Arcangeli* (Saccardo - Mycotheca italica, no 1406) (L); Appenino, Reggiano, SW of Felina, 18 June 1978, *Moser 78/74* (IB); Vercella, c. 1855, *Cesati* (B, type). — LICHTENSTEIN: Rugellerriet, 8 May 1989, *Prongué 8933* (herb. Prongué); Mauren, 25 June 1989, *Prongué 8952* (herb. Prongué); Maurenberg, 11 July 1989, *Prongué 8981* (herb. Prongué); Ruggell, 29 Sept. 1989, *Prongué 89228* (herb. Prongué). — NETHERLANDS: prov. Flevoland, Oostelijk Flevoland, Abbert, 12 April 1989, *van Zanen* (BERN); Revebos, 6 Oct. 1981, *Bas* (L 982.103-188); prov. Gelderland, Nunspeet, Bloemkampen, 1 Oct. 1988, *Kuyper 2920* (WAG-W). — SPAIN: Madrid, 11 Dec. 1981, *Moreno 2275* (GDAC); Cadalso de los Vidrios, 6 Jan. 1982, *Moreno 2292* (GDAC); Los Santos de la Humosa, 12 March 1983, *Moreno 2505* (GDAC); Islas Canarias, Gran Canaria, Pinar de Tamadaba, 13 Jan. 1978, *Bañares 1172* (La Laguna); La Palma, Reserva Los Tiles, March 1989, *Bañares 4000* (La Laguna). — SWEDEN: Småland, Bringe tofta parish, Uddeberg, 12 Oct. 1947, *Lundell 2815* (Fungi Exsiccati suecici, praesertim Upsaliensis no. 2056, as *C. sphaerosporus*) (K). — SWITZERLAND: Kt. Aargau, Oberrüti, 5 April 1979; *Bächler 0504-79 Ba11* (MNLU); Tägerig, Pulvern, 11 Feb. 1990, *Gsell* (BERN); Kt. Bern, Bäriswil, Wolfstogel, 8 Sept. 1990, *Senn-Irlet 90/62* (BERN); Bern, Bremgartenwald, 1 Oct. 1982, *Irlet 82/391*; 12 Oct. 1987, *Senn-Irlet* 87/274 (BERN); Kappelen, Alte Aare, 10 Sept. 1988, *Senn-Irlet 88/359*; 25 Oct. 1988, *Senn-Irlet 88/458, 88/463, 88/464* (BERN); Köniz, Schwarzwassergraben, 21 Dec. 1982, *Irlet 82/469* (BERN); La Neuveville, 21 Feb. 1988, *Senn-Irlet 88/18* (BERN); Oltigen, Niederriedstausee, 27 Feb. 1983, *Irlet 83/7* (BERN); Rubigen, Aaredamm, 11 Dec. 1988, *Senn-Irlet 88/488, 88/490* (BERN); Rümligen, Taanwald, 14 Nov. 1987, *Senn-Irlet 87/300* (BERN); Zielbach, Gerlafinger Weiher, 18 Feb. 1990, *Senn-Irlet 90/2, 90/3* (BERN); ct. Genève, Moulin de Vers, 9 Jan. 1983, *Monthoux* (G 13002); ct. Jura, Boécourt, Cras des Fonnes, 25 Sept. 1989, *Chételat** (BERN); Kt. Luzern, Buchrain, Perlenbrücke, 7 Dec. 1976, Breitenbach *0712-76 Br1* (NMLU); Eigenthal, 1 Sept. 1978, *Zwyssig 0109-78 Br16* (NMLU); Entlebuch, Emmenmätteli, 1 Oct. 1988, *Senn-Irlet 88/425, 88/431* (BERN); Ettiswil, 27 Dec. 1985, *Bächler 2712-85 Ba1* (NMLU); ct. Neuchâtel, Creux du Van, Ferme Robert, 7 Oct. 1982, *Irlet 82/396* (BERN); cte Ticino, Auressio, 1 Nov. 1981, *Zenone* (Lugano 2333); Someo, 18 Oct. 1982, *Irlet 82/426* (BERN).

Based on macroscopical features alone, the pinkish tints of the young lamellae and the (sub)distant lamellae are characteristic. Microscopically the species is easy recognizable because of its antler-like cheilocystidia and the echinulate spores. *Crepidotus cesatii* var. *cesatii* is the most common European *Crepidotus* species.

I have seen several collections with small and very variable spores (< 6 µm). Each of these collections, however, had signs of a disturbed development, i.e., I found many two-spored basidia in collections in which the spore size and form varies considerably from 5–9 µm, from globose to oblong on the same lamella. In one collection *(Senn-Irlet 90/2)* cystidioles (pleurocystidia sensu Hesler & Smith, 1965) were present on the surface of the lamella. I interpret these abnormalities as being induced by drought or low temperatures and therefore without any taxonomic significance. *Crepidotus cesatii* var. *cesatii*, fruiting throughout the year and several times on the very same substrate, seems to be especially susceptible to climatic influences.

In the original description Rabenhorst describes the spores as "rotundis v. ovoides ..." which gave rise to a certain confusion about the spore shape and subsequently in the interpretation of this taxon. Although no original material is left (Pfister, 1977), it is clear that Patouillard described and depicted *Agaricus variabilis* var. *sphaerosporus* as a taxon with perfectly globose spores, leaving no doubt about the spore shape. Yet, he noticed coniferous twigs as substrate, which is very rare for this taxon. A re-examination of the holotype of *Agaricus cesatii* from Italy where it was growing on *Platanus*, showed globose spores of 7–9 µm. The type material in B is in very poor condition: almost nothing is left. The spores were found in droppings of insects close to the original place of the fruitbody. But there is no longer any doubt that Rabenhorst described a taxon with globose spores. Therefore *C. sphaerosporus* must be regarded as a synonym of *C. cesatii.*

Examination of the type of *C. cesatii* var. *gothoburgensis* Pilát (Senn-Irlet, 1992c) has shown that it fits perfectly into the range variation of *C. cesatii* var. *cesatii.*

10b. **Crepidotus cesatii** var. **subsphaerosporus** (J. Lange) Senn-Irlet, *comb. nov.* — Figs. 23, 52

Crepidotus variabilis var. *subsphaerosporus* J. Lange, Fl. agar. dan. 5 (1940) IV (basionym). — Neotype (designated here): Switzerland: Bern, Röthenbach, Schallenberg, 1000 m, *Abieti-Fagetum*, on fallen *Picea* twigs, 11.X.1989, *Senn-Irlet 89/240* (G). — *Crepidotus subsphaerosporus* (J. Lange) Hesler & Smith, N. Amer. Spec. Crepidotus (1965) 121.

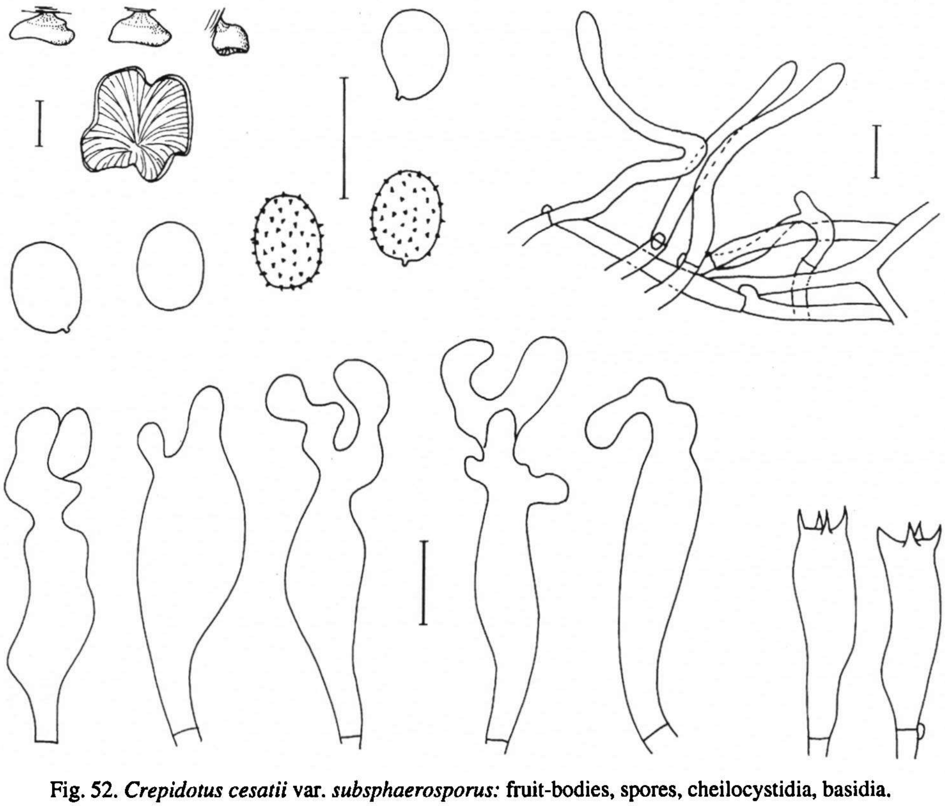


Fig. 52. *Crepidotus cesatii* var. *subsphaerosporus:* fruit-bodies, spores, cheilocystidia, basidia.

Crepidotus subepibryus Pilát, Studia bot. cech. 10 (1949) 50 (type PRM, see Senn-Irlet, 1993).

Crepidotus kubickae Pilát, Studia bot. cech. 10 (1949) 53 (type PRM, see Senn-Irlet, 1992c).

Misapplied names. Crepidotus cesatii var. *sphaerosporus* (Pat.) Ortega & Buendia sensu Ortega & Buendia, Int. J. Myc. Lichenol. 4 (1989) 96; sensu Norstein, Gen. Crepidotus Norway (1990) 94. — *Crepidotus cesatii* var. *cesatii* sensu Hesler & Smith, N. Amer. Spec. Crepidotus (1965) 125.

Pileus 2–26 mm, semicircular, more rarely rounded flabelliform, young often ungulate, later hemispherical to convex, with broadly inflexed margin, sometimes slightly lobed, sessile, laterally or dorsally attached, not striate except in very old, hygrophanous specimens, mat, felted-tomentose, tomentose, white and remaining so when dried; at point of attachment sometimes villose-tomentose. Lamellae, L = 12–20, l = 1–3, crowded to (sub)distant, narrow, up to 3 mm wide, ventricose, narrowly adnexed to adnate, young white, later cream to salmon, or pinkish cinnamon (M 7.5 YR 6/6, 6/8, 5/6); edge fimbriate and whitish. Stipe visible only in very young fruit-bodies. Flesh thin, white. Taste none or faintly adstringent. Smell none. Spore print ochraceous-tawny to fulvous or pinkish cinnamon (M 7.5 YR 6/6, 10 YR 5/6–6/6).

Spores 6–9 × 4.5–7 µm, Q = 1.2–1.45, mean volume 129 μm^3, broadly oblong to oblong or ovoid to obovoid in frontal view, echinulate with spines clearly visible in optical section, faintly to moderately coloured. Basidia 17–28(–32) × 6–10 µm, four-spored, clamped. Cheilocystidia (13–)22–60(–70) × 6–12 µm, narrowly utriform, cylindrical or clavate, in upper part mostly branched, often antler-like, sometimes flexuous or angled, hyaline, thin-walled. Pileipellis a transition between a trichoderm and a loose cutis, mostly with straight, sometimes coiled, 2.5–6(–8) µm wide, hyaline hyphae; terminal cells undifferentiated; at the margin with pileocystidia shaped like cheilocystidia. Pigment lacking. Clamp-connections in all tissues.

Habitat & Distribution – On twigs, branches and logs of coniferous wood (*Picea, Abies, Pinus*), rarely on hardwood. Temperate to boreal. From lowlands up to subalpine zone (highest altitude: 1670 m). Frequent only in boreal and upper montane-subalpine zones. August–November.

Collections examined. AUSTRIA: Salzburg, Flachgau, Fürstenbrunn, 13 Oct. 1989, *Rücker 373-89* (SZU); Tennengau, St. Koloman, 7 Aug. 1989, *Rücker 118-89* (SZU); Steiermark, St. Gallen, Hennau, 22 Sept. 1979, *Moser 79/589* (IB). — CZECHOSLOVAKIA: Moravia, Zdanicky les, 28 Nov. 1963, *Lazebnicek* (BRNM 333556). — ESTONIA: Jarvselja, Tartu, 30 Oct. 1985, *Kalamees* (TAA 124 561); Saaremaa, insula Kessulaid, 10 Oct. 1983, *Kalamees* (TAA 123268). — FINLAND: Sirkapuro, Oulankajoki, 24 Aug. 1978, *Moser 78/297* (IB). — FRANCE: dpt Doubs, Russey, Tourbière de la Chenalotte, 27 Aug. 1934, *Favre* (G 7939). — GERMANY: Bayern, Bayrischer Wald, 18 June 1986, *Luschka* (herb. Luschka 1254). — RUSSIA: Krasnodar, reserv. caucasicum, 7 Sept. 1975, *Kalamees* (TAA 94496). — SWEDEN: Gotland, Atlingbo, 5 Sept. 1950, *Petersson* (UPS). — SWITZERLAND: Kt. Bern, Bern, Bremgartenwald, 30 Oct. 1982, *Irlet 82/440* (BERN); Grindelwald, Itramerwald, 12 Oct. 1986, *Senn-Irlet 86/184* (BERN); Rüti b. Riggisberg, Gurnigelwald, 6 Sept. 1989, *Bieri & Senn-Irlet 89/173* (BERN); Rümligen, Taanwald, 15 Nov. 1987, *Senn-Irlet 87/301* and *87/302* (BERN); Kt. Graubünden, Cinuos-chel, Splars, 18 Aug. 1957, *Favre* (G 13807); Kt. Solothurn, Rüttenen, Weissenstein-Röti, 23 Oct. 1988, *Senn-Irlet 88/435* and *88/451* (BERN); ct. Vaud, Pont de Nant, 31 Aug. 1982, *Irlet 82/265* (BERN); Montreux-Pautex, 3 Oct. 1989, *Glausen 89/229** (BERN); ct. Valais, Verbier, 6 Nov. 1982, *Irlet 82/460* (BERN); neotype (designated here): Bern, Röthenbach, Schallenberg, 1000 m, *Abieti-Fagetum*, on fallen *Picea* twigs, 11 Oct. 1989, *Senn-Irlet 89/240* (G).

Favre (1935) and Pilát (1948) circumscribed *Crepidotus cesatii* as a species with a remarkable variability in spore shape, including the two variants accepted here. Singer (1947), also aware of that fact, guessed that *C. cesatii* may have 'mycoecotypes', one on hardwood, the other on coniferous wood. Other authors, however, accepted two (Norstein, 1990) or three taxa (Watling & Gregory, 1989; Moser, 1983) or even more taxa in this complex (Hesler & Smith, 1965).

After the study of about 100 collections from all over Europe, I am convinced that there exist but two taxa in Europe, separated on account of their spore shape. Small-spored collections are discussed in *C. cesatii* var. *cesatii.*

Some authors (e.g. Ortega & Buendia, 1989) stress the fact that the hyphae of the pileipellis are mostly straight in var. *subsphaerosporus* and mostly coiled in var. *cesatii.* Norstein (1990) was able to prove the correctness of that observation statistically by means of a Kruskal-Wallis one way analysis. My observations confirm this as a trend, but I could not prove it statistically.

A type study of *C. kubickae* Pilát (Senn-Irlet, 1992c) has shown that *C. kubickae* is based on old fruit-bodies of *C. cesatii* var. *subsphaerosporus.*

11. **Crepidotus variabilis** (Pers.: Fr.) Kummer — Figs. 12, 13

Agaricus variabilis Pers., Observ. mycol. 2 (1800) 46. — *Agaricus variabilis* Pers.: Fr., Syst. mycol. 1 (1821) 275. — *Crepidotus variabilis* (Pers.: Fr.) Kumm., Führ. Pilzk. (1871) 74. — *Claudopus variabilis* (Pers.: Fr.) Gill., Champ. Fr. (1876) 426. — *Dochmiopus variabilis* (Pers.: Fr.) Pat., Hyménomyc. Eur. (1887) 113. — Neotype (designated here): Netherlands, prov. Gelderland, Winterswijk, 'Willinkswerst', on dead fallen branches (*Fraxinus*) in mixed deciduous forest on calcareous loam, 30.IX.1973, *C. Bas 6182* (L 973.164-257).

Crepidotus variabilis var. *microsporus* P. Karst., Bidr. Känn. Finl. Nat. Folk 32 (1879) 289. — *Dochmiopus microsporus* (P. Karst.) P. Karst., Finlands Basitsvampar (1889) 158 (type: Stockholm, Herbarium Romell 10218).

Agaricus sessilis Bull., herb. France (1783–84) pl. 152 (iconolectotype). — *Derminus sessilis* (Bull.) Schroet., Krypt.-Fl. Schlesien 1 (1889) 578. — *Hyporrhodius sessilis* (Bull.) Migula, Krypt.-Fl. 3 (2/2) (1912) 556.

Crepidotus sessilis Britz., Ber. naturwiss. Ver. Schwaben Neuburg 31 (1894) 167.

Agaricus niveus Sow., Col. Figs., Engl. Fungi (1797) 97 (non *Crepidotus niveus* Velen. 1947).

KEY TO THE VARIETIES

1a. Cheilocystidia small, 20–40 × 7–12 µm, spores 5.5–7.5 × 2.5–4 µm
a. var. *variabilis*
b. Cheilocystidia long, cylindric, flexuous, branched, 25–70 × 4–6 × 2–3 µm, spores 6–8 × 3–4.5 µm .... b. var. *trichocystis*

11a. **Crepidotus variabilis** var. **variabilis** — Fig. 53, Plate 2a, b

Crepidotus variabilis var. *variabilis* sensu Hesler & Smith, N. Amer. Spec. Crepidotus (1965) 108.

Crepidotus variabilis var. *microsporus* P. Karst., Bidr. Känn. Finl. Nat. Folk 32 (1879) 289. — *Dochmiopus microsporus* (P. Karst.) P. Karst., Finlands Basitsvampar (1889) 158 (type: Stockholm, herb. Romell 10218).

Selected description. Favre, Schweiz. Z. Pilzk. 13 (1935) 146.

Pileus 5–10 mm, rounded flabelliform to reniform, semicircular, plano-convex, with margin involute to inflexed but becoming lobed, undate and straight, tomentose, becom-

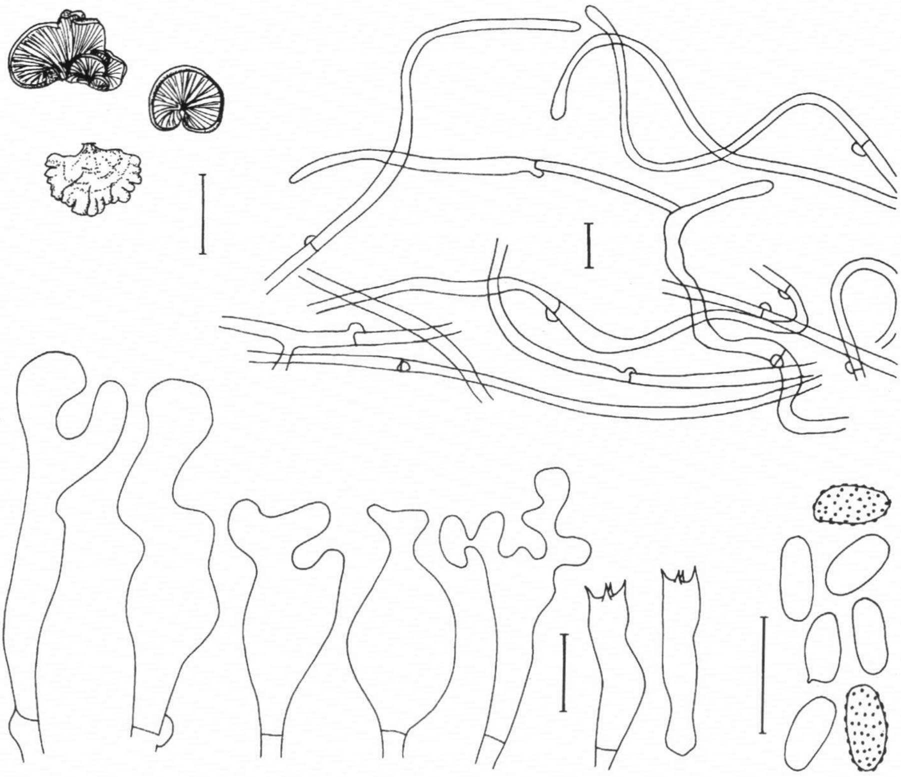


Fig. 53. *Crepidotus variabilis* var. *variabilis*: fruit-bodies, pileipellis, cheilocystidia, basidia, spores.

ing felted or silky-smooth, white, remaining so when dried but in one case pale yellow; at point of attachment sometimes tomentose-villose. Lamellae, L = 14–18, l = 1–2, moderately broad, up to 3 mm wide, moderately crowded, subventricose, narrowly adnexed, white, soon pale ochraceous-salmon or ochraceous-tawny to finally cinnamon-brown (M 10 YR 8/4, 7/6–6/8, 7.5 YR 7/6–6/6); edge fimbriate, whitish. Stipe only visible in very young specimen. Flesh thin, whitish. Taste mild. Smell none or fungoid. Spore print pinkish cinnamon to cinnamon (M 7.5 YR 6/6-5/6).

Spores 5.5–7.5 × 2.5–4 µm, Q = 1.6–2.3, mean volume 37 μm^3, elongate to (sub-) cylindrical or oblong in frontal view, cylindrical in side view, distinctly punctate-warty, verruculose, moderately coloured. Basidia 17–26 × 4.5–7 µm, four-spored, clamped. Cheilocystidia 20–24(–58) × 5–12(–15) µm, clavate, obpyriform, flexuous, mostly branched, angulate. Pileipellis a trichoderm of straight, flexuous to distinctly coiled, filiform, 2.5–5 µm wide hyphae; terminal cells never differentiated. Pigment lacking. Clamp-connections present in all tissues.

Habitat & Distribution – Gregarious, often imbricate on hardwood, rarely on coniferous woods, mostly on twigs, litter, sometimes on herbaceous stems. Meridional to boreal. From lowlands to montane zone. Locally frequent. August–January.

Collections examined. AUSTRIA: Steiermark, Burgau, 21 Sept. 1972, *Riedl* (W 25130). — BELGIUM: Louette-Saint-Pierre, *Aubert* (Westend & Wall. herb. Crypt. Belg. no. 1283 as *Agaricus variabilis*) (K); Bouillon, 12 Sept. 1957, *Koster 6315* (L). — BULGARIA: Svinecni, Mt. Zozensva Planina, 28 Aug. 1975, *Hinkova* (SOM 9420). — ESTONIA: Rakvere, Nova Rihula, 11 Aug. 1958, *Kalamees* (TAA 70992); Ralkula, 8 Aug. 1958, *Kalamees* (TAA 70958). — FRANCE: dpt Finistère, Lanvéoc, Bois à Postic, 24 Dec. 1974, *Mornand 74130B1* (herb. Mornand); Lanvéoc, Bois du Poulmic, 25 Dec. 1983, *Mornand 8306B1* (herb. Mornand); dpt Somme, Ste. Segrée, Aug. 1966, *Bon 60801* (herb. Bon); dpt Doubs, Tourbière de Remoray, 20 Aug. 1939, *Favre* (G 7932); Russey, Tourbière de Plaimbois, 7 Sept. 1935, *Favre* (G 7931); dpt Pas-de-Calais, Forêt de Desvres, 17 Oct. 1991, *Senn-Irlet 91/247* (BERN). — GERMANY: Baden-Württemberg, Sandhausen, 15 May 1983, *Winterhoff* (herb. Winterhoff); Saarland, Neunkirchen, Elzenberger Mühle, *Schmitt 7116* (herb. Schmitt); Brandenburg, Triglitz, 6 Oct. 1910, *Jaap* (Otto Jaap Fungi selecti no. 538 as *Crepidotus cesatii*) (BERN); Bredower Forst bei Nauen, 7 Oct. 1906, *Sydow* (Sydow-Mycotheca germanica no. 551 as *Crepidotus chimonophilus*) (BERN); Lothringen, Schoenecker Wald bei Forbach, Sept./Oct. 1912, *Ludwig* (Sydow-Mycotheca germanica no. 1202 as *Crepidotus chimonophilus*) (BERN); Nordrhein-Westfalen, Sennelager-Roterbach, 8 Oct. 1988, *Sonneborn 4118* (herb. Sonneborn). — NETHERLANDS: prov. Drente, Wijster, 7 Nov. 1958, *Barkman 6001* (WAG-W); Mantinger bos, 22 Oct. 1958, *Barkman 5855* (WAG-W), Schoonloer strubben, 19 Oct. 1976, *Jansen 181* (WAG-W); Beilen, Brunstinger plas, 23 July 1984, *Arnolds 5153* (WAG-W), Dwingeloo, 25 Sept. 1975, *Arnolds* (WAG-W 3413); prov. Gelderland, Winterswijk, 30 Sept. 1973, *Bas 6182* (L 973.164-257); prov. Noord-Brabant, Dorst, 18 Dec. 1966, *Jansen* (L 966.342-002); *Jansen & Maas Geesteranus* (L 956.148-143); prov. Noord-Holland, Hilversum-Corversbos, 20 Jan. 1975, *Daams* (L 974.176-349); Leijduin, 16 Aug. 1968, *Kits van Waveren* (L 986.112-123); neotype (designated here): prov. Gelderland, Winterswijk, 'Willinkswerst', on dead fallen branches (*Fraxinus*) in mixed deciduous forest on calcareous loam, 30 Sept. 1973, *C. Bas 6182* (L 973.164-257). — POLAND: Bialowieza National Forest, 17 Oct. 1981, *Pegler* (K). — SPAIN: Madrid, El Pardo, 27 Dec. 1978, *Alvarez* (GDAC 1631); Hervás, Cáceres, 7 Nov. 1976, *Moreno 1643* (GDAC). — SWEDEN: Upland, Bondkyrka, Hammarby, 17 Sept. 1937, *Lundell* (Fungi Exsiccati Suecici praesertim Upsaliensis no. 531 as *C. variabilis*) (K). — SWITZERLAND: Kt. Bern, Bern, Bremgartenwald, 30 Oct. 1982, *Irlet 82/439*, 8 Oct. 1991, *Senn-Irlet 91/197* (BERN); ct. Jura, Boécourt, sur la montagne, 25 Sept. 1989, *Chételat* (BERN); Les Ordons, Oct. 1990, *Chételat 26* (BERN), Bassecourt, Mt. Choisi, 26 Sept. 1989, *Chételat 21* (BERN); cte Ticino, Malvaglia, 22 Oct. 1981, *Lucchini 1666* (Lugano); ct. Vaud, Le Mont sur Lausanne, 17 June 1979, *Clémençon 79/13* (LAU).

Crepidotus variabilis belongs to those species with a white pileus and fairly crowded lamellae that are quite impossible to identify without microscopical examination. The lobed, undate margin, however, proved to be a rather good indication. The cylindrical spore-shape is the best indicative character for this species. *Crepidotus variabilis* has the smallest spores in respect to a calculated volume of 36.5 µm^3.

Already Pilát (1948), after having examined several distributed exsiccates, emphasized the fact that *C. variabilis* has often been misinterpreted. I share with Norstein (1990) the suspicion that Fries himself may have included other small, white *Crepidotus* species, such as *C. cesatii*, *C. subverrucisporus* and probably *C. lundellii*, in his concept of a 'variable' species aptly named *Agaricus variabilis*, as these species are rather common in southern Scandinavia (see Norstein, 1990).

11b. **Crepidotus variabilis var. trichocystis** Hesler & Smith — Fig. 54

Crepidotus variabilis var. *trichocystis* Hesler & Smith, N. Amer. Spec. Crepidotus (1965) 108. — Holotype: USA, Michigan, Burt Lake, Maple Bay, 18.VII.1963, *Smith 66819* (MICH) (not seen).

Macroscopical characters as var. *variabilis*.

Spores 6.5–9 × 3–4.5 µm, Q = 1.6–2.2, mean volume 54 µm^3, elongate, to (sub-) cylindrical, in front view oblong, in side view cylindrical, distinctly punctate-warty, ver-

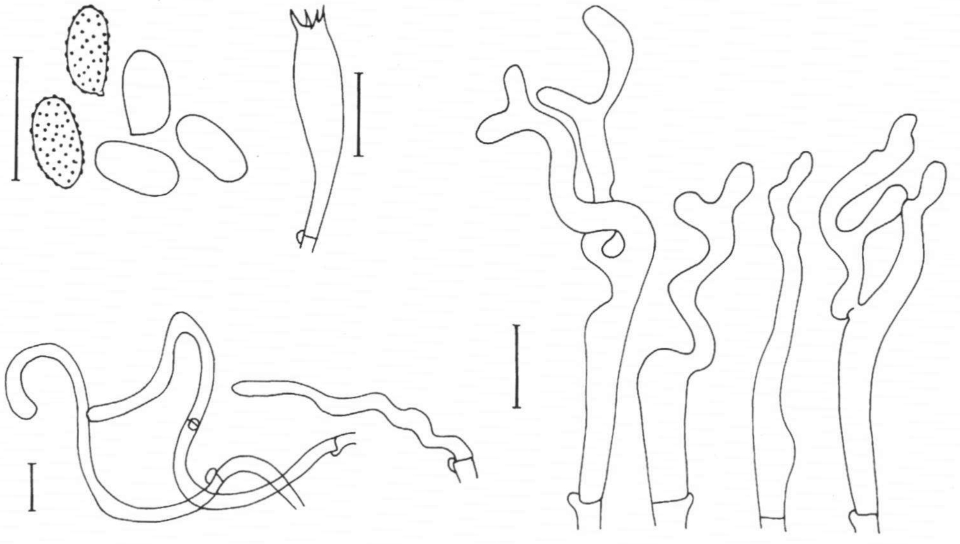


Fig. 54. *Crepidotus variabilis* var. *trichocystis:* basidium, pileipellis, spores, cheilocystidia.

ruculose, moderately coloured. Basidia 25–30 × 5.5–6.5 µm, clamped. Cheilocystidia 25–70 × 4–6 (in upper parts 2–3) µm, (sub)cylindrical to narrowly lageniform, flexuous, frequently branched. Pileipellis a trichoderm of straight, flexuous to distinctly coiled, filiform, 2–4 µm wide hyphae; terminal cells never differentiated. Pigment lacking. Clamp-connections present in all tissues.

Habitat & Distribution – On twigs of hardwood. Submeridional. In Europe only known from France.

Collections examined. FRANCE: dpt Hérault, Roquehaute pr. Agde, 21 Nov. 1978, *Monthoux* (G 15569).

This variety is separated from the type variety by Hesler & Smith (1965) on account of the shape of the cheilocystidia and the somewhat wider spores. Exactly these characters can be found in this collection from southern France. The SEM reveals the same type of ornamentation as the type variety. This single collection does not allow any statement based on statistics.

Section **Crepidotellae** Hesler & Smith

Crepidotus sect. *Crepidotellae* Hesler & Smith, N. Amer. Spec. Crepidotus (1965) 110 (type: *C. submollis* Murr.).

Crepidotus sect. *Versuti* Hesler & Smith, N. Amer. Spec. Crepidotus (1965) 35 (type: *Crepidotus versutus* (Peck) Sacc.).

Crepidotus sect. *Betulae* Hesler & Smith, N. Amer. Spec. Crepidotus (1965) 99 (type: *Crepidotus betulae* Murr.).

Spores always longer than broad, oblong, ellipsoid, ovoid or amygdaliform, smooth, rugulose or vermiculose; fruit-bodies white or yellow.

Subsection **Fibulatini** Sing.

Crepidotus subsect. *Fibulatini* Sing., Lilloa 13 (1947) 94 (type: *Crepidotus albidus* Ell. & Ev.).

Spores ellipsoid, oblong, ovoid or amygdaliform, ornamentation of spores rugulose or vermiculose; hyphae with or without clamp-connections.

12. **Crepidotus lundellii** Pilát — Figs. 8, 9, 55

Crepidotus lundellii Pilát in Lund. & Nannf., Fungi exs. suec., fasc. V-VI (1936) 10. — Lectotype (designated here): Fungi exs. suec. no. 220 (K).

Crepidotus amygdalosporus Kühn. in Kühn. & Romagn., Bull. Soc. Nat. Oyonnax 8 (1954) 74. — Lectotype, designated here by Senn-Irlet & Monthoux: France, Boissy, 3.VIII, *Kühner* (G 18394).

Crepidotus subtilis P.D. Orton, Trans. Brit. myc. Soc. 42 (1960) 221 (type: Great Britain, Whitlands Landslip, Rousdon, Devon, 2 Dec. 1958, *Orton 1514* (E)).

Crepidotus versutus var. *subglobisporus* Pilát, Sb. Nar. Mus. Praze II B (3) (1940) 74 (type: Ucraina, Kobylecká Polana, Svidovec-Krajná Rika, 600–1000 m, in *Fagus* virgin forest, July–August 1937, *Pilát* (PRM 23529)).

Crepidotus lundellii var. *subglobisporus* (Pilát) Pilát, Atl. Champ. Eur. 6 (1949) 50.

Misapplied names. Crepidotus inhonestus P. Karst. sensu P.D. Orton, Trans. Brit. mycol. Soc. 41 (1960) 221; Pegler & Young, Kew Bull. 27 (1972) 321; Norstein, Gen. Crepidotus Norway (1990) 83.

Selected icon. Mos. & Jül., Farbatl. Basidiomyc. 3 (1986) III Crepidotus 3.

Selected descriptions. Norstein, Gen. Crepidotus Norway (1990) 83. Stangl et al., Z. Mykol 57 (1991) 121–124, 138–141 (as *C. autochthonus, C. caspari, C. lundellii and C. sambuci*).

Pileus 4–30(–50) mm, circular, semicircular, rounded flabelliform to reniform, young ungulate, campanulate, later plano-convex, sessile, laterally or dorsally attached, with margin shortly inflexed, becoming straight and somewhat lobed, felted-tomentose, later silky except at tomented margin, in very old specimen hygrophanous, white to cream-buff or chamois (M 2.5 Y 8/6, 10 YR 8/4–7/4–7/6), with similar colours when dried; point of attachment often tomentose-villose, white. Lamellae, L = 12–18, l = 1–5, narrowly to moderately broad up to 3.5 mm, (moderatley) crowded, subventricose to ventricose, narrowly adnexed to free, pale whitish clay, later brown to snuff-brown, without pinkish tints (M 2.5 Y 7/4–6/6, 7.5 YR 6/6, 10 YR 8/3–8/4, 7/6–6/6); edge fimbriate (lens). Stipe only in very young fruit-bodies visible, < 1 mm, white. Flesh rather thin, up to 2 mm wide, white. Smell sometimes raphanoid. Taste slightly farinaceous. Spore print ochraceous-tawny to buffy brown (M 10 YR 5/4–6/6).

Spores 6–9.5 × 4–6 µm, Q = 1.3–1.7, mean volume 112 µm^3, oblong to ovoid in frontal view, sometimes slightly amygdaliform in side view, marbled to faintly rugulose; walls rather faintly coloured. Basidia 20–37 × 5–10 µm, four-spored, clamped. Cheilocystidia 28–65(–90) × 6–12(–19) µm, clavate, narrowly utriform, more rarely capitate, branched or septate, hyaline, thin-walled, rarely with some granular bodies. Pileipellis a transition between a cutis and a trichoderm of loosely interwoven, cylindric, straight to coiled, 4–6 µm wide hyphae; segments of shorter, cylindrical, up to 10 µm wide hyphae with slightly thicker walls may be present; terminal cells towards the margin often broad and clavate, towards the point of attachment cylindric, 2–4 µm wide; pileocystidia frequent; several hyphal segments with yellow contents or with many refractive bodies; further pigment lacking. Clamp-connections present in all tissues.

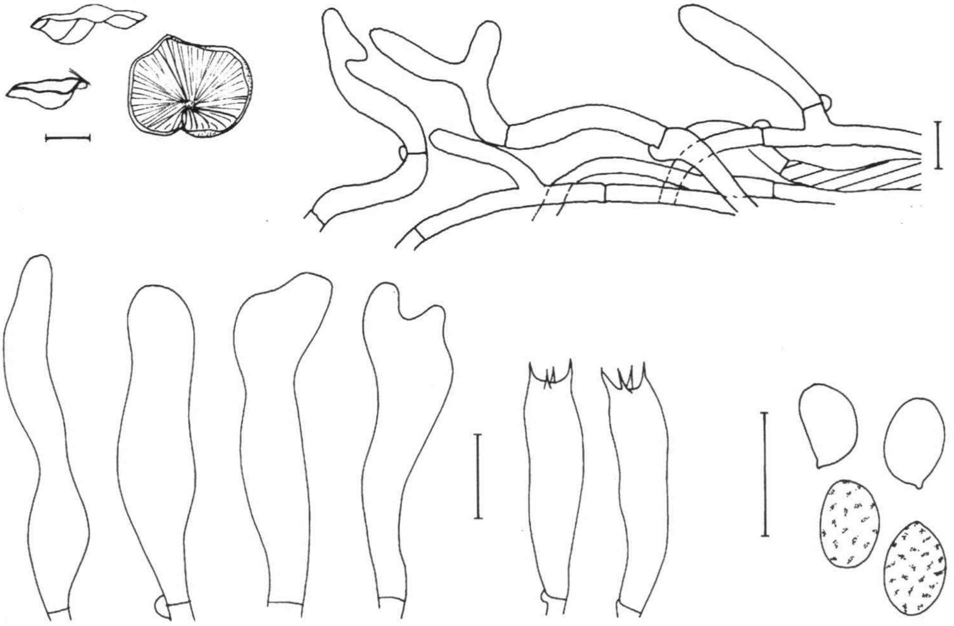


Fig. 55. *Crepidotus lundellii:* fruit-bodies, pileipellis, cheilocystidia, basidia, spores.

Habitat & Distribution – On hardwood twigs and branches, rarely on logs or herbaceous stems, mosses, litter, coniferous wood or on bare (?) soil. Submeridional to boreal. From lowlands to subalpine zone (highest altitude 1500 m). Frequent, probably common in alluvial forests. Throughout the year, mainly in August.

Collections examined. AUSTRIA: Kärnten, Sattnitz, bei Stemmeritsch, 21 Sept. 1969, *Moser 68/124* (IB); Salzburg, Pinzgau, Kaprunertal, 25 July 1992, *Senn-Irlet 92/118* (BERN). — BULGARIA: Kokaljave, Svinecni, Mt. Zozenska planina, 28 Aug. 1975, Hinkova (SOM 9420). — ESTONIA: Haapsalu, reserv. Matsalu, 21 July 1979, *Vaasma* (TAA 113162); Viljawdi, Loodi, 10 Aug. 1988, *Kalamees & Vaasma* (TAA 143772). — FRANCE: dpt Maine-et-Loire; Vaudelnay, Bois de Chanteloup, 3 Oct. 1982, *Mornand 8127* (herb. Mornand); Baunė, Les Bruères, 7 Nov. 1989, *Mornand* (herb. Mornand); dpt Somme, Hangest vers Conde-Folies, 14 Oct. 1979, *Bon 79101014* (herb. Bon). — GERMANY: Baden-Württemberg, Weisweiler, 4 Oct. 1982, *A.F.M. Reijnders 67* (herb. Reijnders); Untergronbach, 11 June 1984, *Winterhoff 84108* (herb. Winterhoff); Nordrhein-Westfalen, Borgentreich-Rösebecker Bruch, 24 Oct. 1982, *Runge* (Münster); Saarland, Eimerdorf, 28 July 1982, *Schmitt 9526* (herb. Schmitt); Bayern, München, 9 Oct. 1966, *Einhellinger* (M). — GREAT BRITAIN: Middlesex, Ruislip woods, 9 Sept. 1992, *Senn-Irlet 92/207* (BERN). — LICHTENSTEIN: Schaan, 10 May 1989, *Prongué 8935* (herb. Prongué). — NETHERLANDS: prov. Flevoland, Oostelijk Flevoland, Larserbos, 21 Sept. 1988, *Tjallingii* (L 983.353-110); prov. Gelderland, Buren, 23 Oct. 1971, 22 July 1974, *Tjallingii* (L 982.216-933, 982.216-972), idem, Kleiputten, 25 Aug. 1982, *Kuyper 2126* (L); prov. Limburg, Linne, 20 Sept. 1969, *Benjaminsen 690921*; prov. Noord-Holland, Amsterdamse bos, 8 Dec. 1960, *Kits van Waveren* (L 986.112-109); Amsterdam, Amsterdamse Bos, 1 Nov. 1954, *Reijnders* (L 954.292-064); prov. Overijssel, Ommen, 29 Sept. 1977, *Kuyper 2916* (WAG-W); prov. Utrecht, Zeist, Appellaantje, 25 Aug. 1982, *Bas 7806* (L), Linschoten, 2 July 1982, *Kuyper 2033* (L); Winterswijk, 'Bekendelle', 29 Sept. 1973, *Bas 615* (L); prov. Zeeland, Hontenisse, Kruisdorp, 23 Nov. 1981, *Meijer* (L 981.180-132); prov. Zuid-Flevoland, Eind, Jan. 1989, *Chrispijn* (WAG-W); prov. Zuid-Holland, Voorschoten, 'Ter Wadding', 31 Aug. 1985, *Bas 8374* (L); Gieten, 'De kleine Houten', 3 Nov. 1982, *Arnolds 4962* (WAG-W). — SWEDEN: Uppland, Djurö, Runmarö, 19 Aug. 1949, *Rydberg* (S); Almunge parish, near Harparbol lund, 15 Sept. 1935, Lundell & Ålberg Fungi exs. suec. no. 220) (neotype, K). — SWITZERLAND: Kt. Aargau, Niederrohrdorf, Taumoos, 1 Dec. 1984, *Gsell* (BERN); Kt. Bern, Biel-Beaumont, Nov. 1989, *Aeberhard 90/36* (BERN); Kappelen, alte Aare, 9 Sept. 1988, *Senn-Irlet 88/359*, 26 Oct. 1988, *Senn-Irlet 88/462, 88/460, 88/459* (BERN); Lenk, Rohrbach, 29 June 1948, *Favre* (G 7894); Neuenegg, Forst, 5 Sept. 1988, *Senn-Irlet 88/349* (BERN); ct. Jura, Boécourt, Les Moulins, 5 Oct. 1989, *Chételat* (BERN); Les Ordons, 6 Oct. 1989, *Chételat* (BERN); sur Paicheux, 15 Sept. 1989, *Chételat* (BERN); Kt. Luzern, Entlebuch, Emmenmätteli, 1 Oct. 1988, *Senn-Irlet 88/426, 88/424* (BERN); Immensee, Volgisried, 23 Nov. 1987, *Mürner 2311/RM* (NMLU); Schiltwald-Grundwald, 14 June 1979, *Bächler 1406-79 Ba14* (NMLU); Emmen, 3 July 1979, *Bächler 0307-79 Ba1* (NMLU); Haltikon-Meggerwald, 30 Oct. 1989, *Kränzlin 3010-89* (NMLU); Kt. Schwyz, Muotathal, Bödmerenwald, 3 Oct. 1991, *Senn-Irlet 91/172* (Bern); ct. Vaud, Pont de Nant, 1 Sept. 1986, *Moser 86/148* (IB).

Crepidotus lundellii belongs to the white *Crepidotus* species that require an accurate microscopical analysis for identification. However, the clay-coloured to snuff-brown lamellae without any pinkish tints may be a good indication in the field.

The faint spore ornamentation, the shape of the cheilocystidia, and the structure of the pileipellis distinguish *C. lundellii* from *C. subverrucisporus*, the latter with narrowly lageniform cheilocystidia and strongly ornamented spores. Crooked terminal cells in the pileipellis, typical for *C. subverrucisporus*, have never been observed in *C. lundellii*.

The type of spore ornamentation, viz. very low ridges and warts, proved to be very constant in the SEM.

Beside *C. epibryus* and *C. subverrucisporus* no other European *Crepidotus* species got so many names as *C. lundellii*. The main differences for the separation of these taxa are the shape (broadly oblong vs amygdaliform) of the spores and minor discrepancies in spore size, and the presence or absence of yellowish tints on the pileus (see paragraph 5.2.4). It is true, that *C. lundellii* shows considerable variation in these characters, but I am unable to separate more taxa; too many intermediates exist. I did not find one single collection with exclusively amygdaliform spores; all collections have a certain percentage of oblong to broadly oblong spores. Norstein (1990) comes to the same conclusion.

One infraspecific delimitation, however, seems possible: three collections from *Fagus* and *Salix* twigs (L 981.282-322, L 981.180-132, SZU 223-89) have very small (mean length < 7 µm) spores which are all broadly oblong. They fit perfectly the concept of *C. lundellii* var. *subglobisporus* (Pilát) Pilát. For the time being the recognition of an infraspecific taxon is, however, not warranted, since the difference of the mean length of the spores between the largest of the small-spored group and the smallest of the large-spored group is only 0.3 µm (see also Fig. 38) and no other distinguishing character has been found.

13. **Crepidotus luteolus** (Lamb.) Sacc. — Figs. 10, 56, Plate 3a

Agaricus luteolus Lamb., Fl. mycol. Belg. 1 (1880) 181. — *Crepidotus luteolus* (Lamb.) Sacc., Syll. Fung. 5 (1887) 888. — Neotype (designated here): Switzerland: Kt. Bern; Dorfwald ob Schwarzenburg, clearing in mixed forest, on dead stems of various plants (*Rubus fruticosus, Urtica dioica, Athyrium filix-femina*), 12.X.1989, leg. & det. *Senn-Irlet 89/243* (G).

Misapplied names. Dochmiopus terricola (Britz.) Favre sensu Favre, Schweiz. Z. Pilzk. 13 (1935) 147. — *Crepidotus pubescens* Bres. sensu J. Lange, Dansk bot. Ark. 9 (6) (1938) 51; sensu A. Pears., Trans. Br. mycol. Soc. 32 (1949) 268. — *Dochmiopus epibryus* (Fr.: Fr.) Romagn., Rev. Mycol. 2 (1937) 137.

Selected icones. Mos. & Jül., Farbatl. Basidiomyc. 3 (1986) III Crepidotus 4; Mal. & Bert., Fl. Champ. sup. Maroc 2 (1975) 481.

Pileus 2–25 mm, orbicular, semicircular to reniform, young ungulate, campanulate, later plano-convex, sessile, laterally or dorsally attached, with narrowly inflexed margin, later often lobed, not hygrophanous, mat, felted-tomentose, later smoothly-silky, but at margin sometimes remaining tomentose, yellowish to cream or pinard-yellow to straw-yellow (M 10 YR 8/4–8/6, 2.5 Y 8/4–8/8); in dried specimen cream to yellow, antimon, apricot-yellow, yellow-buff, pinard-yellow; at point of attachment tomentose. Lamellae, L = 10–22, l = 1–3, rather narrow, moderately crowded, subventricose, narrowly adnexed, young white or yellowish to sulphur-yellow, later cinnamon-buff to cinnamon (10 YR 7/4–7/6, 8/6, 7.5 YR 7/4–7/6–5/6); edge white, minutely fimbriate, later even. Stipe only visible in very young fruit-bodies, curved, tomentose. Flesh thin, white. Odour none. Taste slightly farinaceous. Spore print pinkish-cinnamon, cinnamon-buff to cinnamon (M 7.5 YR 6/6–5/6).

Spores 7.5–10.5 × 4.0–5.5 µm, Q = 1.65–2.2, mean volume 105 µm^3, elongate in frontal view, amygdaliform in side view, minutely punctate to rugulose; walls moderately coloured. Basidia 20–32 × 5.5–8.5 µm, four-spored, clamped. Cheilocystidia 35–65 (–83) × 5–10 µm, cylindrical, flexuous, branched and angled, more rarely slightly clavate or narrowly lageniform. Pileipellis a transition between a cutis and a trichoderm of 3–6 µm wide, filiform hyphae. Pigment yellowish, intracellular, visible only in fresh material. Clamp-connections abundant in all tissues.

Habitat & Distribution – On hardwood twigs, herbaceous stems (*Urtica, Rumex, Rubus,* etc.), sometimes on mosses and coniferous twigs. Submeridional to temperate. From lowlands to subalpine zone (highest altitude 1380 m). Common. Throughout the year.

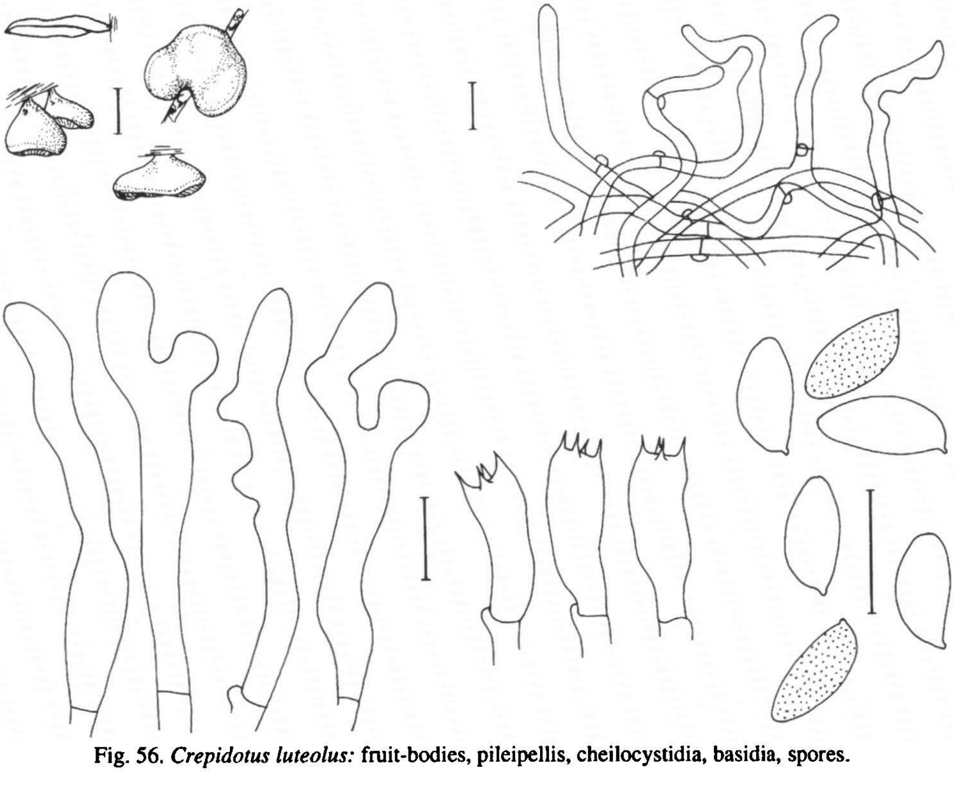


Fig. 56. *Crepidotus luteolus:* fruit-bodies, pileipellis, cheilocystidia, basidia, spores.

Collections examined. AUSTRIA: Kärnten, Ober Göltschach, Sattnitz, 10 Sept. 1967, *Moser 67/120* (IB); Stemeritsch, Sattnitz, 21 Sept. 1968, *Moser 68/123* (IB); Tirol, Waldhüttl bei Innsbruck, 29 Oct. 1948, *Moser 48/88* (IB); Wörgl, Berglsteinersee, 10 Sept. 1982, *Irlet 82/302* (BERN); Wien, Deutsch Kaltenbrunn, 10 Oct. 1973, *Reijnders 179* (herb. Reijnders). — BULGARIA: Sofia, Svinecu Dol., Mt. Zozenska planina, 7 Sept. 1976, *Hinkova* (SOM 12030). — FRANCE: dpt Finistère, Lanvéoc, 28 Dec. 1989, *Mornand* 8922 (herb. Mornand); dpt Maine-et-Loire, Vauldenay, Chanteloup, 31 Feb. 1979, *Lohmeyer 7936B1* (herb. Mornand); Ecouflant, 31 Jan. 1988, *Mornand* (herb. Mornand); dpt Savoie, Allevard, Gleysin de Pinsot, 4 Sept. 1978, *Bon*; dpt Doubs, Besançon, Mamirolle, Forêt du Gros Bois, 6 Nov. 1981, *Moser 81/526* (IB); ex herb. Kühner sub nomen *Dochmiopus remotus* (G 18432). — GERMANY: Baden-Württemberg, Sandhausen, 23 Nov. 1972, *Winterhoff 7244b* (herb. Winterhoff); Bayern, Kreis Coburg, Plesten, 2 Nov. 1985, *Engel 318* (K); Bayrischer Wald, Lärchenberg, 13 Aug. 1987, *Luschka* (herb. Luschka 1258); Nordrhein-Westfalen, Hohenlimburg, 25 Oct. 1989, *Runge* (Münster); Warburg-Scherfede, 21 Oct. 1982, *Runge* (Münster); Münster, 28 June 1985, *Papen* (Münster); Warendorf, 14 Oct. 1984, *Runge* (Münster); Rheder, Sieselberg, 24 Oct. 1982, *Runge* (Münster); Saarland, Völkingen-Kreuzberg, 21 Oct. 1973, *Schmitt 10572*, 30 Oct. 1974, *Derbsch 10603* (herb. J.A. Schmitt); Saarbrücken-Schafsbrücke, 25 Oct. 1981, *Schmitt 9080* (herb. J.A. Schmitt). — ITALY: Varese, Vergiate, Sept. 1982, *Macchi 3056* (Lugano); Reggio Emilia, 25 Oct. 1991, *Schild* (BERN). — LICHTENSTEIN: Eschnerberg, 27 June 1989, *Prongué 8956* (herb. Prongué); Schaanwald, 26 Sept. 1989, *Prongué 89216* (herb. Prongué); Profaschgwald, 1 Nov. 1989, *Prongué 89262* (herb. Prongué). — NETHERLANDS: prov. Drente, Ruinen, 15 Oct. 1984, *Arnolds* (WAG-W 5276); Dwingeloo, 9 Nov. 1983, *Arnolds 5144* (WAG-W); prov. Friesland, Schiermonnikoog, 27 Dec. 1985, *Jalink & Nauta* (L 985.125-039); prov. Gelderland, Wageningen-Hoog, 1 May 1979, *Tjallingii*; Hierden-Bloemkampen, 1 Oct. 1988, *Tjallingii*; Putten-Schovenhorst, 15 Nov. 1986, *Tjallingii* (L 970.294-008); prov. Limburg, St. Pietersberg, Encibos, 18 Oct. 1950, *Maas Geesteranus* (L 950.293-145); prov. Noord-Brabant, Dorst, 4 Dec. 1954, *Jansen* (L 954.292-117); Leemkuilen, 1 Nov. 1956, *Jansen* (L 956.148-147); prov. Noord-Holland, Vogelenzang, Bekslaan, 18 April 1970, *Bas* (L 968.190-165); Overeen, 2 Nov. 1974, *Tjallingii* (L 970.294-002); prov. Utrecht, Bunnik, Rijnauwen, 24 Nov. 1973, *Arnolds 3118* (WAG-W); Maarssen, Kleine Plas, 31 Oct. 1981, *van der Aa*; prov. Zeeland, Hontenisse, Hengstdijk, 23 Nov. 1981, *Meijer* (L 981.180-182); prov. Zuid-Holland, Warmond, 2 Dec. 1951, *Maas Geesteranus* (L 950.24-29); Oostvoorne Mildenburg, 8 Nov. 1975, *Bas* (L 969.16-160). — SPAIN: Salamanca, 19 Oct. 1979, *Sanchez 1799* (GDAC). — SWITZERLAND: Kt. Bern, Bern, Bremgartenwald, 17 Nov. 1988, *Senn-Irlet 88/480* (BERN); Schwarzenburg, Dorfwald, 12 Oct. 1989, *Senn-Irlet 89/243** (G) (neotype, G); ct. Jura, Montavon, Les Lavoirs, 27 Sept. 1989, *Senn-Irlet 89/194* (BERN); Kt. Luzern, Horw, Birreggwald, *Iff 1510-79Ba10* (MNLU); Sempach, Chrüsenrainwald, 10 Jan. 1977, *Breitenbach 1001-77 Br1* (MNLU); Entlebuch, 1 Oct. 1988, *Senn-Irlet 88/423* (BERN); Kt. Obwalden. Alpnach, Wichelsee, 26 Dec. 1978, *Bächler 2612-78Ba1* (NMLU); Kt. Schwyz, Haltikon, Meggerwald, 30 Oct. 1989, *Kränzlin 3010-89K* (NMLU); Kt. Solothurn, Biberist, 13 Oct. 1988, *Aeberhard 88/482* (BERN); Biberist, Altisberg, 22 Oct. 1988, *Aeberhard 88/483* (BERN); Biberental, 1 Nov. 1982, *Aeberhard 88/481* (BERN); Ichertswil, Nov. 1989, *Aeberhard 90/37* (BERN).

If the yellow colours are present, *Crepidotus luteolus* is easily recognized. Otherwise the spore shape and size as well as the cylindrical, flexuous, branched cheilocystidia are very distinctive characters.

It is remarkable that this common species has obviously not been described earlier than in the late 19th century.

14. **Crepidotus subverrucisporus** Pilát — Figs. 11, 57

Crepidotus subverrucisporus Pilát, Studia bot. cech. 10 (1949) 151. — Holotype: Czechoslovakia, Bohemia, Chrustenica, 20.VIII.1948, *Vacek* (PRM 49034).

Crepidotus velenovskyi Pilát, Studia bot. cech. 10 (1949) 152 (type: PRM 14309).

Crepidotus bickhamensis P.D. Orton, Notes R. bot. Gdn Edinb. 41 (1984) 573 (type: E).

Misapplied names. Crepidotus epibryus (Fr.: Fr.) Quél. sensu Norstein, Gen. Crepidotus Norway (1990) 102; sensu Pilát, Atl. Champ. Eur. 6 (1948) 66. — *Phialocybe epibrya* (Fr.: Fr.) P. Karst. sensu Horak, Syn Gener. Agaricalium (1968) 453.

Selected descriptions. P.D. Orton, Notes R. bot. Gdn Edinb. 41 (1984) 573 (as *C. bickhamensis*); Stangl et al., Z. Mykol. 57: 143 (as *C. velenovsky*); Senn-Irlet, Nordic J. Bot. 11 ('1991'; 1992) 592–593.

Pileus 5–10 mm, semicircular, rounded flabelliform, reniform, ungulate, campanulate, later plano-convex, young with inflexed margin, later with straight margin, at times lobed, not or only slightly hygrophanous, felted-tomentose, white to cream (M 10 YR 8/4); in dried specimens yellowish cream, pale orange or greyish orange; at point of attachment often tomentose, white. Lamellae, L = 8–15, l = 1–3, medium broad, close to subdistant, ventricose, narrowly adnate, white, becoming light ochraceous-buff to cinnamon or reddish brown (M 2.5 Y 8/3–6/6, 7.5 YR 6/6–10 YR 7/4–6/6–5/6); edge fimbriate, white. Flesh thin, white. Odour none. Taste mild. Spore print sordid flesh-pink to cinnamon (M 5 YR 6/6).

Spores 7.5–10 × 4.5–6 µm, Q = 1.3–1.8, mean volume 152 μm^3, oblong in frontal view, slightly amygdaliform in side view, distinctly rugulose; walls dark coloured. Basidia 20–29(–35) × 6–8.5 µm, four-spored, clamped. Cheilocystidia 21–65(–80) × 5–12 µm, narrowly lageniform, cylindrical, angled, sometimes faintly flexuous. Pileipellis a transition between a cutis and a trichoderm, towards margin a distinct trichoderm of 3–5 (–7) µm wide, cylindrical, more or less straight to coiled, branched, hyaline hyphae; terminal cells ofter slightly narrower, straight or crooked; pileocystidia sometimes present at pileus margin. Pigment in general lacking, but some cells of pileipellis occasionally filled with yellow (necro-?) pigment. Clamp-connections present in all tissues.

Habitat & Distribution – On hardwood, on twigs of various deciduous trees or shrubs. Submeridional to boreal. From lowlands up to subalpine zones. Scattered. July–December.

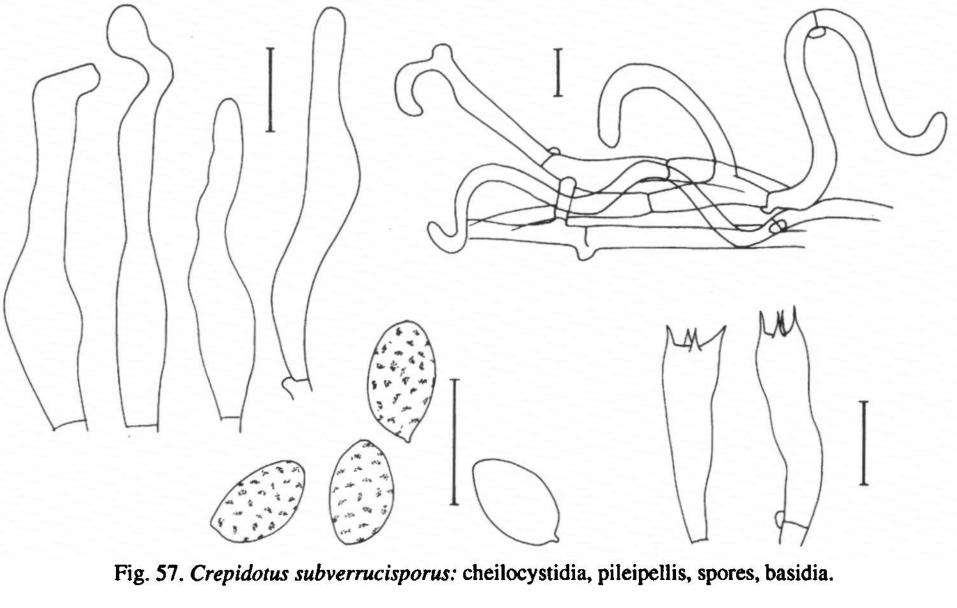


Fig. 57. *Crepidotus subverrucisporus:* cheilocystidia, pileipellis, spores, basidia.

Collections examined. AUSTRIA: Tirol, Stamserwald, 2 Aug. 1966, *Moser 66/112* (IB) and 22 July 1968, *Moser 68/32* (IB); Salzburg, Flachgau, Käferheim, 9 July 1990, *Rücker 51-90* (BERN); Pinzgau, Kaprunertal, 26 July 1991, *Senn-Irlet 92/120* (BERN). — BULGARIA: Kokaljave, Zozenska planina, 28 Nov. 1968, *Hinkova et al.* (SOM 6989), 7 Oct. 1976, *Hinkova* (SOM 12030). — CZECHOSLOVAKIA: Bohemia, Chrustenica, 20 Aug. 1948, *Vacek* (PRM 49034, holotype); Moravia, Pavlovské vrchy, 19 Aug. 1965, *Kriz** (BRNM 313003). — ESTONIA: Kothla-Järve, Kuremae, 18 Sept. 1987, *Kalamees* (TAA 141819); Toila, 5 July 1961, *Kalamees* (TAA 72392). — FRANCE: ex herb. Kühner sub nomen *C. epibryus* (G 18420-21). — GERMANY: Baden-Württemberg, Kaiserstuhl, Weisweil, 25 Oct. 1978, 4 Oct. 1982, *Reijnders* (herb. Reijnders); Hockenheim, Mörlach, 15 Sept. 1988, *Winterhoff 8892* (herb. Winterhoff); Bayern, Nationalpark Berchtesgaden, 19 June 1985, *Schmid-Heckel* (M), Erding, Eichenrieder Moos, 16 July 1974, *Einhellinger* (M); Bayreuth, Oberaufsess, 10 June 1990, *Engel E/13035* (herb. Engel). — ITALY: prov. Parma, Borgotaro, Passo Cento Croce, 3 Oct. 1983, *Moser 83/466* (IB); prov. Trento, Val di Sol, Malé, 5 Aug. 1972, *Bresinsky & Sarcletti* (M). — LICHTENSTEIN: Valina, 15 July 1989, *Prongué 8977* (herb. Prongué). — NORWAY: Sör-Tröndelag, Trondheim, Malvik, 15 Sept. 1972, *Strid 11226* (S). — RUSSIA: Krasnodar, reserv. Caucasus, Kisa, 10 Sept. 1975, *Kalamees* (TAA 94631). — SPAIN: Granada, Alhama de Granada, 13 Nov. 1980, *Ortega & Galan 1762* (GDAC) (as *C. microcarpus*). — SWEDEN: Västmanland, Sala stad, 27 July 1948, *Morander* (UPS). — SWITZERLAND: Kt. Bern, Oberburg, 18 Dec. 1988, *Senn-Irlet 88/494* (BERN); Brienz, Birchetal, 25 Sept. 1991, *Senn-Irlet 91/151* (BERN); Kt. Graubünden, S-chanf, Val Trupchun, 28 Aug. 1954, *Favre* (G 13813), Scuol/Schuls, Val Tavrü, 31 Aug. 1943, *Favre* (G 13809); 27 Aug. 1948, *Favre* (G 13811); Chaposch-Flurins, 6 Sept. 1945, *Favre* (G 13810); Val Sesvenna, 29 Aug. 1943, *Favre* (G 13808); 21 Aug. 1945, *Favre* (G 13812); Ct. Jura, Boécourt, Oct. 1989, *Chételat 16* (BERN); Kt. Schwyz, Steinen, 3 Oct. 1991, *Senn-Irlet 91/171* (BERN); Cte Ticino, Bolle di Magadino, 6 Oct. 1988, *Lucchini 55* (Lugano).

PAKISTAN: W. Pakistan: Loon Bogla Muzaftarabad, 23 July 1963 (K).

Macroscopically it is difficult to distinguish this species from other white *Crepidotus* species. The dark, distinctly rugulose spores and the narrowly lageniform cheilocystidia are the most important distinctive characters.

Dried specimens are most often light orange (K & W 5A5, 5A4, 6A5, 6A4) which may give rise to a confusion with *Crepidotus luteolus* from which *C. subverrucisporus* is best separated by the shape of the spores and the elongate cystidia with acute apex. Unfortunately most herbarium collections lack notes on the fresh fruit-body colours; therefore it remains uncertain if *C. subverrucisporus* exhibits yellowish tints also in living specimens.

Crepidotus subverrucisporus is rather variable in several microscopical characters: among the cheilocystidia of the holotype are some septate and branched ones. Exactly the same shapes were found in one other collection (IB, *Moser 83/466*) from northern Italy, on *Robinia* also. If further collections will prove that this character is constant, it might well serve for infraspecific delimitation.

The spore ornamentation as observed in the SEM varies from verruculose-rugulose to almost vermiculate-rugulose. Faintly ornamented spores come close to *C. luteolus*.

Subsection **Autochthoni** Senn-Irlet, *subsect. nov.*

Type: *C. autochthonus* J. Lange.

Sporis levibus, hyphis fibulatis, sine hyphis gelatinosis.

Spores smooth, hyphae with clamp-connections.

15. Crepidotus autochthonus J. Lange — Figs. 4, 58

Crepidotus autochthonus J. Lange, Fl. agar. dan. 5 (1940) III. — Neotype (designated here): Denmark, Jylland, Marie Lund ved Kodling, 24.VIII.1987, *JHP 74.87* (C).

Crepidotus fragilis Joss., Bull. trimest. Soc. mycol. Fr. 53 (2) (1937), 18 (not val., no Lat.).

Crepidotus mollis var. *pseudoapplanatus* Pilát, Studia bot. cech. 10 (1949) 151 (type: W, Acqu. 1889 no. 370793, see Senn-Irlet, 1992c).

Misapplied names. Derminus (Crepidotus) depluens (Batsch) Schroet. sensu Schroet., Pilze Schlesiens (1889) 279. — *Crepidotus applanatus* sensu Quél., *Crepidotus applanatus* sensu Rea, British Basidiomycetae (1922) 455.

Selected icon. J. Lange, Fl. agar. dan. 4 (1939) pl. 132E.

Selected description. Joss., Bull. trimest. Soc. mycol. Fr. 53 (1937) 216–219 (as *C. fragilis*).

Pileus 20–30(–40) mm, flabelliform, semicircular to circular, convex to infundibuliform, with inflexed, sometimes lobed margin, indistinctly hygrophanous, mat, young distinctly tomentose, later minutely felted, becoming furrowed, cream-buff to pale buff or olive-buff (M 10 YR 7/4, 8/4–8/6); in dried state cream-buff to chamois; at point of attachment strigose-fibrillose. Lamellae, L = 16, l = 1–3, moderately to distinctly crowded, narrow up to 2–3 mm broad, arcuate to subventricose, when young whitish, becoming buffy-brown to snuff-brown (M 7.5 YR 5/6, 10 YR 5/4–5/6); edge even, at times undulate. Stipe often visible, short and thick, often in the shape of a pseudostipe, white, villose or tomentose, eccentric. Flesh thin, thicker near base, whitish, brittle, very brittle when dried. Taste mild. Odour not recorded. Spore print cinnamon to fulvous (M 7.5 YR 4/6).

Spores 7–9 × 5–6 µm, Q = 1.3–1.7, mean volume 122 μm^3, oblong to ovoid in frontal view, amygdaliform with acute apex in side view, apex at times almost mucronate, absolutely smooth, rather thick-walled, dark coloured. Basidia 24–30(–35) × 6–10 µm,

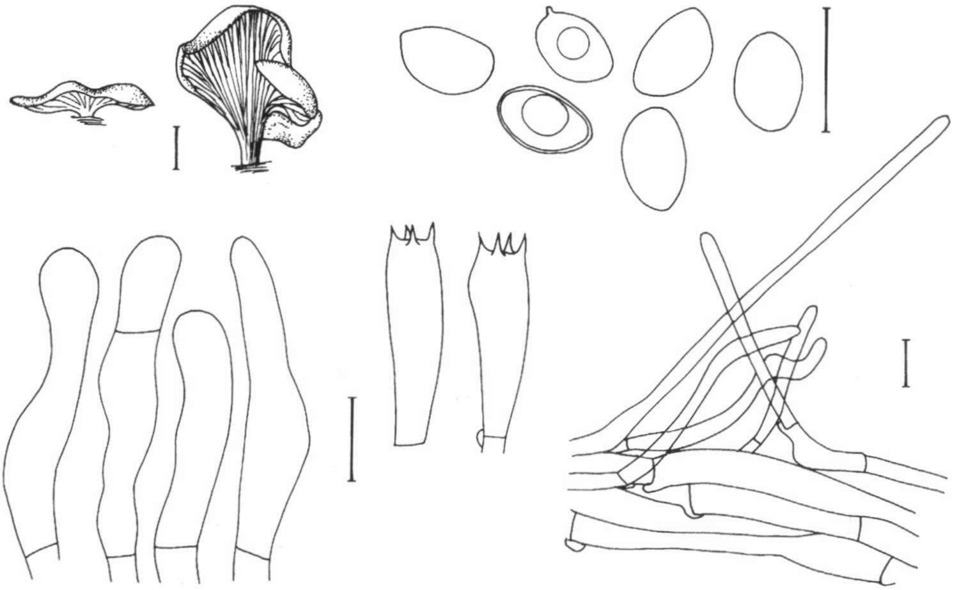


Fig. 58. *Crepidotus autochthonus:* fruit-bodies, spores, cheilocystidia, basidia, spores.

four-spored, occasionally mixed with some two-spored, clamped. Cheilocystidia (11–) 20–45(–55) × 5.5–11 µm, cylindrical to narrowly utriform, sometimes subcapitate, occasionally septate, hyaline, thin-walled. Pileipellis a transition between a trichoderm and a cutis; terminal cells straight, 3–6 µm wide, sometimes some pileocystidia shaped like cheilocystidia present. Pigment lacking. Clamp-connections present in all tissues.

Habitat & Distribution – On soil, most probably always in connection with litter or wood debris, rarely clearly on wood, in frondose forests, probably mainly in alluvial forests. Temperate. From lowlands up to submontane zone (highest altitude 640 m). Scattered. July–September.

Collections examined. AUSTRIA: Wien, Maurerwald, 26 June 1983, *Mrasek* (WU 2738); Lainzer Tiergarten, 5 July 1981, *Mader* (WU 1070). — BELGIUM: prov. Namur, Han, Bois banal, 8 Sept. 1975, *Tjallingii* (herb. Tjallingii). — CZECHOSLOVAKIA: Moravia, Kromerize, 17 July 1954, *Zavrel* (BRNM 333532). — DENMARK: Jylland, Marie-Lund ved Kolding, 24 July 1987, *Petersen 74.87* (neotype, C); Falster, Pomle Nakke, 31 July 1985, *Knudsen & Petersen* (C). — FRANCE: dpt Ht-Rhin, Colmar, Forêt le Neuland, 20 Sept. 1986, *Wilhelm 88/485** (BERN); dpt Doubs, Lougres, 17 Sept. 1955, *Huijsman* (L 955.239-420); dpt Maine-et-Loire, Forêt de Longuenée, 27 July 1981, *Mornand* (herb. Mornand); Champigny, 18 Oct. 1975, *Mornand 75151B1* (herb. Mornand); dpt Rhône, Laye, 29 May 1955, Josserand (herb. Josserand). — SWITZERLAND: ct. Vaud, Mauraz, 10 Sept. 1970, *Clémençon 700910B* (LAU).

Crepidotus autochthonus is the sole European *Crepidotus* growing almost exclusively on soil and exhibiting rather large flabelliform to deeply infundibuliform fruit-bodies. Microscopically the smooth, dark-coloured, thick-walled spores are characteristic features. In shape and surface structure they resemble those of *C. mollis*. The combination of the above mentioned characters together with the character of the simple shaped cheilocystidia give *C. autochthonus* a rather isolated systematic position within section *Crepidotellae.*

Subsection **Pleurotellus** (Fay.) Senn-Irlet, *subsect. et stat. nov.*

Pleurotellus Fay., Ann. Sci. nat. (Bot.) VII, 9 (1889) 339 (basionym; type: *Pleurotellus graminicola* Fay. = *Crepidotus epibryus).*

Hyphae without clamp-connections; spores smooth or minutely rugulose, oblong to fusoid; fruit-bodies white.

16. **Crepidotus epibryus** (Fr: Fr.) Quél. — Figs. 5, 59, Plate 3c, d

Agaricus epibryus Fr.: Fr., Syst. mycol. 1 (1821) 275. — *Crepidotus epibryus* (Fr.: Fr.) Quél., Fl. mycol. France (1888) 107. — *Phialocybe epibrya* (Fr.: Fr.) P. Karst., Bidrag Känn. Finl. Nat. Folk 32 (1879) 415. — *Dochmiopus epibryus* (Fr.: Fr.) Romagn., Rev. Mycol. 2 (1937) 137. — Neotype (designated here): Netherlands, prov. Zuid-Holland, Warmond, Huis te Warmond, on rotten gramineous stalks and leaves, leg. *Maas Geesteranus 15643* (L 978.18-915).

Agaricus variabilis var. *hypnophilus* Pers., Mycol. eur. 3 (1828) 28 (type: K, examined by Singer, see Singer, 1961: 143). — *Agaricus hypnophilus* (Pers.) Berk., Outl. Brit. Fungol. (1860) 139. — *Crepidotus hypnophilus* (Pers.) Norstein, Gen. Crepidotus Norway (1990) 78.

Agaricus herbarum Peck, Bull. Buffalo Soc. nat. Sci. 1 (1873) 53 (type: NYS, examined by Singer, see Singer, 1947). — *Crepidotus herbarum* (Peck) Sacc., Syll. Fung. 5 (1887) 888. — *Pleurotellus herbarum* (Peck) Sing., Lilloa 13 (1947) 84.

Agaricus (Pleurotus) hypnophilus Berk., Outl. Br. Fungol (1860) 39. — *Pleurotellus hypnophilus* (Berk.) Fay., Ann. Sci. nat. (Bot.) VII, 9 (1889) 339.

Pleurotellus graminicola Fay., Censimento dei funghi osservati nelle Valli Valdesi del Piemonte durante il mesi Agosto-Ottobre del 1885–87, off-print p. 12, 1892. (Type: G, examined by Horak, see Horak, 1968).

Crepidotus commixtus Bres. in Krieger, Fungi saxon. Exsicc. no. 1766-1767 (1912) (type: K).

Crepidotus bufonius Velen., Novit. mycol. nov. (1947) 76 (fide Pilát, 1948).

Misapplied names. Agaricus sessilis Bull. sensu Fries, Syst. mycol. 1 (1821) 275. — *Pleurotus chioneus* (Pers.) sensu Favre, Schweiz. Z. Pilzk. 13 (1935) 148. — *Crepidotus pubescens* (Vahl) Schroet. sensu Schroet., Krypt. Fl. Schlesien 1 (1889) 624; sensu Kühner & Romagn., Fl. anal. Champ. sup. (1953) 57.

Selected icon. Cooke, Ill. Brit. Fungi (1885) pl. 516 C (as *Agaricus epibryus*).

Selected descriptions. Favre, Schweiz. Z. Pilzk. 13 (1935) 148 (as *Pleurotus chioneus*). Horak, Beitr. Kryptog. fl. Schweiz 13 (1968) 481–483 (as *Pleurotellus graminicola*).

Pileus 2–20(–25) mm, semicircular, rounded flabelliform, reniform, sometimes circular, campanulate, plano-convex, sessile, laterally or dorsally attached, with margin shortly inflexed, later straight and often lobed, mat, not hygrophanous, never striate, felted-tomentose, white, also when dried; at point of attachment tomentose, never strigose-villose, white. Lamellae, L = 8–14, l = 1–2, moderately crowded to crowded, narrow, 1–2 mm broad, arcuate to subventricose, narrowly adnexed, white, then pale ochraceous, later cinnamon-buff to cinnamon or sayal-brown (M 7.5 YR 8/6, 10 YR 8/3–8/6, 7/6–5/6); edge minutely fimbriate. Stipe in younger fruit-bodies clearly visible, eccentric, 1–2 × 1 mm, white, tomentose. Flesh very thin, white. Taste and odour none. Spore print ochraceous-buff to ochraceous-tawny (M 10YR 7/6–6/6).

Spores 6.5–9.5 × 2.5–3.5 µm, Q = 2.1–3.2, mean volume 38 µm^3, cylindrical to fusoid in frontal view, amygdaliform to distinctly pip-shaped in side view, smooth, faintly coloured, hyaline in light microscope. In preparation often in dyads and tetrads. Basidia 17–25 × 5–7 µm, four-spored, clampless. Cheilocystidia (20–)33–55 × 4–7 × 1.8–2.5

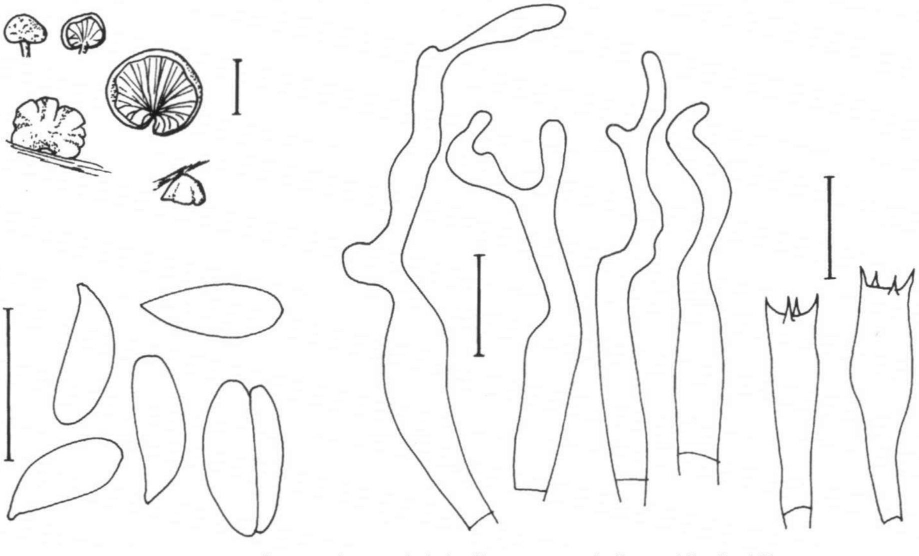


Fig. 59. *Crepidotus epibryus:* fruit-bodies, spores, cheilocystidia, basidia.

(–4) µm, cylindrical, narrowly lageniform, whip-like, flexuous, often branched, hyaline, thin-walled. Pileipellis a transition between a cutis and a trichoderm of loosely interwoven or slightly coiled, cylindrical, 2–4 µm wide hyphae; terminal cells not differentiated, straight. Pigment none. Clamp-connections absent.

Habitat & Distribution – On herbaceous stems, mainly grasses, hardwood twigs, litter, mosses, or even man-made substrates (rope). At a given spot mycelium fruiting sometimes on various substrates. Meridional to boreal. Rather common and widespread throughout Europe from lowlands to upper montane zone (highest altitude 950 m). May–February.

Collections examined. AUSTRIA: Wien, Deutsch Kaltenbrunn, 10 Oct. 1973, *A.F.M. Reijnders* (herb. Reijnders). — CZECHOSLOVAKIA: Moravia, Kurim in silva Siberna, 1 Oct. 1952, *Smarda* (BRNM 333562). — FRANCE: dpt Maine-et-Loire, La Poueze, 17 Feb. 1987, *Galand* (herb. Mornand 8783 B1); St. Sylvain, l'Echarbot, 25 Nov. 1979, *Mornand*; dpt Deux-Sèvres, Taizé, 18 Nov. 1979, *Mornand 79239*; dpt Paris, Bois de Boulogne, 1845, *Leveillé* (G 15572); ex herb. Kühner sub nomen *C. pubescens*, 15 Oct. 1944 (G 18423); Corse, Val de Nielhe, Verghio, 1 Nov. 1982, *Maas Geesteranus 15695* (L). — GERMANY: Königstein, 24 June 1902, *Krieger* (Krieger, Fungi saxonici no. 1766, paratypus *Crepidotus commixtus* Bres.); Schandau, Oct. 1901, *Krieger* (Krieger, Fungi saxonici no. 1767 as *Crepidotus commixtus* Bres., paratypus) (K); Nordrhein-Westfalen, Lennestadt-Bilstein, 27 Oct. 1983, *Runge* (Münster); Brilon-Alme, Nettetal, 6 Oct. 1983, *Runge* (Münster); Saarland, Halde Jägersfreude, 11 Oct. 1981, *Schmitt 8884* (herb. Schmitt). — GREAT BRITAIN: England, Arbrook common, Esher, Surrey, 5 Nov. 1989, *Spooner* (K). — ITALY: prov. Trento, Calcaranica-Caldonazzosee, 8 Oct. 1974, *Moser 74/572* (IB). — LICHTENSTEIN: Balzers, 30 Oct. 1989, *Prongué 89263* (herb. Prongué). — NETHERLANDS: prov. Flevoland, O. Flevoland, Roggebotbos, 1 Nov. 1980, *A.F.M. Reijnders*; prov. Noord-Holland, Velzen, Midden-Herrenduin, 6 Nov. 1976, *Bas* (L 976.300-581); prov. Overijssel, Rijsen, Rijsserberg, 11 Sept. 1955, *Maas Geesteranus* (L 955.117-184); neotype (designated here): prov. Zuid-Holland, Warmond, Huis te Warmond, on rotten gramineous stalks and leaves, leg. *Maas Geesteranus 15643* (L 978.18-915). — SPAIN: Madrid, 17 Nov. 1982, *Esteve 2819* (GDAC). — SWITZERLAND: Kt. Aargau, Bremgarten, Fischbachmoos, 9 Oct. 1981, *Irlet 81/428*; 20 Oct. 1984, *Gsell 90/4** (BERN 90/4); Kt. Bern, Belp, Hunzigenau, 28 Oct. 1986, *Senn-Irlet 86/194*; 11 Dec. 1988, *Senn-Irlet 88/487* (BERN); ct. Jura, Bassecourt, Mt. Choisi, 5 Oct. 1989, *Chételat* (BERN); Kt. Luzern, Horw, Birreggwald, 3 Jan. 1976, *Kränzlin 1412-75-K* (NMLU); Kt. Schaffhausen; Stein a.Rh., 22 Nov. 1881, *Schenk* (Rabenhorst-Winter, Fungi europaei, no 2732 pro parte) (BERN); Kt. Solothurn, Oberdorf, Nesselboden, 23 Oct. 1988, *Senn-Irlet 88/452* (BERN); cte Ticino, Barbegno, 9 Nov. 1980, *Weidmann* (Lugano 1176); Bedigliora, 15 April 1983, *Riva* (Lugano 3189).

Several mycologists (Pilát, 1948; Moser, 1983; Watling & Gregory, 1990) separate this species from the genus *Crepidotus* and place it in *Pleurotellus*. Their main reason for maintaining the genus *Pleurotellus* is the pale spore colour. Indeed, that is a striking character of *C. epibryus*. Yet, spore colour varies considerably within the genus *Crepidotus*, being an important taxonomic character on species level for most authors.

The spore shape, another striking character of *Crepidotus epibryus*, resembles strongest that of *C. versutus*. Again this can be seen as the extreme on a line along which spores are becoming more and more elongated. Dyads and tetrads of spores are often observed in *C. versutus* as well.

Smooth spore walls occur in several species of *Crepidotus*.

The cheilocystidia of *C. epibryus* have often been overlooked in the past, as they collapse easily and therefore seem to be lacking in old or poorly dried herbarium material. The circumscription of *Pleurotellus* as having no cystidia is therefore untenable, as it is typified by *P. graminicola* Fay. (see Horak, 1968), in my opinion a synonym of *C. epi-*

bryus. The whip-like shape of the cystidia can again be regarded as an extreme form of those found in *C. versutus*. Singer (1973) indicates similar cystidia for *C. polylepidis* and *C. longicystis*. Substrates and habitats of *C. epibryus* are similar to those of *C. luteolus*.

In view of the above picture I do not see any good reason for separating *C. epibryus* from *Crepidotus* in a genus of its own. The characters in common are overwhelming: (i) fruit-body development, (ii) structure of hymenophoral trama, (iii) structure of the pileipellis, (iv) colour of the lamellae; occasionally with pinkish tinges (collection of Spooner at Kew); snuff-brown in occasional large fruit-bodies (e.g. BERN 90/4), shape of fruit-body.

Agaricus (Crepidotus) epibryus Fr. has been interpreted in many different ways, at least three species have been confused in this process.

Fries stresses the fact that his small species with a white, sericeous pileus grows on mosses. Not so many *Crepidotus* species occur on mosses (see Table II). Besides with *C. luteolus*, this is occasionally the case with *C: lundellii* and *C. cesatii*, but these three species have brownish lamellae, thus not fitting Fries' description: "lamellis confertis gilvis." The descriptions of *C. epibryus* of Quélet (1872) and Romagnesi (1937) stress mainly spore shape and ornamentation and agree with *C. luteolus*. A critical analysis of Pilát's description (1948) of *C. epibryus* and a re-examination of specimens listed under *C. epibryus* (e.g. de Thümen, Mycoth. univ. no. 401) convinced me, that Pilát's circumscription of *C. epibryus* includes at least partly *C. luteolus* and *C. subverrucisporus*.

Cooke (1884–1886) illustrates on plate 516 C a fungus, growing on grasses, with a very thin pileus called *Agaricus epibryus*, representing what many mycologists call *Crepidotus (Pleurotellus) herbarum*. Karsten (1879) as well notes herbs as substrate of *Phialocybe epibrya* and thus describes most probably the same species as Cooke.

An important macroscopical character of *Crepidotus herbarum*, i.e. *C. epibryus*, is the fact that the lamellae rarely turn deep brown, but remain pale ochraceous, that is 'gilvus'! Having in mind that this species in widely distributed in Scandinavia (Norstein, 1990) and grows sometimes on mosses I conclude that it can hardly be doubted that Fries' original description of *A. epibryus* covers what is usually called *C. herbarum*.

17. **Crepidotus versutus** (Peck) Saçc. — Figs. 7, 60

Agaricus (Crepidotus) versutus Peck, Ann. Rep. N.Y. State Mus. 30 (1878) 70. — *Crepidotus versutus* (Peck) Sacc., Syll. Fung. 5 (1887) 888. — Holotype: USA, New York; Forestburgh, Sept., *Peck* (NYS) (see also Singer, 1947).

Agaricus pubescens Vahl, Fl. danica 8 (1792) t. 1073/2. — *Pleurotus pubescens* (Vahl) Schroet., Krypt. Fl. Schlesien 1 (1889) 624 (misappl. to *C. epibryus*). — *Crepidotus pubescens* Bres., Iconogr. mycol. 16 (1930) 790.

Crepidotus bresadolae Pilát, Atl. Champ. Eur. 6 (1948) 46 (superfl. name change for *C. pubescens* Bres.).

Geopetalum geophilus Murr., N. Amer. Fl. 9 (1916) 299. — *Crepidotus geophilus* (Murr.) Redhead, Sydowia 37 (1986) 255.

Agaricus chimonophilus Peck (fide Murrill, 1917).

Selected descriptions. Norstein, Gen. Crepidotus Norway (1990) 70; Senn-Irlet, Nordic J. Bot. 11 ('1991'; 1992) 593–595.

. Pileus 7–25 mm, semicircular, rounded flabelliform to reniform, rarely spatulate, young ungulate, campanulate, later convex to plano-convex, sessile, laterally or dorsally attached, old slightly undulate, with margin shortly inflexed, soon becoming straight, later sometimes crenate, felted, slightly tomentose at margin, white, in old hygrophanous specimens more greyish; white or more rarely buff or chamois when dried; at point of attachment sometimes villose, white. Lamellae, L = 10–14, l = 1–3, moderately broad, moderately crowded, rarely subdistant or distinctly crowded, subventricose to ventricose, narrowly adnexed or free, white, soon clay-white, pale yellow-orange, pinkish buff, light ochraceous-buff, cinnamon-buff (M 2.5 Y 8/3, 10 YR 7/6, 7.5 YR 6/8–5/8, 5/6), when dried cinnamon-brown; edge fimbriate and whitish. Stipe absent or only visible in very young fruit-bodies, < 1 mm, tomentose, white. Flesh thin, white, very brittle when dried. Odour and taste none. Spore print sayal-brown, buckthorn-brown, clay-brown.

Spores 8.5–12 × 5–6.5 µm, Q = 1.6–2.1, mean volume 165 µm³, elongate in frontal view, slightly amygdaliform in side view, sometimes with a faint suprahilar depression, marbled to almost smooth; walls rather faintly coloured; in preparations often in dyads and tetrads. Basidia 25–40 × 7–10.5 µm, four-spored, sometimes mixed with two-spored, clampless. Cheilocystidia 26–75 × 5–9 µm, cylindrical, flexuous, more rarely narrowly lageniform, often slightly moniliform and subcapitate, rarely branched, often septate, i.e. forming chains, hyaline, thin-walled. Pileipellis a transition between a trichoderm and a cutis of loosely interwoven, cylindrical, curved, up to 6 µm wide hyphae; terminal cells erect, undifferentiated, i.e. cylindrical or at pileus margin shaped like cheilocystidia. Pigment lacking. Clamp-connections absent from all tissues.

Habitat & Distribution – On hardwood (mainly *Betula, Alnus*) or on soil in connection with wood, mainly at damp places. Temperate to arctic. From lowlands to montane zone (highest altitude: 630 m). Frequent only in boreal Europe, otherwise scattered to rare. September–December.

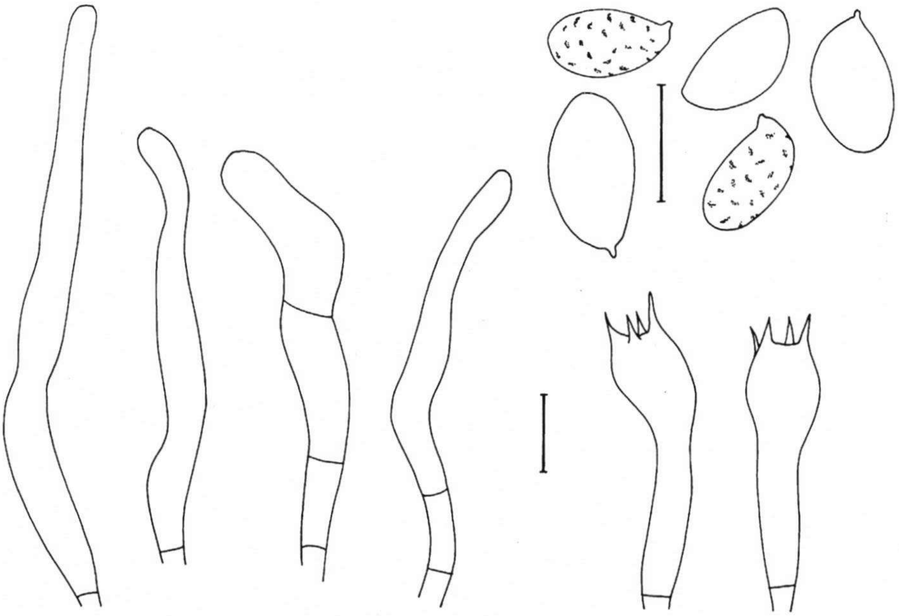


Fig. 60. *Crepidotus versutus:* spores, basidia, cheilocystidia.

Collections examined. AUSTRIA: Wien, Riltschen, 11 Oct. 1973, *A.F.M Reijnders 35* (herb. Reijnders). — ESTONIA: Ahunapalu, Tartu, 7 Oct. 1989, *Kalamees* (TAA 144415); Pärnu, Nigula reserv., 19 Sept. 1982, *Kalamees* (TAA 122508); Ilumetsa, Rapina, 21 Sept. 1956, *Kalamees** (TAA 70405). — FRANCE: dpt Pas-de-Calais, Forêt Domaine de Boulogne, 13 Oct. 1991, *Senn-Irlet 91/214* (BERN). — GERMANY: Schleswig-Holstein, Sachsenwald, 4 Nov. 1903, *Jaap* (Otto Jaap-Fungi selecti exsiccati no. 67 as *Crepidotus cesatii* Rab. var. *versutus* Peck) (BERN). — ICELAND: Egilstadir, Selskogur, 25 Sept. 1987, *Hallgrimsson 11614*; 26 Sept. 1987, *Hallgrimsson 11640*; 4 Sept. 1985, *Hallgrimsson 10125*; Langhus, Fljotum, 15 Sept. 1976, *Hallgrimsson 9022*; Thvera, Dalsmynni, 24 Sept. 1968, *Hallgrimsson 5479*. — NETHERLANDS: prov. Limburg, Epen, Bovenste Bos, 27 Oct. 1965, *Jansen* (L 964.296-111). — SWITZERLAND: Kt. Luzern, Lamperdingen, Dietschibergwald, 14 Dec. 1975, *Kränzlin 1412-75 K* (NMLU); cte Ticino, Bolle di Magadino, 6 Nov. 1987, *Lucchini* (Lugano).

USA: New York, Orange Co, Harriman State Park, 14 Oct. 1962, *Rogerson* 178 (NY); County Park, 7 Nov. 1975, *Rogerson* (NY), Ulster Co, Catskill Park, 14 Oct. 1990, *Senn-Irlet 90/109* (BERN); New Hamsphire, White Mts Nat. Park, 16 Aug. 1963, *Bigelow 12333* (NY).

Crepidotus versutus is another pure white *Crepidotus* species which needs to be microscopically checked. It differs from other white *Crepidotus* species in lacking clamp-connections and in distinctly elongate spore shape.

For a discussion on the nomenclature see Norstein (1990).

EXCLUDED OR DOUBTFUL SPECIES

carpatorossicus. — *Crepidotus carpatorossicus* Pilát, Studia bot. cech. 10 (1949) 153.

Type: Ucraina, Transcarpates, VIII.1934 (PRM 23474). As shown elsewhere (Senn-Irlet, 1992c) the type collection represents *Chromocyphella muscicola* (Fr.) Donk.

caspari. — *Crepidotus caspari* Vel., Mykologia 3 (1926) 70.

Type: PRM, not seen. If a re-examination of the type material would prove the expected identity with *C. autochthonus* J. Lange, *C. caspari* would become the correct name for that species.

citrinus. — *Crepidotus citrinus* Larsen, Botany of Iceland 2 (1932) 545, non *Crepidotus citrinus* Petch, Ann. R. bot. Gdns Peradeniya 9 (1924) 225. — *Crepidotus larsenii* Pilát, Atl. Champ. Eur. 6 (1948 74.

No type material is left in Iceland and Copenhagen. Judging from the original description this is probably *C. carpaticus*; *C. citrinus* Larsen (non Peck) is best regarded as a nomen dubium.

microcarpus. — *Crepidotus microcarpus* Malençon in Mal. & Bert., Fl. Champ. sup. Maroc (1975) 482.

Type: MPU. I failed to obtain the type material. Judging from the original description *C. microsporus* comes very close to *C. subverrucisporus* Pilát.

muscigenus. — *Crepidotus muscigenus* Vel., Novit. mycol. nov. (1947) 77.

Type: PRM, not seen. Judging from the description given by Pilát (1948) conspecificity with *C. luteolus* seems probable.

niveus. — *Crepidotus niveus* Vel., Nov. mycol. noviss. (1947) 87.

Type: PRM, not seen. See Pilát (1951).

pallescens. — *Crepidotus pallescens* Quél., Bull. Soc. bot. Fr. 25 (1878) 287.

Pilát (1948) examined the type specimen and found only young, not yet sporulating fruit-bodies. Judging from the protologue it could represent *C. luteolus.*

sambuci. — *Crepidotus sambuci* Vel., Ceské Houby (1922) 919.

According to Pilát (1949) a synonym of *Crepidotus haustellaris,* i.e. *Simocybe rubi.* The Latin description of Pilát (1948), however, differs in some details from the present concept of that species. The cap is described as "... extus glaber, albus, solum basi long tomentosus, ..."; the lamellae "... initio sublutescentibus, tum griseo-ochraceis ...". While the microscopical characters are in accordance with those of *S. rubi,* the macroscopical characters fit other species better. Orton (1960) recorded tentatively a collection as *C. sambuci,* which represents undoubtedly a typical *Crepidotus* species close to *C. lundellii.* Indeed, the microscopical details for *C. sambuci* given by Velenovský agree very well with those of *C. lundellii,* viz. the ovoid spores and the often capitate cheilocystidia. Unfortunately the original description lacks any information on spore ornamentation. Moser (1983) accepted Orton's interpretation; but till now the species has been only recorded from Great Britain. I examined only one collection labelled as *C. sambuci* gathered by the Dutch mycologist F.A. Tjallingii accompanied by extensive notes. With the exception of the lemon-yellow colours observed in the young fruit-bodies, the collection did not deviate from the range of variation of *C. lundellii.* For the time being I consider *C. sambuci* as doubtful species.

serbicus. — *Crepidotus serbicus* Pilát, Bull. trimest. Soc. mycol. Fr. 53 (1937) 82.

Type: Jugoslavia, Serbia, Kapaonik Mountains, V.1936, *Cernjanski* (PRM 485751). A re-examination of the type material (Senn-Irlet, 1993) convinced me that *C. serbicus* must be regarded as a nomen dubium as it consists of an immature fruit-body covered with alien spores.

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Legends to Plates 1–3 (*pages 77–79*)

Plate 1

a. *Crepidotus mollis*
Switzerland: Jura, Bolcourt, 23 Aug. 1977, Chételat EHC 1977

b. *Crepidotus mollis*
Switzerland: Brienz, Birchtal, 25 Sept. 1991, *Senn-Irlet 91/149*

c. *Crepidotus cesatii* var. *cesatii*
Switzerland: Jura, Bolcourt, Dec. 1984, *Chételat EHC1984*

d. *Crepidotus cesatii* var. *cesatii*
Switzerland: Bern, Oberburg, 18 Dec. 1988, *Senn-Irlet 88/493*

Plate 2

a. *Crepidotus variabilis* var. *variabilis*
Switzerland: Bern, Bremgartenwald, 30 Oct. 1982, *Senn-Irlet 82/439*

b. *Crepidotus variabilis* var. *variabilis*
Switzerland: Jura, Bassecourt, 1979, *Chételat EHC 1979*

c. *Crepidotus lundellii*
Austria: Salzburg, Pinzgau, Kaprunertal, 25 July 1992, *Senn-Irlet 92/118*

d. *Crepidotus lundellii*
Netherlands: Utrecht, Zeist, Appellaantje, 25 Aug. 1982, *C. Bas 7806*

Plate 3

a. *Crepidotus applanatus* var. *applanatus*
Austria: Salzburg, Flachau, 27 July 1990, *T. Rücker 96/90*

b. *Crepidotus luteolus*
Switzerland: Zollikofen, Williwald, 1 Nov. 1992, *Senn-Irlet 92/601*

c. *Crepidotus epibryus*
Switzerland: Bern, Belpau, 11 Dec. 1988, *Senn-Irlet 88/487*

d. *Crepidotus epibryus*
26 Oct. 1989, *Senn-Irlet 89/284*

Plate 1

a. *Crepidotus mollis*

b. *Crepidotus mollis*

c. *Crepidotus cesatii* var. *cesatii*

d. *Crepidotus cesatii* var. *cesatii*

Plate 2

b. *Crepidotus variabilis* var. *variabilis*

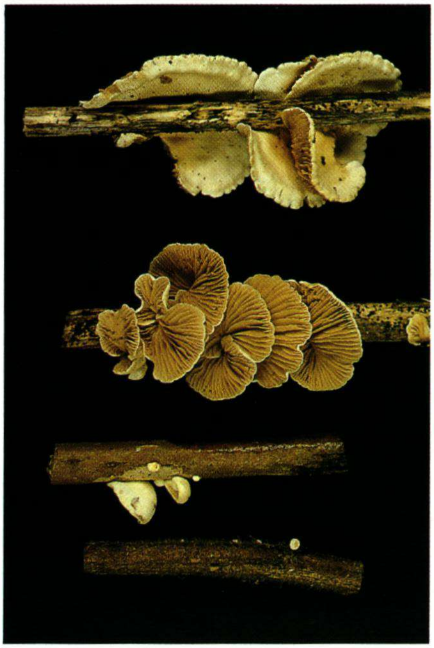
d. *Crepidotus lundellii*

a. *Crepidotus variabilis* var. *variabilis*

c. *Crepidotus lundellii*

Plate 3

a. *Crepidotus applanatus* var. *applanatus*



b. *Crepidotus luteolus*

c. *Crepidotus epibryus*

d. *Crepidotus epibryus*

INDEX

New names are in **bold-face** type. Subdivisions of genera are indicated by the sign §, illustrations by an asterisk (*) added to the page number.