KEYS TO SECTIONS OF *PARASOLA, COPRINELLUS, COPRINOPSIS* AND *COPRINUS* IN BRITAIN

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The title refers, of course, to species, commonly known as "Ink Caps" (Note 1), that were all included in one genus, *Coprinus*, until the turn of the last century. The keys provided here, and to be included in future issues of *Field Mycology*, draw heavily on the work of the late Kees Uljé. Uljé's work at the Rijksherbarium at Leiden was published in a number of articles in *Persoonia* and was drawn together in Volume 6 of the *Flora Agaricina Neerlandica* (Uljé, 2005) after he died. The British species were also covered in Volume 2 of the *British Fungus Flora* (Orton & Watling, 1979), an account that was notable for its detailed and comprehensive coverage when it was published in 1979, although a number of newly described or then non-British species have subsequently been added to the British list.

The adoption of three additional genus names by Redhead *et al.* (2001), two already used in the past and one, *Parasola*, newly coined, was prompted by DNA studies. In particular, the work of Hopple and Vilgalys (1999) made it clear that the type of the genus, *Coprinus comatus*, along with one close ally, *Coprinus sterquilinus*, were closer to species in *Agaricaceae* (*Agaricus*, *Lepiota* etc.) than they were to the rest of the species then included in *Coprinus*. This observation was actually supported by a careful review of the classical taxonomy as described by Scott Redhead (2001) in an earlier issue of *Field Mycology*.

Since *Coprinus comatus* is the type species defining the genus, either the majority of the Ink Caps had to be put into other genera or the type of *Coprinus* had to be changed to another species. A formal proposal to switch the type to *Coprinus atramentarius* was made but failed to be accepted. Given that rejection, it is incorrect to use *Coprinus* in the broader sense if the distinction between the *Coprinus comatus* group and the rest of the Ink Caps is accepted. Had the type changed, it might have been possible to argue for the continued use of *Coprinus* in its broader sense (but excluding the *comatus* group) instead of the three newly adopted genera (Note 2). This choice is not now available, although it is open to someone to classify them all as *Psathyrella* should he or she wish to buck the current trend of creating genera with ever decreasing numbers of species!

In their paper, Redhead *et al.* (2001) provided a key to the newly adopted genera but added "not recommended for standard identifications" to its title. I have found it convenient to use keys to what were previously designated as subsections of *Coprinus*, regarding them as sections (see Note 3) of the appropriate newly adopted genera. So the key leads to the section and only incidentally to the genus, except for *Coprinus* in the strict sense, where the current genus was previously one Subsection. Detailed keys to the species in these sections will follow in future issues of Field Mycology.

Following is a key to these sections. Before embarking on the key, Step 0 addresses the question "am I using the right key?" Not in the sense of "does it work?" or "are better keys available?" - although these are questions always worth asking - but in the sense of "is my unknown likely to be one of the species in the key?".

Step 0. Species of gilled agarics with most or all of the characters:

Gills autodigesting (liquefying) to a dark inky fluid ("deliquescent"); fertile surface of gills with large ("pavement") sterile cells (pseudoparaphyses) separating basidia, which also are in several distinct sizes (lengths); spores in shades of dark brown to completely black, with germ pore; cap thin-fleshed, becoming strongly plicate (grooved, pleated) on opening; gills thin, parallel or subparallel and packed closely together (very crowded); gills with large, conspicuous, thin

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walled, colourless facial cystidia (may be present or absent in smaller and non-deliquescent species and absent in *Coprinus* s.str.); cap with veil as filamentous or globose cells, often easily brushed off or washed off by rain (scaly and attached in *Coprinus* s.str.), or with projecting hair-like pileocystidia ("setules"), sometimes combined with some sparse veil or completely bald but, if so, cap opening to flattened-convex, strongly radially pleated and not deliquescing during sporulation.

[Note: all photos © Derek Schafer unless stated otherwise].

Key to Genera and their sections

1 **Large, flesh reddening, with ring; tan-coloured scales forming part of the tissue of the cap at the top**. The unopened cap elongate, scales forming part of the tissue of the cap, rather than a separate layer, stem cylindrical usually with swollen base, hollow with a separable thread or strand of silky or cottony material running the length of its interior and attached at each end; with a distinct ring initially at the base of stem, sometimes becoming detached or remaining at the base; gills lacking facial cystidia; mature basidia with darkened sterigmata; gills initially white then reddening in places before becoming black from the spores. . . . . . . ***Coprinus* s.str. (*C. comatus* & *sterquilinus*)** (Figs. 1–4).

(Two British species, fairly easy to recognise. The scales resemble those of some *Agaricus* species but in more mature fruitbodies, especially of *C. sterquilinus*, can become fibrillose and, with a somewhat plicate cap, look like other Ink Caps. Large Ink Caps in other genera include: *Coprinopsis picacea* (Fig. 12), which has a swollen base to the stem, but not a ring, and detachable scales in patches; and *Coprinopsis atramentaria* (fig. 8), which has thin adpressed scales and a ring-like zone towards the base of the stem; both have large facial cystidia, unlike the two *Coprinus* species. Some dung species in *Coprinopsis* section *Lanatuli* can resemble smaller specimens of *Coprinus sterquilinus* but they also have facial cystidia and detachable cap veil).

1* **Not with the above characters 2**

Figs. 1–3 *Coprinus comatus*. Cross-section shows the central thread of tissue running down the stem.

Fig. 4. *Coprinus sterquilinus*. Photo © Stuart Skeates.

2 CAP with bristles (= setules, = pileocystidia) or without veil . . . . Sections a-c:

a. Cap with setules

CAP setules can usually be seen easily with a hand lens, especially in younger fruitbodies (Fig. 5). The stem is also covered in cystidia. Stem cystidia are also found in other sections of *Coprinellus* that do not have cystidia on the cap, but are absent in *Parasola* species, which can be confused when very young with Setulosi species. The Setulosi comprise a large and sometimes difficult section.

. . . . ***Coprinellus* section *Setulosi***

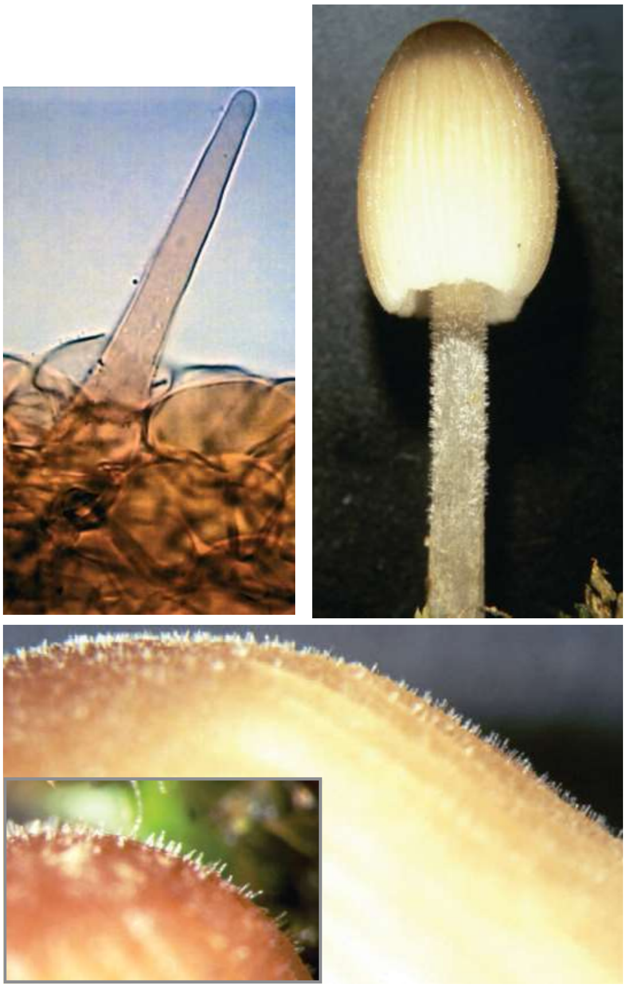

Fig. 5. Examples of cap and stem bristles (= setules, = pileocystidia) in Section *Setulosi* (stained with congo red).

...or b.

CAP thin & membranous, with sparse, long, thick-walled hairs, stem smooth:

Parasola* section *Auricomi

(one species *P. auricomus*, if we exclude *Parasola conopilus* recently transferred from *Psathyrella*) (see Fig. 6)

Fig. 6. *Parasola auricoma* and thick-walled cap hairs

...or c.

CAP bald – lacking any veil or hairs on cap or stem (except possibly a few fibrils at the base of the stem):

Parasola* section *Glabri

(*P. plicatilis* and allies)—see Fig. 7a-c

Fig. 7. Examples of *Parasola* section *Glabri.*

2* CAP not like this (with veil and without setules)...................... 3

(Note that all "Coprini", except the plicatilis-like Glabri and Auricomi and some Setulosi, have veil).

3 Large, fleshy species, veil thin and attached (may be hard to see), stem with characteristic ring-like line, cap colour whitish to grey or brown and cap sometimes laterally wrinkled but not plicate (pleated)....................
Coprinopsis* section *Atramentarii

(The ring-like line around the stem marks the point where the bottom of the cap meets the stem; below it has the thin flat scales of the cap, above is finely grooved where the gills were in contact —see Figs 8-9).

Fig. 8. *Coprinopsis atramentaria*, section *Atramentarii*.

Fig. 9. *Coprinopsis romagnesiana,* a member of section *Atramentarii* Photo © John Holden.

3* Lacking characteristic line on stem; smaller/less fleshy species, veil on cap more obvious OR cap with ochre colours and/or more plicate (pleated) . . 4

4 Ochre caps, growing in bunches (fasciculate), veil in the form of glistening mica-like granules (spheres under the microscope) but can be washed off and invisible, stem hairy with caulocystidia in young fresh specimens, spores mitriform (shaped in face view like a bishop's hat. A very common species, generally on wood.....
.... *Coprinellus micaceus* (Fig. 10)
(see also couplet 8, section Micacei)

Fig. 10. *Coprinellus micaceus* fruitbodies with mitriform spore inset.

4* Not as above 5

5 Veil on cap filamentous, formed of chains of elongate cells, generally unbranched, often forming tufts with pointed tips on the cap surface ....
... *Coprinopsis* section *Lanatuli* (Fig. 11)
(see note about *Coprinellus flocculosus* on page 49)

Fig. 11. Examples of *Coprinopsis* section *Lanatuli*: *C. pachyderma* above; *C. lagopus* below left; tufts of pointed hairs stained with congo red, below right.

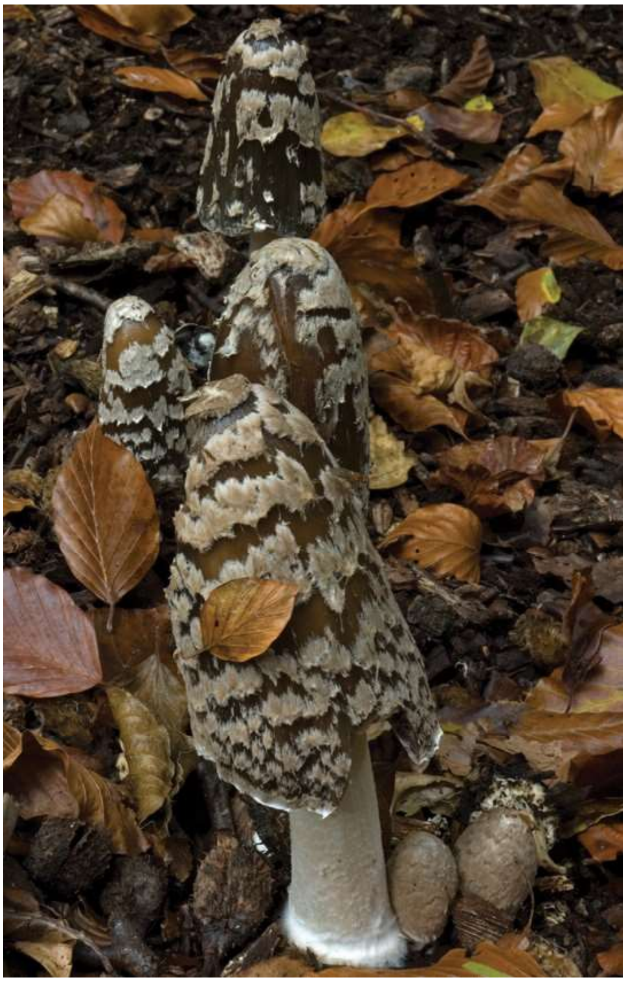

Fig. 12. The largest member of *Coprinopsis* section *Alachuani*: *Coprinopsis picacea.*

5* Veil different 6

6 Veil on cap filamentous but branched or diverticulate, thick- or thin-walled (includes many tiny herbicolous species but also the much larger *C. picacea*) . . . . . *Coprinopsis* section *Alachuani* (Figs 12-13)

6* Veil on cap with a large proportion of globose, sub-globose or irregularly rounded cells (length generally less than 2 x width) 7

7 Cap usually brown or ochre, never pure white; long closed and not opening fully flat; veil present in the form of scattered granulose floccules (may be almost completely washed away) or small flocculose scales or patches; fruitbodies medium-sized, fleshy, sometimes fasciculate on wood 8

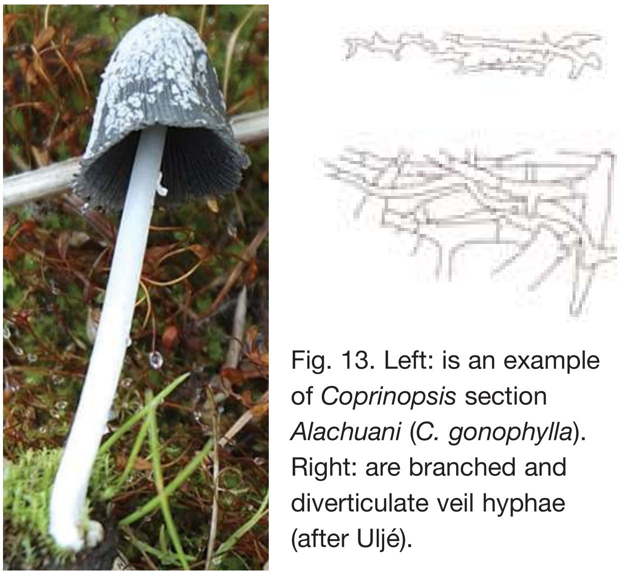

Fig. 13. Left: is an example of *Coprinopsis* section *Alachuani* (*C. gonophylla*). Right: are branched and diverticulate veil hyphae (after Uljé).

7* Cap white to grey, generally opening fully when mature; veil mealy-powdery, entirely covering the cap; fruitbodies generally smaller (but can be large in e.g. *Coprinopsis nivea,* see Fig. 22). 9

8 **Cap veil in scattered glistening granules often washed off by rain and difficult to see; consisting mainly of globose thin-walled cells in a matrix of narrow, branched hyphae (Fig. 14) . . . .**
. . . *Coprinellus* section *Micacei*
(see also couplet 4 above)

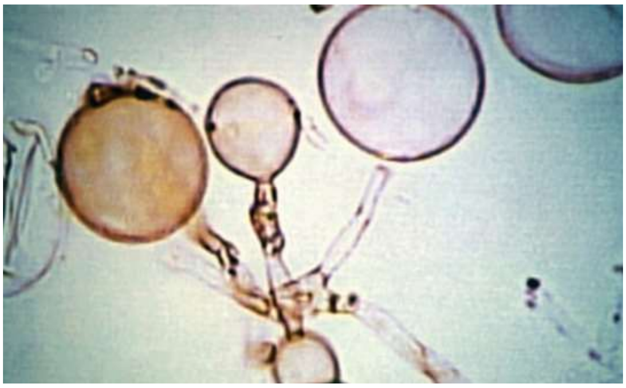

Fig. 14. Globose cells from veil of *C. micaceus*, stained with congo red,.

8* **Cap veil of more persistent, floccose scales, including chains of cells; some may be thickened & yellow-brown, inflated to a fusiform, ellipsoid or globose shape between the septa. . . . .**
. . . . *Coprinellus* section *Domestici*
(Figs 15-17)

(The yellow-brown, thick-walled cells form the tips of the veil flocks and can be missing in fresh specimens or depending on which bit of tissue is selected; in such cases, there will still be strings of thin-walled inflated spindle-shaped cells (Figs 15-16), distinct from the sphaerocysts inflated at the ends of narrow branched hyphae in the first half of the couplet)

Fig. 15. Chains of thick-walled cells in veil of *C. domesticus*.

Fig. 16. Cap surface of *C. domesticus*. Photo © Derek Schafer.

Fig. 17. *Coprinellus truncorum*.

Included in section *Domestici* is *Coprinellus flocculosus* with veil that can resemble section *Lanatuli* but the veil is more floccose, has rounded end cells (Fig. 18) and lacks clamp connections. The spores are large and dark with a very eccentric germ pore.

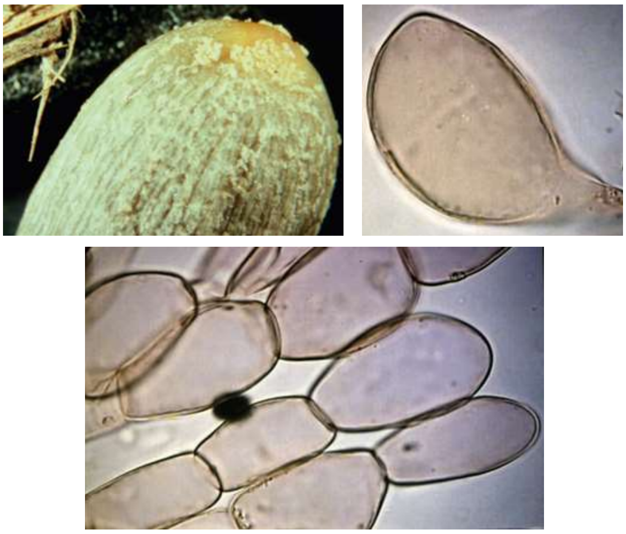

Fig. 18. *Coprinellus flocculosus* showing cap surface and rounded end cells of veil.

9. Cap veil cells with nipple-shaped warts/peg-like protrusions evenly distributed over the globose or sub-globose cells and forming part of the cell wall structure; spores often with "perispore" (myxosporium); fruitbodies of some species with strong, unpleasant smell (Figs 19–20). . . . . ***Coprinopsis* section *Narcotici***


Fig 19. An example of *Coprinopsis* section *Narcotici*, *C. laanii* showing mealy-powdery cap surface.

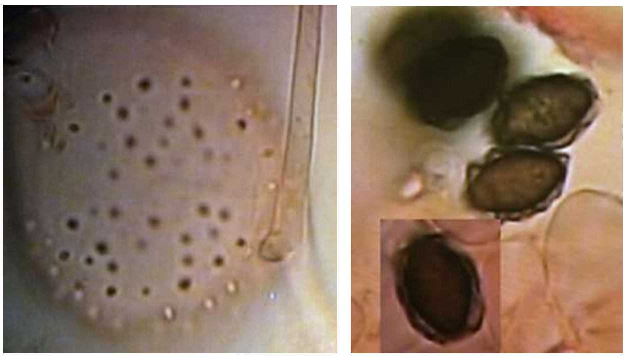
Fig. 20. Cell from veil of *C. laanii* with protrusions, stained with congo red (left) and spores with outer myxosporium (right).

9*. Cap veil cells smooth or encrusted with angular lumps not forming part of the cell wall; spores without a myxosporium; fruitbodies without unpleasant smell (Figs 21–22) . . . . ***Coprinopsis* section *Nivei***

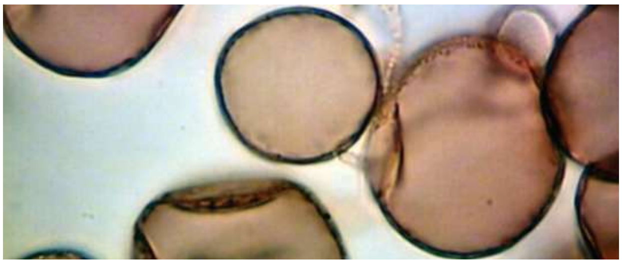
Fig. 21. Cells from cap veil of *C. cortinatus*, stained with congo red, a species that surely belongs in *Coprinopsis* section *Nivei* but has not yet been formally combined in that genus.


Fig. 22. *Coprinopsis nivea*.

NOTES

Note 1

The term Ink Cap refers to dark-spored species that share the character of programmed liquefaction of their gills as part of the spore liberation process. Strictly, a number of the species included in *Coprinus* in the broad sense, do not do this (*Coprinellus disseminatus* and *Parasola plicatilis*, for example) and should not, perhaps, be called Ink Caps.

Note 2

Since the DNA studies also showed that a number of *Psathyrella* species as well as *Lacrymaria* were interposed between groups of *Coprinus s.l.* species, this would have required those relevant species to be transferred to *Coprinus*.

Note 3

The following new combinations are made here (and I would like to acknowledge the help of Dr. Paul Kirk with the nomenclature):

Coprinellus sect ***Setulosi*** (J.Lange) D.J. Schafer, comb. nov.
Basionym: ***Coprinus*** subsect ***Setulosi*** J. Lange in *Dansk bot. Ark.* 2 (no.3): 38, 1915.
Thin-walled pileocystidia and caulocystidia ('setules') present; with or without veil on pileus or stem; with or without thick-walled sclerocystidia on pileus.

Coprinellus sect ***Micacei*** (Fr.) D.J. Schafer, comb.nov.
Basionym: ***Coprinus*** sect. ***Micacei*** Fr., *Epicr. syst. mycol.* (Uppsala): 247, 1838.
Caps with brown, ochre or orange colours, sometimes very pale but never pure white; conical or campanulate, remaining not fully expanded for most of

spore discharge. Lacking setules on cap; veil present in the form of scattered, granulose flocks, often mostly removed, consisting of globose cells arising from a matrix of narrow branched hyphae and colouring pink or lilaceous in alkali.

Coprinellus sect ***Domestici*** (Singer) D.J. Schafer, comb. nov.
Basionym: ***Coprinus*** subsect ***Domestici*** Singer, *Sydowia* 2: 36, 1948.
Caps with brown, ochre or orange colours, sometimes very pale but never pure white; subglobose, conical or campanulate, remaining not fully expanded for most of spore discharge. Lacking setules on cap; veil present on cap in the form of floccose scales, consisting of chains of cells expanded to fusiform or subglobose form between narrower septa, not colouring in alkali and lacking clamp connections.

Coprinopsis sect ***Atramentarii*** (Fr.) D.J. Schafer, comb. nov.
Basionym: ***Coprinus*** sect. ***Atramentarii*** Fr. Epic. syst. mycol: 243, 1838.
Caps ochre-brown, grey-brown or grey, often pale, medium sized to large, veil in the form of thin, flat adpressed scales or fine and silky, attached to cap surface and often barely visible; the caps sometimes laterally wrinkled but not plicate; the stem with a ring-like line at its original point of contact with the cap, with veil as on cap below, finely grooved above.

Coprinopsis sect ***Lanatuli*** (Fr.) D.J. Schafer, comb.nov.
Basionym: ***Coprinus*** sect. ***Lanatuli*** Fr., Epic. syst. mycol: 250, 1838.
Caps lacking setules, with hairy-floccose veil, often in tufts with pointed tips, consisting of chains of largely unbranched elongate hyphae wider at one end of the chain, narrower at the other with distinct terminal elements, the hyphae constricted at the septa and with clamp connections.

Coprinopsis sect ***Alachuani*** (Singer) D.J. Schafer, comb. nov.
Basionym: ***Coprinus*** subsect ***Alachuani*** Singer, *Lilloa* XXII: 459, 1949.
Caps lacking setules, white to dark grey below the veil, rarely brown, with hairy-floccose or felty veil consisting of branched and/or diverticulate hyphae, lacking globose or subglobose elements.

Coprinopsis sect ***Narcotici*** (Uljé & Noordel.) D.J. Schafer, comb. nov.
Basionym: ***Coprinus*** subsect ***Narcotici*** Uljé & Noordel., *Persoonia* 15: 261, 1993.
Caps small, thin-fleshed, white to grey entirely covered in mealy-powdery veil, at centre often woolly-floccose or forming clumps, expanding to become applanate, usually radially grooved and splitting; consisting of globose or subglobose cells with nipple-shaped warts that form part of the cell wall and are not dissolved by aqueous acid; a myxosporium is usually evident on the spores.

Coprinopsis sect ***Nivei*** (Citérin) D.J. Schafer, comb. nov.
Basionym: ***Coprinus*** subsect ***Nivei*** Citérin, *Doc. mycol.* 22 (no. 86): 17, 1992.
Caps thin-fleshed, white to grey entirely covered in mealy-powdery veil, at centre often woolly-floccose or forming clumps, expanding to become applanate, usually radially grooved and splitting; consisting of globose, subglobose or irregularly rounded cells, smooth or with crystalline encrustation that dissolves in aqueous acid, sometimes with broad diverticulae but lacking more regularly distributed, smaller nipple-like warts; spores lacking an evident myxosporium.

Parasola sect ***Glabri*** (J. Lange) D.J. Schafer, comb. nov.
Basionym: ***Coprinus*** subsect ***Glabri*** J. Lange in *Dansk bot. Ark.* 2 (no.3): 38, 1915.
Caps and stems lacking veil, pileocystidia and setae.

Parasola sect ***Auricomi*** (Singer) D.J. Schafer, comb. nov.
Basionym: ***Coprinus*** subsect ***Auricomi*** Singer, *Sydowia* 2: 36, 1948.
Caps and stems lacking veil and pileocystidia, except that caps have long, narrow thick-walled setae.

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