TRAVAUX MYCOLOGIQUES

dédiés à

R. KÜHNER

Numéro spécial du Bulletin de la Société Linnéenne de Lyon
43e année ——— Février 1974

THE EUROPEAN SPECIES OF *VOLVARIELLA* SPEGAZZINI

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Summary. — Some of the species of *Volvariella* having a coloured volva are discussed and *Volvaria murinella* var. *umbonata* J. E. Lange, *V. murinella* Quélet sensu Gilbert non Quélet and *V. volvacea* sensu auctt. p.p. is described as a new species : *Volvariella caesiotincta*. A revised key is given to the European species.

In Trans. Brit. Myc. Soc. 43 (1960) 383 I gave a key to the species of *Volvariella* included in the New Check List of British Agarics and Boleti (ibid. Suppl. : 166-167), which was an attempt to sort out the rather confused use of specific epithets in this genus according to my knowledge of them at that time. As J. E. LANGE (Flora Agaricina Danica II (1936) 76) has so pertinently pointed out, the species other than *V. speciosa* are all from rather uncommon to very rare and often seen as single specimens only, so that their identification is sometimes rather difficult, and some names have been used in different ways. However, subsequent collections I have made and a reappraisal of the literature, including the excellent key by MOSER (Kleine Kryptogamenflora Band IIb/2 (1967) 176), make it necessary for me to modify my original key and to introduce one new species. Opportunity is taken to include in the key, as MOSER does, two seemingly little-known European species, which do seen reasonably clearly defined.

The species having the volva coloured externally which need detailed consideration are: *Volvariella volvacea* (Bull. ex Fr.) Sing., V. *murinella* (Quél.) Moser, and V. *taylori* (Berk & Br.) Sing. If one looks through the various descriptions of *V. volvacea,* one finds two quite distinct spore sizes quoted: 6-8/3-4 µ, and 7-9 or 10/5-6 µ, (although some authors have combined the two, favouring one size and giving the other in brackets), as well as two different habitats, the one on or about rotten wood, and the other in gardens or greenhouses on compost or sawdust or spent tan. This surely indicates two different taxa, but there is no doubt to which taxon the epithet *volvacea* should be applied, since in his original description (Syst. Myc. I (1821) 278) FRIES gives the habitat as 'in hortis inter pulverem coriarium' and describes the cap as 'fibrillis adpressis nigro-virgato'. Both

of these characters apply to the larger spored taxon, for which *volvacea* should therefore be used. This is the interpretation of KÜHNER & ROMAGNESI in Flore Analytique des Champignons Supérieurs (1953) 426, and also of SHAFFER in his paper on *Volvariella* in N. America (Mycologia 49 (1957) 563). Good descriptions of this are given by JOSSERAND (Bull. Soc. Myc. Fr. 75 (1959) 386) and by HORAK (Beitrage für Kryptogamenflora der Schweiz, XIII (1968) 709). In Europe this taxon is probably an alien which can establish itself at times in places.

V. volvacea is discussed with its probable synonym, *Volvaria esculenta* Massee, by *Heim* (Bull. Soc. Myc. Fr. 63 (1947) 121). SINGER has also discussed the identity of *V. volvacea* in Mushrooms and Truffles (1961) 111-119, and has renamed the tropical taxon described by HEIM (l.c. 121) *Volvariella volvacea* var. *heimii* Sing. He does not regard the spore size and cap character differences between this tropical taxon and the European *V. volvacea* as of more than varietal significance. However, as these characters are used for species separation in this genus, I think to use them also to separate varieties or other infraspecific ranks is inconsistent and confusing, and I would suspect that two species are indicated, but not having seen either of them I cannot comment further.

In my key of 1960 I attributed spores of size 6-8/3-4 µ to *volvacea*, and stated that is was 'non sensu KÜHNER & ROMAGNESI, which is an alien with larger spores', but did not mention habitat, though I had the lignicolous taxon in mind. I was clearly mistaken in this statement, and am glad to have this opportunity to correct this and express my agreement with KÜHNER & ROMAGNESI.

There remains, then, the problem of what to do with the smaller spored taxon which has, I believe, a strictly lignicolous habitat. There are two other epithets involved in this problem, viz: *murinella* and *taylori*. I did not really attach so much significance to habitat in the years up to 1960 as I should have done, but am now convinced that in *Volvariella* (as in many other genera of agarics) habitat is a diagnostic character. This has been indicated previously by J. E. LANGE (l.c. 76). who used it as a main character in his key to the species of this genus. I was not in 1960 sufficiently sure just what the lignicolous taxon I had in mind for *volvacea* really was, and failed to separate it from *volvacea* sensu Fries, and also to recognise

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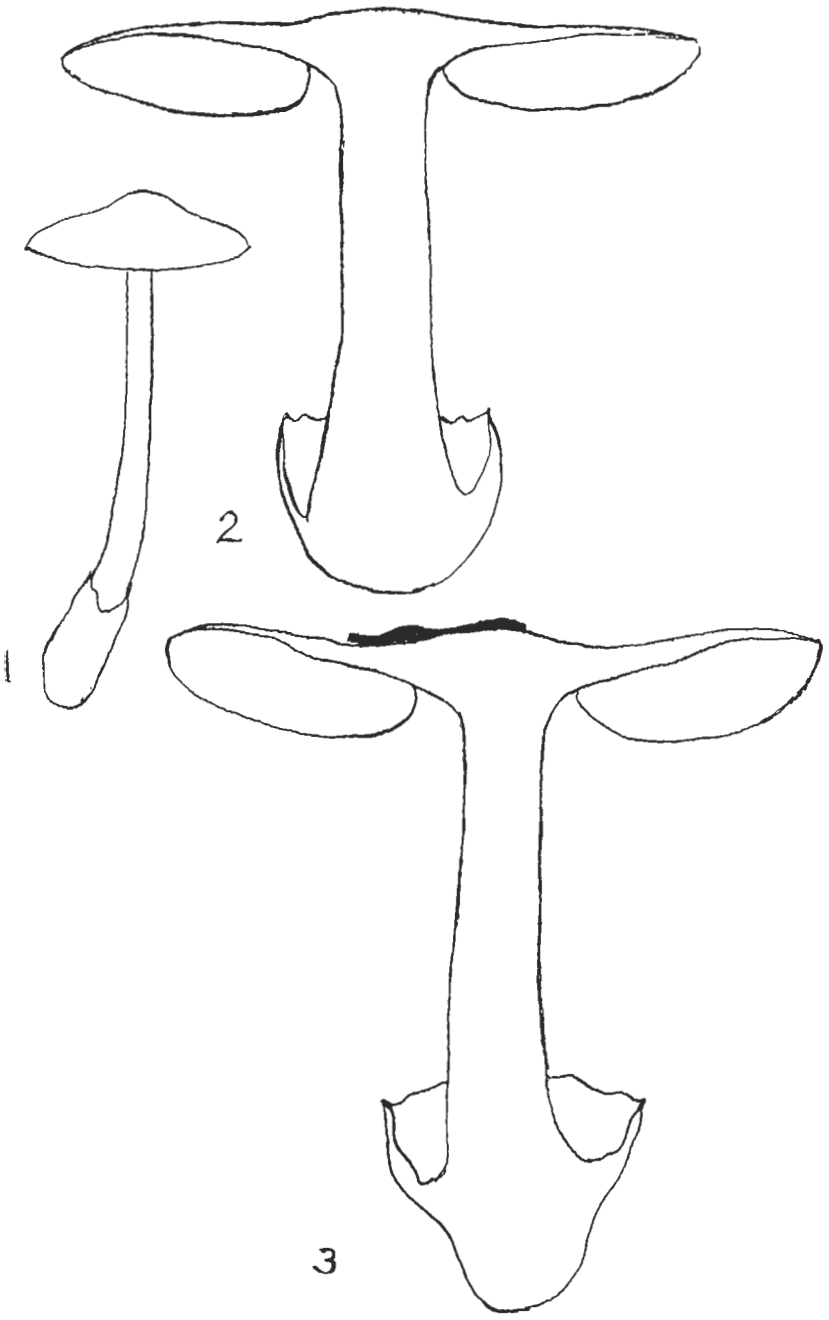
Fig. 1 : *V. caesiotincta*, Surlingham, Norfolk, 1 Aug. 1968, small fruit-body (× 1) ; Fig. 2 : *idem*, 10 Sep. 1972, large fruit-body (× 1) ; Fig. 3 : *idem*, 23 Aug. 1969, large fruit-body with fragment of volva on cap centre (× 1).



other descriptions of it which exist under the epithet *murinella* which I regrettably included in 1960 under *V. taylori.* These latter epithets will now be discussed.

Volvaria murinella was originally described by QUÉLET (Assoc. Fr. Avanc. Sci. (1882) 5) as having a *white* volva and the cap « finement peluché d'un beau gris », and the habitat was given as « dans une pelouse moussue sous les pins », that is, terrestrial. This taxon is excellently described and illustrated by J. E. LANGE (l.c. Pl. 67 B), although from « black garden soil ». PATOUILLARD (Tab. Anal. Fung. 424) also describes a terrestrial taxon with white volva under this name. This is the interpretation I included in my key of 1960 and which MOSER uses in his key of 1967. I believe this to be the correct interpretation, since the epithet *murinella* must surely be used for a taxon with a white volva and terrestrial habitat.

V. murinella as depicted by GILBERT in Bull. Soc. Myc. Fr. 43 (1927) Atlas Pl. 21 is, however, described as growing on rotten beech and as having the volva grey externally, with spores 6.5-8/4.5-5 µ, some of which are figured distinctly coffin-shaped. *V. murinella* var. *umbonata* J. E. Lange (Fl. Ag. Dan. V (1940) Pl. 200 B) is from a rotten stump and has spores 6-6.5/3.75-4 µ, and also has the volva grey externally, and despite a discrepancy in spore size, is surely the same as that described by GILBERT. Both these represent my lignicolous taxon, but should not be referred to *murinella* because of the habitat and the volva coloured externally. The specimen illustrated by GILBERT has a patch of the volva on the cap just as I have seen it in Norfolk, England.

V. taylori was originally described by BERKELEY & BROOME from Jersey as growing on the ground and as having a brown volva, and has, I believe, spores of a broader shape than my lignicolous taxon. It is well illustrated by J. E. LANGE (Fl. Ag. Dan. II (1936) Pl. 68 B) and by BRESADOLA (Ic. Myc. Pl. 527[1]), and probably also BOUDIER (Ic. Myc. Pl. 85) and COOKE (Illustr. 296 (296)). SHAFFER (l.c. 565) gives a wider range of spore size, but his average measurements (« 6.3-7.3/4.4-5.4 µ ») and shape (« ovoid to oval, occasionally subglobose or obovoid ») and the habitat (« solitary to gregarious on soil ») indicate the same taxon and are in agreement with my own findings.

J. E. LANGE (Fl. Ag. Dan. II Pl. 68 A) has illustrated a somewhat similar taxon with volva coloured externally under the name *V. plumulosa,* and was followed in this by MOSER. (1967). This is not in agreement with QUÉLET's diagnosis of *plumulosa,* however, which is described as having a volva white externally, and which is regarded by many authors as a synonym of *V. hypopithys,* with which I would agree. Since *V. plumulosa* sensu

J.E. LANGE is separated from *V. taylori* mainly by differences of colour of cap, I would not at the moment regard it as a separate species, and have included this with *V. taylori*. If it is a different species, then it will need renaming and redescribing.

I have myself made one collection of a *Volvariella* growing on soil which I believe to be *V. taylori* and several collections of the other taxon growing on or about rotten wood. After drawing spores of these two taxa from spore-prints with camera lucida at x 2000, I find that those of my collection of *V. taylori* are broadly ellipsoid or ovoid sometimes slightly coffin-shaped 5.5-7.5/4-4.5 µ (Fig. 8), whereas those of the lignicolous taxon are ellipsoid or cylindric-ellipsoid often markedly coffin-shaped and 5.5-7.5/

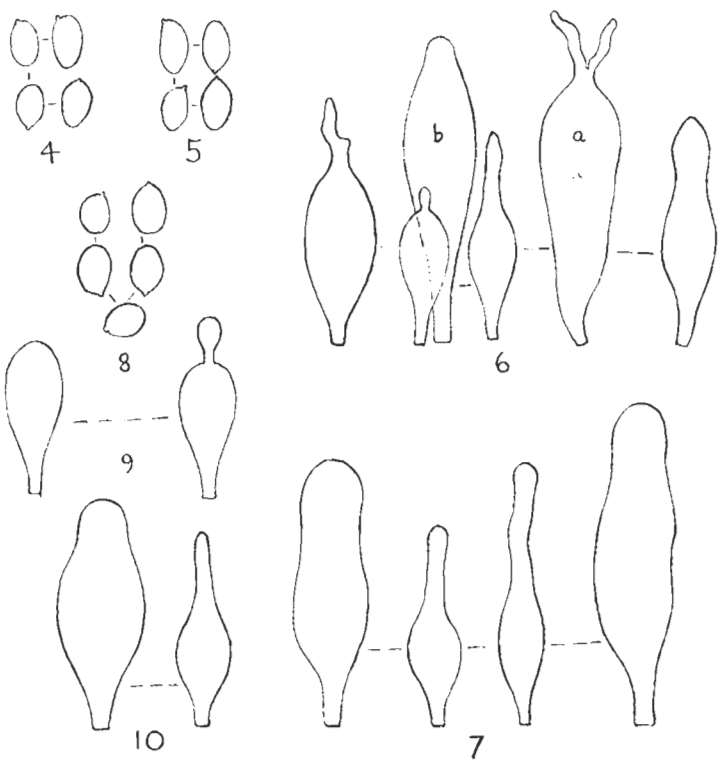


Fig. 4 : *V. caesiotincta*, Surlingham, Norfolk, 1 Aug. 1968, spores from small fruit-body shown in Fig. 1 (× 1 000) ; Fig. 5 : *idem*, 7 Aug. 1968, spores from large fruit-body (× 1 000) ; Fig. 6 : *idem*, marginal cystidia (× 500), a) 23 Aug. 1969, b) 1 Aug. 1968, the remainder 7 Aug. 1968 ; Fig. 7 : *idem*, facial cystidia (× 500), 7 Aug. 1968.

Fig. 8 : *V. taylori*, Abinger Hammer, Surrey, 22 Aug. 1958, spores (× 1 000) ; Fig. 9 : *idem*, marginal cystidia (× 500) ; Fig. 10 : *idem*, facial cystidia (× 500).

3.5-4 µ (Figs. 1, 2), thus appearing narrower. The difference is somewhat subtle, but readily appreciable when a group of spores are viewed together. J.E. LANGE gives the spores of *V. taylori* as « broadly ovate, 6.5-7/5 µ », whereas for *V. murinella* var. *umbonata* they are « oval-ovate, 6-6.5/3.75-4 µ », wich seems to support the differences wich I have found. Other microscopical characters do not seem to help very much, for the facial and marginal cystidia of both taxa are variable, although the marginal cystidia of the lignicolous taxon do seem to develop branched apical appendages more readily, which I have not noted for *V. taylori*. The cells of the fibrils on the cap surface are much the same for both taxa.

A study of a series of specimens over the years from the same elm log at the type locality has enabled me to appreciate the full range of colour and size which this taxon may show. Large specimens are often very distinctly blue (pale « eye-blue » or « leaden-grey » in British Fungus Flora colour chart, 1969) in part, especially around the centre when fresh, but this colour soon fades as the cap expands or dries out, through bluish-grey to ± olive-brown. As with many other lignicolous agarics such large specimens tend to be found on the larger logs or stumps. Smaller specimens on the woody frass surrounding the very decayed part of the log or in the remains of the stump did not show this blue colour at all and were ± olive-brown with whitish margin. They then looked quite different and resembled *V. taylori* much more, but could be readily distinguished by their spores. The surface of the cap, as in other species of this genus, with silky-fibrillose cap, is very difficult to describe in words. In this taxon it is finely-fibrillose or velvety-tomentose in the centre and ± loosely and often radially but finely silky-fibrillose in the outer part, with the fibrils sometimes forming V-shaped scales. The margin is finely silky-fibrillose lacerate at first but becomes ± smooth with age. This is quite different from the blackish-virgate darker brown cap of *V. volvacea,* although much more like the finely velvety-tomentose cap of *V. murinella,* or of *V. taylori,* which was originally described as « striato-rimose from the apex », a feature which I noted for the outer part of the cap in my notes on my collection of *V. taylori.*

I think, therefore, that the lignicolous habitat and narrower spore-shape as well as the cap characters discussed above are sufficiently diagnostic to warrant the separation of the lignicolous taxon as a distinct species from both *V. volvacea* (sensu Fries), *V. murinella* (sensu Quélet), and *V. taylori* (sensu Berkeley & Broome), with all of which it has at some time or other been confused. As I can find no description that seems to fit this lignicolous taxon, I am describing it as a new species, *Volvariella caesiotincta* P.D.

Orton, of which the following is a diagnosis and description. (The colours are as in the colour chart supplied with the Introduction to British Fungus Flora, Edinburgh, 1969).

Volvariella caesiotincta P. D. Orton, **nov. sp.**

Pileus 33-100 mm, e convexo vel conico-convexo expansus interdum late obtuse umbonatus, primo fuscus, olivaceo-fuscus vel griseo-olivaceus dein pallescens, cum major crescit interdum circa discum caesius vel griseo-cyaneus, ad marginem primo albus vel albidus, ad discum fibrilloso-tomentosus, ad marginem versus radialiter fibrillosus vel laxe albo-sericeo fibrillosus, ad marginem primo albo-sericeo laceratus vel minute squamulosus, interdum ad discum fragmento volvae obductus. Lamellae liberae, remotae, ex albis incarnatae, confertae, L 72-120, l (0)-1-3-(5), ad aciem primo alboflocculoso denticulatae. Stipes 34-100/3.5-11 mm, ad basim (7)-10-22 mm latus, sursum attenuatus ad basim ± incrassatus, albus dein albidus vel pallide cremeus, primo pruinosus vel minute pubescens ; volva extus griseo-olivaceus vel olivaceo-fuscus dein saepe griseascens, intus olivaceo-griseus, cremeus vel albidus, extus floccoso-punctatus vel sericeo-fibrillosus, saepe trifidus etiam irregulariter fissus. Caro alba dein interdum partim cremea vel griseascens. Odor praecipue sectus vulgo fortis pungente pyrinus leviter vini.

Sporae ellipsoideae vel leviter angulatae, 5.5-7.5-(8)/3.3-4 µ. Basidia 4-sporigera. Cystidia aciei lamellarum diversiformia, clavata vel lageniformia vulgo ad apicem apiculata vel furcata, 40-120/8-24-(32) µ, ad apicem 3-6-(10) µ lata. Cystidia faciei lamellarum diversiformia, vulgo ± lageniformia, etiam utriformia vel irregulariter clavata, 40-90/12-28 µ, ad apicem 5-20 µ lata. Cellulae cuticulae pilei ± cylindricae vel ellipsoideo-cylindricae, 4-28 µ latae.

Ad lignum putridum arboris frondosarum (praecipue Fagi et Ulmi). Tucks Plantation, Surlingham, Norfolk, England, 27 Aug. 1969 (typus in Herb. Edin.)

A sociis a habitatione, sporis et characteribus pilei distinguitur.

Cap 33-100 mm, convex or conico-convex then expanded-convex to ± plane, sometimes broadly obtusely umbonate or with wavy-lobed or puckered margin, *at first sepia, snuff-brown, hazel, drab or grey-olivaceous in centre with paler white or whitish margin, in large specimens often pale eye-blue or leaden-grey around centre at least in places when fresh,* sometimes ± citrine in places, *fading with age or when dry to pale grey-olivaceous or ± smoke-grey usually with ± persistently darker centre,* fibrillose-tomentose at centre and ± radially fibrillose or darker streaky around centre, sometimes minutely V-shaped scaly near margin when fresh, extreme margin at first finely silky-fibrillose lacerate, sometimes with adpressed fragment of volva at centre. *Gills* free, remote, white or whitish then salmon to salmon-pink, crowded, L 72-120, l (0)-1-3-(5), edge white flocculose or denticulate when fresh. *Stem* 34-100/3,5-11 mm, (7)-10-22 mm broad at base, attenuated

upwards from ± thickened base, white then witish or tinged cream, minutely downy-pubescent or pruinose when fresh, sometimes becoming longitudinally streaky or ± smooth, stuffed or solid, extreme base white tomentose ; *volva externally grey-olivaceous or hazel often becoming paler or greyish or buff-tinted with age*, internally pale olivaceous-grey or olivaceous clay-buff to pale creamy-buff or whitish, *externally dark hazel, floccose-punctate or scaly when fresh especially near the free edge*, sometimes with long white silky fibrils on lower part, often 3-lobed but sometimes irregularly torn or split. *Flesh* white then cream or creamy-buff in centre of cap or stem-base, sometimes greyish over gills or in cap centre. *Smell* often strong, especially when cut or enclosed in a box, pungent-fruity or winey.

Spores 5,5-7,5-(8)/3,3-4 µ *rather narrowly ellipsoid or slightly angular* (*coffin-shaped*). *Basidia* 4-spored, 28-40/7-8 µ. *Marginal cystidia* variously shaped, from clavate to lageniform, often with shorter or longer sometimes flexuose or irregularly shaped apical appendage, which may be branched or forked in large fruit-bodies, 40-120/8-24-(32) µ, apex 3-6-(10) µ broad. *Facial cystidia* also variously shaped, mostly ± lageniform often with long necks 5-7 µ broad, but some cylindric-clavate or utriform with apex 10-20 µ broad, 40-90/12-18 µ. *Cells of cap surface* ± cylindric or cylindric-ellipsoid, often with grey-olivaceous or olivaceous-buff vacuole, 4-28 µ broad. *Hyphae of scales on volva of* ± cylindric cells 6-14 µ broad, hyaline or with vacuoles as in cells on the cap.

Habitat singly or in small groups on or about stumps or logs of broad-leaved trees (especially beech or elm). Not uncommon in Southern England, occasionally further north. Blaise Castle, Bristol, Somerset, 10 Sep. 1955 (recorded as *V. volvacea* in error) ; Kingthorpe, Yorkshire, 10 Sep. 1960 (legit R. Watling) ; Tucks Plantation, Surlingham, Norfolk (on elm), 6 Aug. 1967, 1, 7, 8 and 9 Aug. 1968, 23 Aug. 1969, 27 Aug. 1969 (type in Herb. Edinb.) 10 Sep. 1972, 16 Oct. 1972.

Observations. Amongst other species with volva coloured externally, this species differs from *V. volvacea* in smaller spores of a different shape as well as habitat and cap colours, and from *V. taylori* in habitat, narrower spores and often also darker cap colours. *V. bombycina*, the other European species on wood with volva coloured externally, has the cap yellowish at least when fresh and more distinctly scaly as well as larger spores, whilst *V. fuscidala* and *V. cinerescens* have the cap smooth, and striate at the margin. *V. murinella* has the volva white externally as well as a terrestrial habitat and is always rather small. The nearest N. American species, *V. bakeri* (Murrill) Shaffer, has larger spores and different and on the whole darker cap colours. The illustration by GILBERT (as *V. murinella* — see list below) shows a fragment of the volva on the centre of the cap just as I have seen on two or three occasions at the type locality.

The variation in size and colour of cap shown by this species indicates care in dealing with other taxa in this genus. I do not think that shape of gill, the number of lobes into which the volva is split, or, unfortunately, cystidial characters are really diagnostic in this genus. Some species tend to be frequently rather small, whilst others are most often rather large, but a single fruit-body, such as one too often collects in this genus, can be very misleading if it is at the extreme end of the size range. Similarly cap colour

must be carefully used, since that too may vary according to the size of the fruit-body or whether it is young or old, or wet or dry. It seems to me that the characters that really do matter taxonomically are habitat, the colour of the volva externally, the range of size and shape of spore *ascertained from a spore-print,* and the nature of the cap surface, and these are the characters on which I have based my key to the species. The nature of the cap surface also has to be carefully used, since it too may change with the age of the fruit-body or weather conditions. Before we can be really sure that we know the species of this rather attractive but tantalising genus, the cry must always be for more material to be found and carefully examined, except in the case of the more common *V. speciosa* or of the very few species with really distinctive diagnostic characters, e.g. the habitat of *V. surrecta,* or the large size, yellowish scaly cap and habitat of *V. bombycina.* It is hoped that this further discussion of this genus may stimulate more work on it, and perhaps help towards easier determination of the species.

Key to European species of *Volvariella* Speg.

1. Cap distinctly viscid, smooth; spores 11-18/7-10 µ 2
— Not so; cap not or only slightly viscid; spores always less than 11 µ long or narrower 3

2.(1) Robust; cap 64-150 mm, ivory-whitish to grey, sometimes tinged sepia in centre, very viscid when moist; on manured soil, decaying vegetable matter or sawdust; volva white then whitish or greyish; spores 11-18/8-10 µ ..... *speciosa*
— Small to medium; cap 30-50 mm, ivory-whitish, very viscid; in woods (in grass drive sec J. Lange); volva white; spores 11•16/7-8 µ sec J. Lange ..... *media*
Note: this is a disputed and seemingly rare species. It is here taken sensu J. Lange. Fries gives the habitat as « in silvis humosis umbrosis fagineis » in his original diagnosis. Some authors have attributed smaller spores to this taxon, which would suggest different taxa, *e.g.* Bresadola (Ic. Myc. 530), who gives spores 7-9/4-5 µ but indicates a volva grey externally.

3.(1) Growing on other agarics (most often recorded on *Clitocybe nebularis,* but also on *Tricholoma* spp. or other species of *Clitocybe*); volva white or whitish; cap and stem white; spores ellipsoid, 5-6.5/3.5-4 µ ..... *surrecta*
— Not so 4

4. (3) Growing on wood or woody frass; often rather robust; cap 33-150-(200) mm, entirely or in part silky-scaly or loosely silky-fibrillose at least when fresh; volva coloured externally .. 5
— Not growing on wood; small to medium, more rarely large; cap smooth or silky-scaly; volva externally white or coloured 6
5. (4) Cap white then lemon-yellowish, entirely silky-scaly, 70-150 (200) mm; spores 8-10/5-6 µ; volva sepia or hazel externally ..... *bombycina*
— Cap sepia, snuff-brown, hazel or grey-olivaceous, often with white or whitish margin when young, sometimes bluish around centre when fresh, loosely adpressed white silky-fibrillose around often tomentose centre when fresh and sometimes minutely silky-scaly near margin, 33-110 mm; spores 5.5-7.5-(8)/3.3-4 µ; volva externally grey-olivaceous or hazel, sometimes fading to grey ..... *caesiotincta*
6. (4) Volva externally grey-olivaceous, hazel, snuff-brown, date-brown or sepia 7
— Volva externally white, sometimes discolouring slightly with age .. 10
7. (6) Cap minutely silky-fibrillose, velvety-tomentose or strongly fibrillose-virgate at least in part, dry, not striate though sometimes radially rimose at margin 8
— Cap smooth, dry or slightly viscid, margin ± striate (but becoming innately fibrillose-streaky in outer part in *fuscidula*) 9
8. (7) Cap often rather robust, 40-100 mm, snuff-brown, umber, date-brown or sepia, velvety-tomentose then rather strongly fibrillose-virgate especially in outer part; spores 7-9-(10)/5-6 µ, ellipsoid or ellipsoid-ovoid; volva externally date-brown or sepia at least in part; on spent tan, sawdust or greenhouse compost ..... *volvacea*
— Cap small to medium, 30-60 mm, paler or darker grey, grey-olivaceous or hazel, often with whitish margin, sometimes creamy or pale buff at centre, finely innately silky-fibrillose, margin sometimes radially rimose; spores 5.5-7.5-(8)/4-4.5-(5) µ, ovoid or broadly ellipsoid; volva externally grey-olivaceous or hazel; on soil or in grass ..... *taylori* *

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* *Volvaria grisea* Quélet (C. R. Ass. Fr. Avanç. Sci. 5 (1882) tab. 11 fig. 6) with cap 20-30 mm, grey, stem bluish-grey and tomentose, volva 'bistré' and spores ellipsoid-pruniform, 8-9 µ reported from gardens and greenhouses in spring would key out here but awaits rediscovery and clarification.

9.(7) Spores 7-9/4-5 µ, oblong-ellipsoid ; in mixed wood under beech ; cap 30-40 mm, slightly viscid at first, smoke-grey, centre darker, outer part becoming innately fibrillose-streaky, margin striate ; volva externally « stramineo-subfuscidula » ; stem white then dirty brownish ..... *fuscidula*

— Spores 6.5-7/3-3.5 µ, obovate-ellipsoid ; in gardens or grassy fields ; cap 25-35 mm, whitish becoming grey, margin striate ; volva externally becoming grey ; stem white ..... *cinerescens*

10.(6) Cap dry, often small, 16-40 mm, grey or brownish, finely silky-fibrillose felty-scaly ; in grass or in soil ; (spores 6-8.5/3.5-4 µ) ..... *murinella*

— Cap dry or slightly viscid, either very small, 5-30 mm, or slightly larger, 20-50 mm, white, sometimes tinged ivory or pale cream when old, smooth or finely silky-fibrillose scaly ; on soil or in grass in the open or in woods 11

11.(10) In grass or on soil in the open ; stem silky-striate or smooth ; cap often very small, 5-30 mm, silky-smooth or minutely silky-fibrillose, sometimes slightly viscid ; spores 5.5-6.5/4-5 µ, ovoid ..... *parvula*

— In coniferous or deciduous woods ; stem entirely downy-pubescent at least when fresh (easily seen with, often without, a lens) ; cap 20-50 mm, entirely finely silky-fibrillose scaly, margin ciliate-lacerate when fresh ; spores 6-7.5/4-4.5 µ, ovoid or ellipsoid-ovoid ..... *hypopithys*

CHECK LIST OF SPECIES WITH SYNONYMS, MISDETERMINATIONS, AND LIST OF APPROVED ILLUSTRATIONS AND DESCRIPTIONS.

This list does not pretend to be complete. Only those synonyms most likely to be met with and descriptions of recent date are included. The accepted specific epithets are in bold type, synonyms are in italics, and misdeterminations in Roman type. When an author's name in brackets is followed by a date, this refers to a combination with *Agaricus* sensu lato.

The following abbreviations are used :

Boud BOUDIER E. : *Icones Mycologicae.* Paris. (1905-10).
Bres BRESADOLA G. : *Iconographia mycologica.* Milan. (1927-33).
Cke COOKE M.C. : *Illustrations of British Fungi.* London. (1880-90).
KM KONRAD P. & MAUBLANC A. : *Icones Selectae Fungorum.* Paris. (1924-35).

KR KÜHNER R. & ROMAGNESI H. : *Flore Analytique des Champignons Supérieurs de France.* Paris. (1953).
L LANGE J.E. : *Flora Agaricina Danica.* Copenhagen. (1935-40).
M MAUBLANC P. : *Les Champignons de France* (4° édition). Paris. (1952).
MH MICHAEL E. & HENNIG B. : *Handbuch für Pilzfreunde.* Jena and Heidelberg. (1958-70).
R ROMAGNESI H. : *Atlas des Champignons.* Paris. (1956-67).

For journals :

BSMF Bull. Soc. Mycol. Fr.
TBMS Trans. Brit. Mycol. Soc.

Volvariella Speg., 1899.
Syn: *Volvaria* (Fries) Kummer, 1871 non DC, 1805 (*Gyalectaceae, Lichenes*).

bombycina (Schaeff. ex Fr.) Sing., 1951
Volvaria bombycina (Schaeff. ex Fr., 1821) Kummer, 1871.
L 68 E ; M 23 ; MH 31 ; R 186 ; KR : 426, fig. 18 ;
Mycologia 49 (1951) 558 (but volva described as « whitish, in age sordid yellowish or isabelline on the areolae »).

caesiotincta P. D. Orton, 1974
V. murinella var. *umbonata* J.E. Lange, 1940.
V. murinella Quél. sensu Gilbert non Quél.
V. volvacea (Bull. ex Fr.) Kummer sensu auctt. p.p. non Fries.
BSMF 43 (1927) Atlas Pl. 21, *murinella* ; L 200 B, var. *umbonata.* (possibly also R 185, *volvacea,* the figured specimen not the description).

cinerescens (Bres.) Moser apud Gams, 1967
V. cinerescens Bres., 1929.
Bres 532.

fuscidula (Bres.) Moser apud Gams, 1967
V. fuscidula Bres., 1905.
Bres 531.

hypopithys (Fr.) Moser apud Gams, 1953
V. hypopithys (Fr., 1874) Karsten, 1879.
V. pubescentipes (Peck, 1876) Sacc., 1887 (as *V. pubipes* e sphalm.).
V. plumulosa (Lasch) ex Quél., 1877.
V. parvula var. *biloba* Massee, 1893.
V. pusilla var. *biloba* (Massee) J.E. Lange, 1928.

V. media biloba (Massee) Pearson & Dennis, 1948.

V. pusilla (Pers. ex Fr.) Quél. sensu Kühn. & Romagn., 1953 non al.

MH 38 : L 68 D, var. *biloba* ; BSMF 72 (1956) 240, fig 32, *pubescentipes* ; TBMS 43 (1960) 384, figs. 208, 376, 496-7, *id.* ; Mycologia 49 (1957) 572.

media (Schum. ex Fr.) Sing., 1951

V. media (Schum, ex Fr.) 1821, Gillet 1874 (sensu J. Lange).

L 69 B ; (Cke 299 (299), if spores are the correct size).

murinella (Quél.) Moser apud Gams, 1953

V. murinella Quél., 1882 (sensu Quél. non Gilbert, Kühn. & Romagn.).

L 67 B ; Patouillard, Tab. Anal. Fung., 424 ; C. R. Ass. Franç. Av. Sci. (1882) 5, Pl. 11 fig. 6.

parvula (Weinm.) Speg., 1926

Agaricus (*Volvaria*) *pusillus* Pers. ex Fr., 1821 non *A.* (*Naucoria*) *pusillus* Fr., 1821.

Volvaria parvula (Weinm., 1836) Kummer, 1871.

V. pusilla (Pers. ex Fr.) Quél., 1888 (sensu Fr. et al non Kühn. & Romagn., 1953).

Volvariella pusilla (Pers. ex Fr.) Sing., 1951.

Boud 86 ; Bres 533 ; L 68 C, *pusilla* ; KM 18 [1], *id.* ; MH 35, *id.* ; BSMF 72 (1956) 242, fig. 33, *id.* ; Mycologia 49 (1957) 570, *id.*

speciosa (Fr. ex Fr.) Sing., 1951

Volvaria speciosa (Fr. ex Fr., 1821) Kummer, 1871.

V. gloiocephala (DC. ex Fr., 1821) Gillet, 1874.

V. speciosa f. *gloiocephala* (DC. ex Fr.) Konr. & Maubl., 1927.

V. speciosa var. *gloiocephala* (DC. ex Fr.) Heim, 1936.

Volvariella speciosa var. *gloiocephala* (DC. ex Fr.) Sing., 1951.

L 69 D, D[1] ; M 22, *gloiocephala* ; Cke 297 (297) ; 298 (298), *gloiocephalus* ; Boud. 84 ; Mycologia 49 (1957) 553-557.

surrecta (Knapp) Sing., 1951

Volvaria surrecta (Knapp, 1829) Ramsbottom, 1942.

V. loveiana (Berk., 1836) Gillet, 1874.

V. hypopithys subsp. *loveiana* (Berk.) Konr. & Maubl., 1927.

L 68 B, *loveiana* ; KM 17 [2], subsp. *loveiana* ; Cke 295 (295), *loveianus* ; BSMF 72 (1956) 246, figs 35-36, *loveiana* ; MH 36, *id.* ; Mycologia 49 (1957) 574.

taylori (Berk. & Br.) Sing., 1951

V. taylori (Berk. & Br., 1854) Gillet, 1874.

V. plumulosa (Lasch) ex Quél. sensu J. Lange, Moser non Quél.

V. parvula (Weinm.) Kummer sensu Kühn. & Romagn., 1953 non al.

L 68 F: 68 A, *plumulosa*; Cke 296 (296); Boud 85 (excl. spores); Bres 527[1]; BSMF 72 (1956) 244, fig. 34, *parvula*; MH 34 ; Mycologia 49 (1957) 565.

volvacea (Bull. ex Fr.) Sing., 1951

V. volvacea (Bull. ex Fr., 1821) Kummer, 1871.

Cke 294 (294); MH 37; BSMF 75 (1959) 386, figs 6, 7; Beitrage für Kryptogamenflora der Schweiz XIII (1968) 709 ; Mycologia 49 (1957) 563.

(Note: KM 18[2] seems to be a mixture of *volvacea* and *caesiotincta*, the illustration suggests *volvacea*; R 185 seems to be the same mixture, but the illustration suggests *caesiotincta*.)

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