***Cercophora mirabilis* Fuckel – AEB 1360 (= PDD 120028) including a photo of its *Cladorrhinum*-like anamorph**

Collected: March 2023

Substrate: wild red deer (*Cervus elaphus*) dung

Collection site: NZTM grid ref. E1770875 N5447137, in manuka-kamahi regenerating forest, above and to the west of Grace Nicholls Drive, Riverstone Terraces subdivision, Upper Hutt.

Collectors: Ian Flux & Merryl Park; **Identifiers:** Ann Bell & Dan Mahoney

Voucher materials: No dried herbarium specimen but 4 Shear's mounting fluid (SMF) semi-permanent microscope slides; microscopic views of perithecia, asci, ascospores & anamorph; Dan's comments.

References consulted for *Cercophora mirabilis*: (listed in chronological order)

1) Lundqvist N. 1972. Nordic Sordariaceae s. lat. Symbolae Botanicae Upsalienses 20: 1–374. See Lundqvist's description and illustrations on the page after next.
2) Bell A. 1983. Dung Fungi: An Illustrated Guide to Coprophilous Fungi in New Zealand. Victoria University Press, Wellington. 88 pages. See Ann's illustrations on the page after Lundqvist's description/illustrations.
3) Bell A. 2005. An Illustrated Guide to the Coprophilous Ascomycetes of Australia. CBS Biodiversity Series No. 3, Centraalbureau voor Schimmelcultures, Utrecht, the Netherlands, 172 pages. See Ann's illustrations on the page after Lundqvist's description/illustrations.
4) Fungi of Great Britain and Ireland. 2010. *Cercophora mirabilis* A description is provided by Paul Cannon.
5) Doveri F. 2017. Additional reports on coprophilous Lasiosphaeriaceae from tropical climates. Ascomycete.org 9(2): 32–58. *Cercophora mirabilis* is described and illustrated. No anamorph was seen.

Dan's comments: AEB 1360 is a good match to *Cercophora mirabilis.* Its photos and measurements are provided in the pages that follow descriptions/illustrations by Lundqvist and Bell.
Of special significance is the presence of a *Cladorrhinum*-like anamorph. This is photographed and discussed on the page with its photo. Its phialides are shown growing from a *Cercophora mirabilis* ascospore but were also viewed on less-photographic ascospores and from hyphal fragments in my perithecium slide preparations from the incubating dung. Until I saw phialides emanating from the *C. mirabilis* ascospore, I couldn't be sure of their intimate association with it.

References consulted for *Cladorrhinum*: (listed in chronological order)

1) Mouchacca J. & Gams W. 1993. The hyphomycete genus *Cladorrhinum* and its teleomorph connections. Mycotaxon 48: 415–440. Abstract: "The genus *Cladorrhinum* Sacc. & Marchal is characterized by the possession of clustered fertile hyphae, each cell of which possesses a lateral phialidic opening (pleurophialides). The genus *Bahupaathra* Subram. & Lodha, type species *B. samala*, is synonymized with it. The genus is connected with teleomorphs of *Apiosordaria* and *Cercophora* in the Lasiosphaeriaceae, which are reviewed."

2) Bell A. & Mahoney D.P. 1997. Coprophilous fungi in New Zealand II. *Podospora* species with coriaceous perithecia. Mycologia 89(6): 908–915. A *Cladorrhinum* anamorph for *Podospora fimiseda* is reported for the first time.

3) Gams W. 2000. *Phialophora* and some similar morphologically little-differentiated anamorphs of divergent ascomycetes. Studies in Mycology 45: 187–199. *Cladorrhinum* is among the similar anamorphs discussed. Page 190 "The teleomorphs of *Cladorrhinum* are found in *Apiosordaria* von Arx & W. Gams and *Cercophora* Fuckel in the Lasiosphaeriaceae (Mouchacca & Gams, 1993).

4) Miller A.N. & Huhndorf S.M. 2001. Neotropical Ascomycetes 10. New and interesting *Cercophora* species. Sydowia 53 (2): 211–226. At the end of their discussion section (pp. 224–225), see their comments on anamorphs that accompany some of their *Cercophora* species.

5) Madrid H. et al. 2011. Two new species of *Cladorrhinum*. Mycologia 103(4): 795–805. In addition to describing 2 new species, the authors also discuss known teleomorph relationships and where *Cladorrhinum* spp. fall in phylogenetic studies (theirs and others).

6) Huang S-K., Hyde K.D., Mapook A. et al. 2021. Taxonomic studies of some often over-looked Diaporthomycetidae and Sordariomycetidae. Fungal Diversity 111: 443–572. A long and complex reference with many taxonomic name changes. Entering '*Phialophora*', '*Cladorrhinum*', '*Podospora', 'Cercophora*' or '*mirabilis*' into a search of the reference pdf reveals where these changes lie. Some of these changes may (or may not) be widely accepted. For example: their Podosporaceae X. Wei Wang & Houbraken includes *Cladorrhinum* Sacc. & Marchal, *Podospora* Ces. = *Schizothecium* Corda and *Triangularia* Boedijn = *Apiosordaria* Arx & W. Gams. See also the related reference "Wang X.W. et al. 2019. Phylogenetic re-evaluation of *Thielavia* with the introduction of a new family Podosporaceae. Stud. Mycol. 93: 155–252."

Lundqvist N. 1972. Nordic Sordariaceae s. lat. Symbolae Botanicae Upsalienses 20: 1–374. **Portions of pages 88-90 are reproduced below.**

***Cercophora mirabilis* Fuck. 1870: 245 (Fig. 3, pl. 3)**

Coll. orig. on cow dung from "Altersand" opp. Östrich, Nassau, Hessen, Germany, s. dato, Fuckel (G, lectotype); Fuckel, F. Rhen. 2271, 1869, nom. nud. – *Podospora mirabilis* (Fuck.) Gola 1930: 213.

Perithecia scattered or aggregated in small clusters, superficial to semi-immersed, 570-865 x 385-500 µ, obpyriform, covered with flexuous, sparingly ramified, septate, brown, c. 2.5 µ thick hairs; neck cylindrical, 100-300 × 120-160 µ, black, opaque, provided with stout tufts or a palisade of agglutinated, swollen, 1-4-septate, obtuse, 10-30 x 5-6 µ large hairs. **Peridium** membranaceous, subopaque, brown, 3-layered; outer peridial cells angular or rounded, swollen, moderately thick-walled, 6-13 µ in diam. Perithecial contents hyaline. **Paraphyses** filiform-ventricose. **Asci** 8-spored, 250-290 × 15-18 u, clavate; apical ring thickened, simple, c. 3.5 u in diam., c. 1 µ thick, indistinctly triangular in cross-section; subapical globulus round to subglobose, 5 µ or 5 x 7 µ in diam., ±verruculose. **Spores** 2-3-seriate, at their hyaline stage one-celled, vermiform, slightly sigmoid or only bent below, 52-68(-75) x 4-5 µ, filled with one series of c. 14-17 large oil drops, finally swelling above, becoming transversely uniseptate; upper cell at last brown, 15-21(-25) × 9-11 µ, ±equilateral, ellipsoidal, truncate at the base, conical at the apex with an excentrically placed germ pore; pedicel 35-44 x 4-5 u, cylindrical, geniculate below, collapsing. A lash-like, solid **gelatinous cauda** attached to both ends of the spore, 36-50 x 2.5-3 µ, rather fugacious; apical cauda narrower than the basal one.

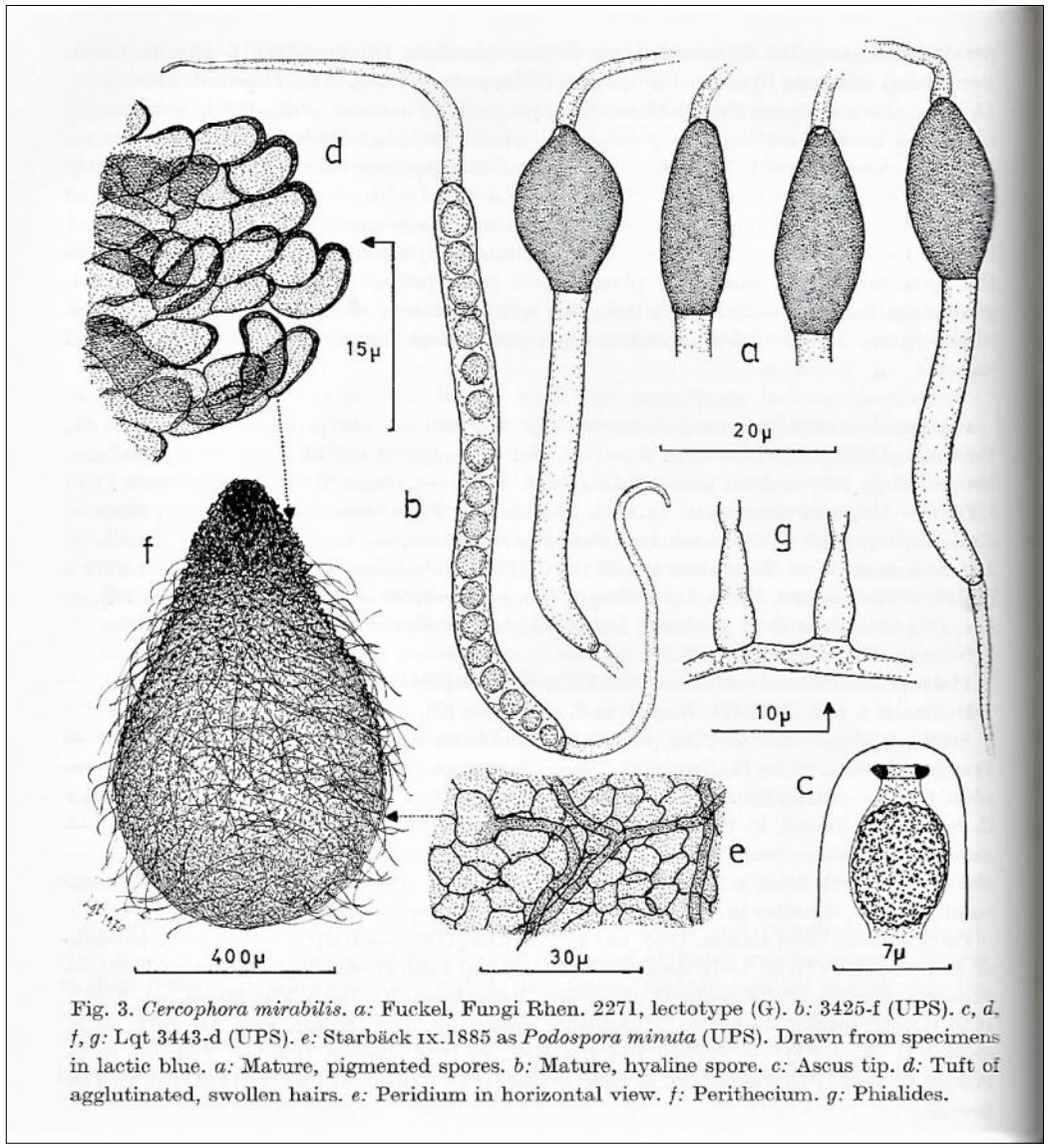


Fig. 3. *Cercophora mirabilis*. *a:* Fuckel, Fungi Rhen. 2271, lectotype (G). *b:* 3425-f (UPS). *c, d, f, g:* Lqt 3443-d (UPS). *e:* Starbäck IX.1885 as *Podospora minuta* (UPS). Drawn from specimens in lactic blue. *a:* Mature, pigmented spores. *b:* Mature, hyaline spore. *c:* Ascus tip. *d:* Tuft of agglutinated, swollen hairs. *e:* Peridium in horizontal view. *f:* Perithecium. *g:* Phialides.

Bell A. 2005. An Illustrated Guide to the Coprophilous Ascomycetes of Australia. CBS Biodiversity Series No. 3, Centraalbureau voor Schimmelcultures, Utrecht, the Netherlands, 172 pages. Portions of page 142, Fig. 88 are copied in below.

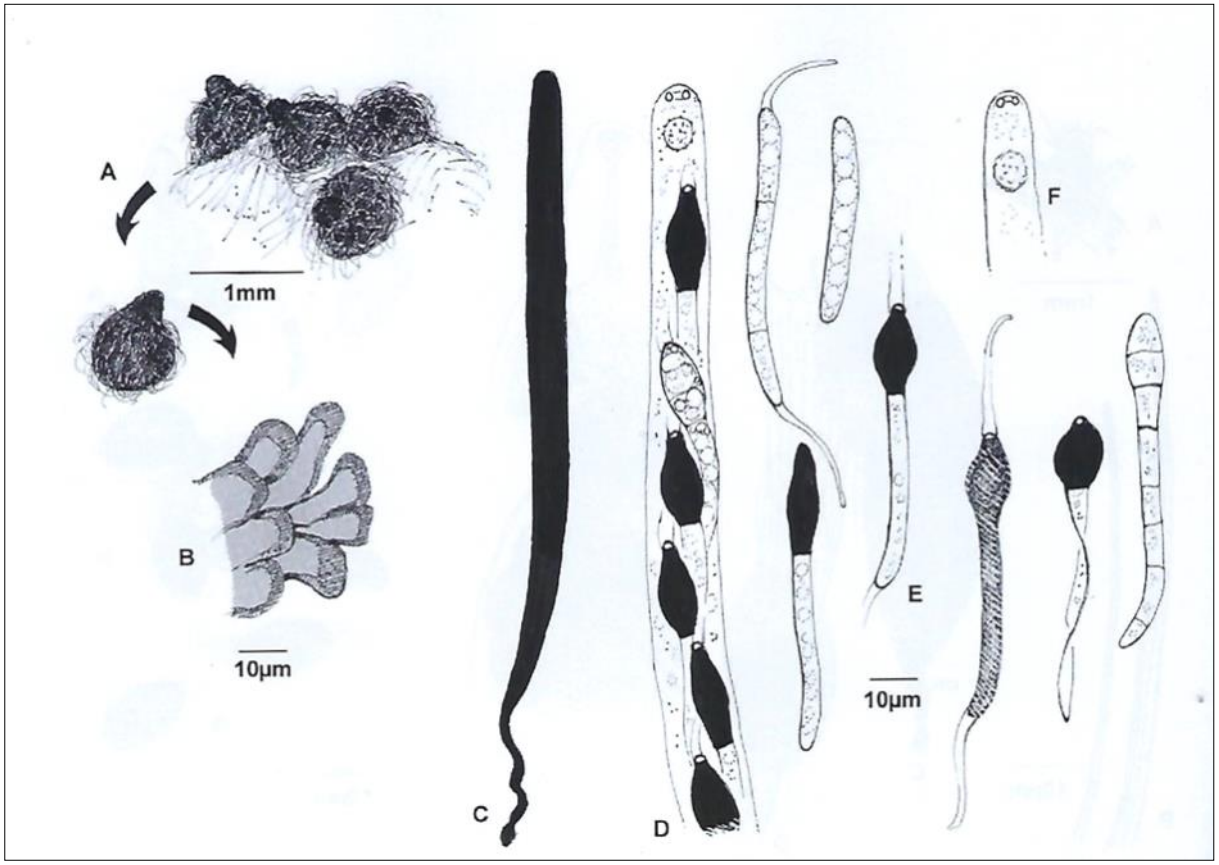
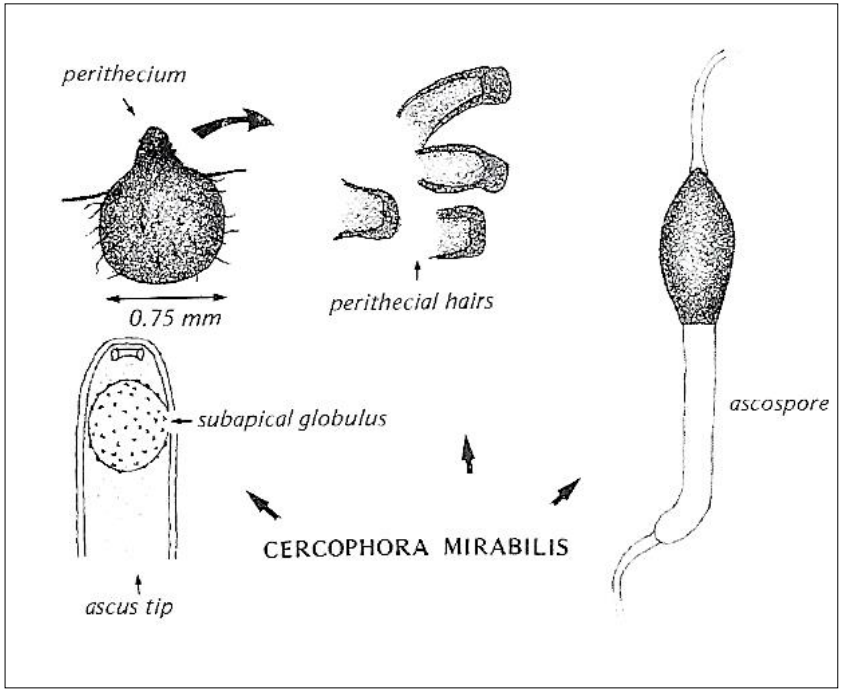
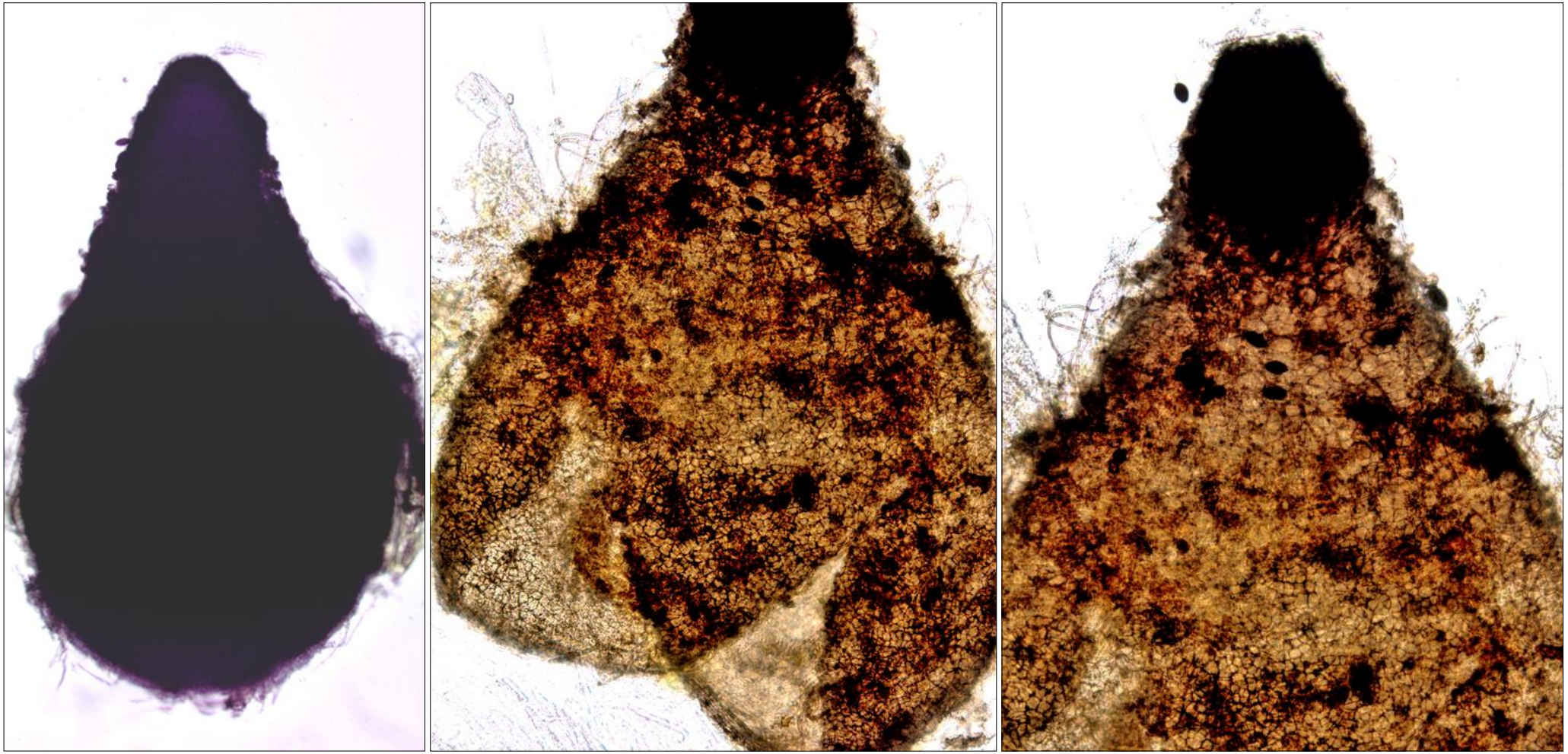


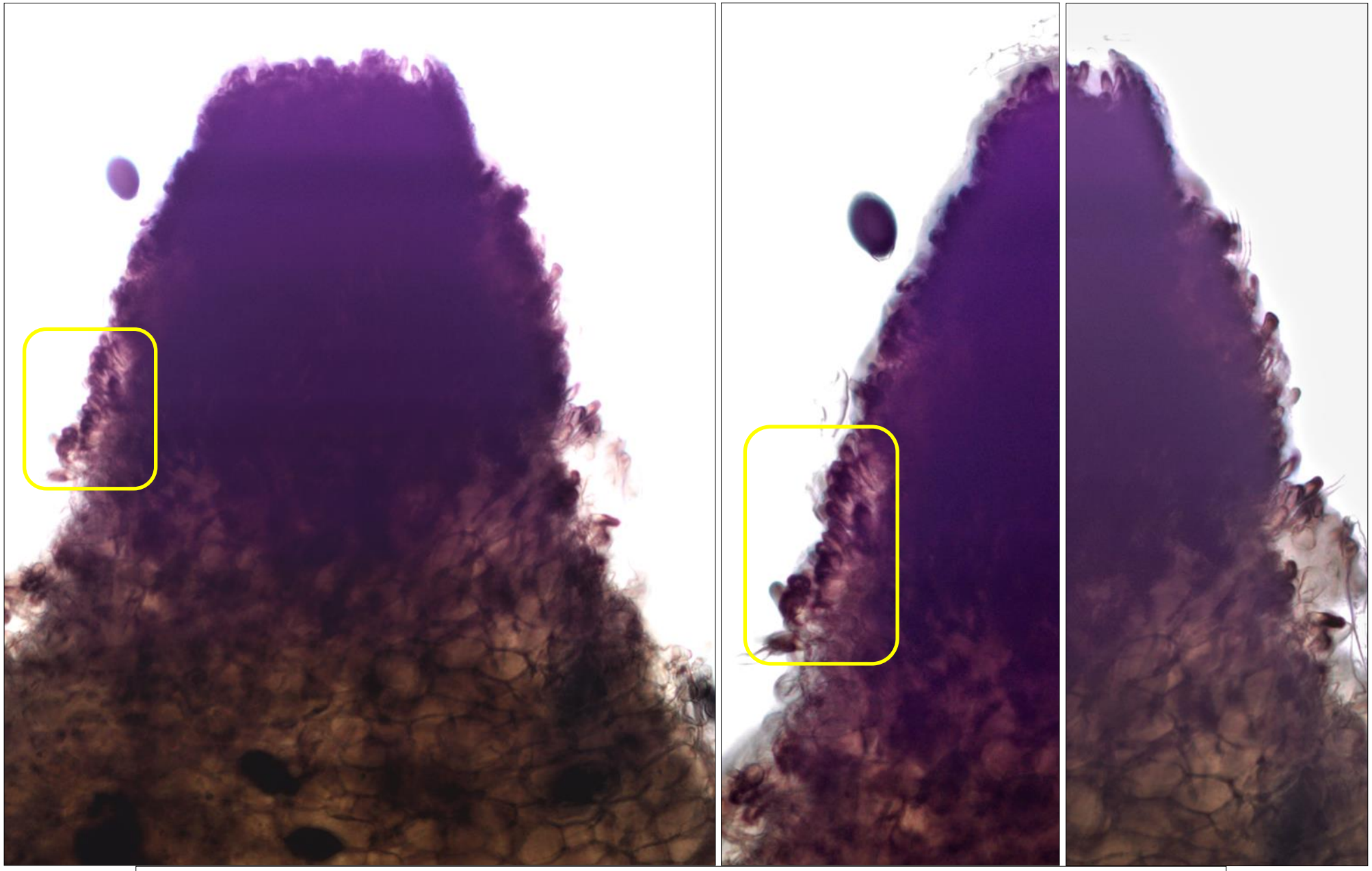
Fig. 88. *Cercophora mirabilis*. A–F. A. Perithecia. B. Tubercles on neck. C. Silhouette of mature ascus. D. Mature ascus with subapical globulus. E. Ascospores in various stages of development. F. Ascus tip showing ring & subapical globulus.

Bell A. 1983. Dung Fungi: An Illustrated Guide to Coprophilous Fungi in New Zealand. Victoria University Press, Wellington. 88 pages. Portions of page 74, Fig. 39 are copied in below.

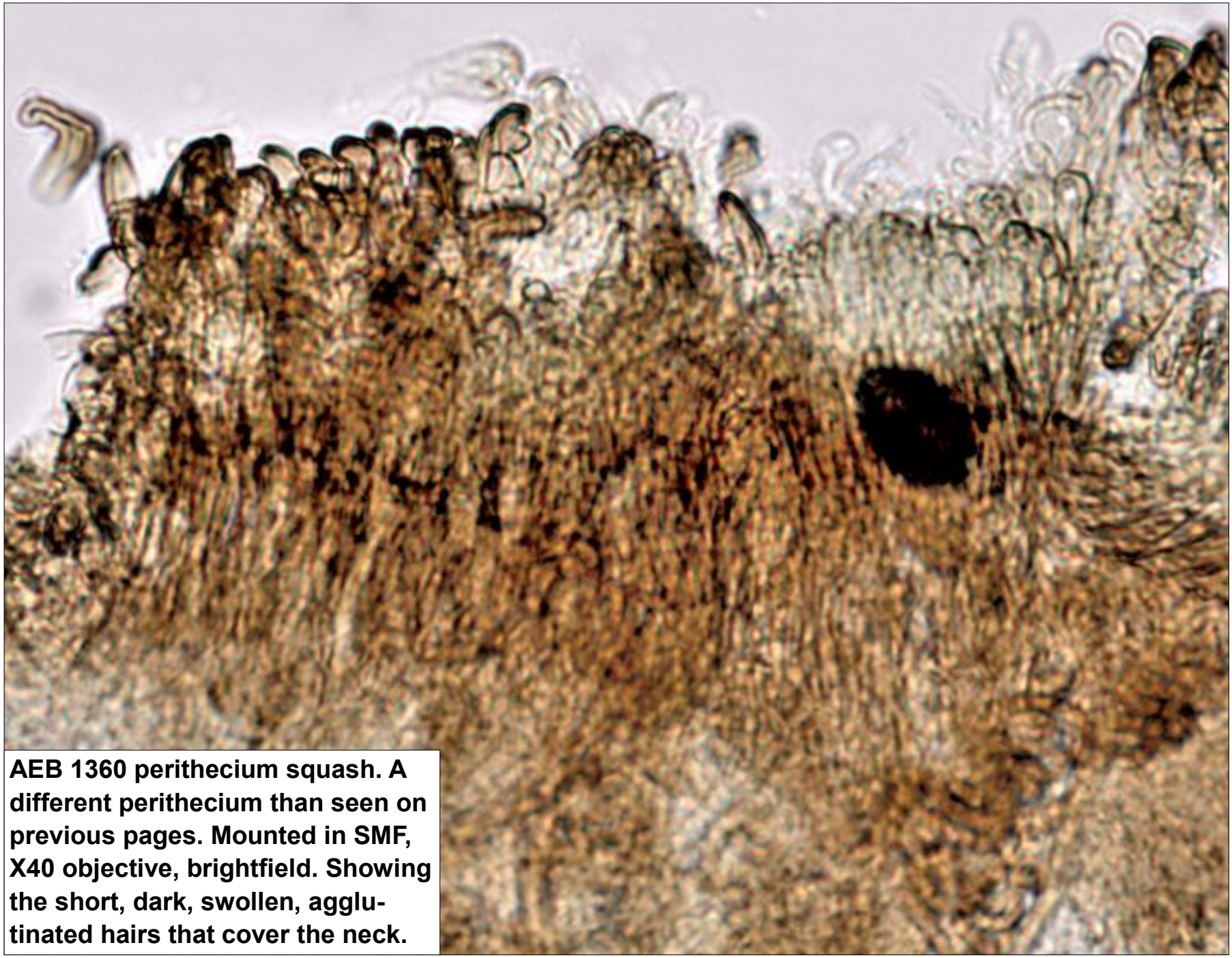




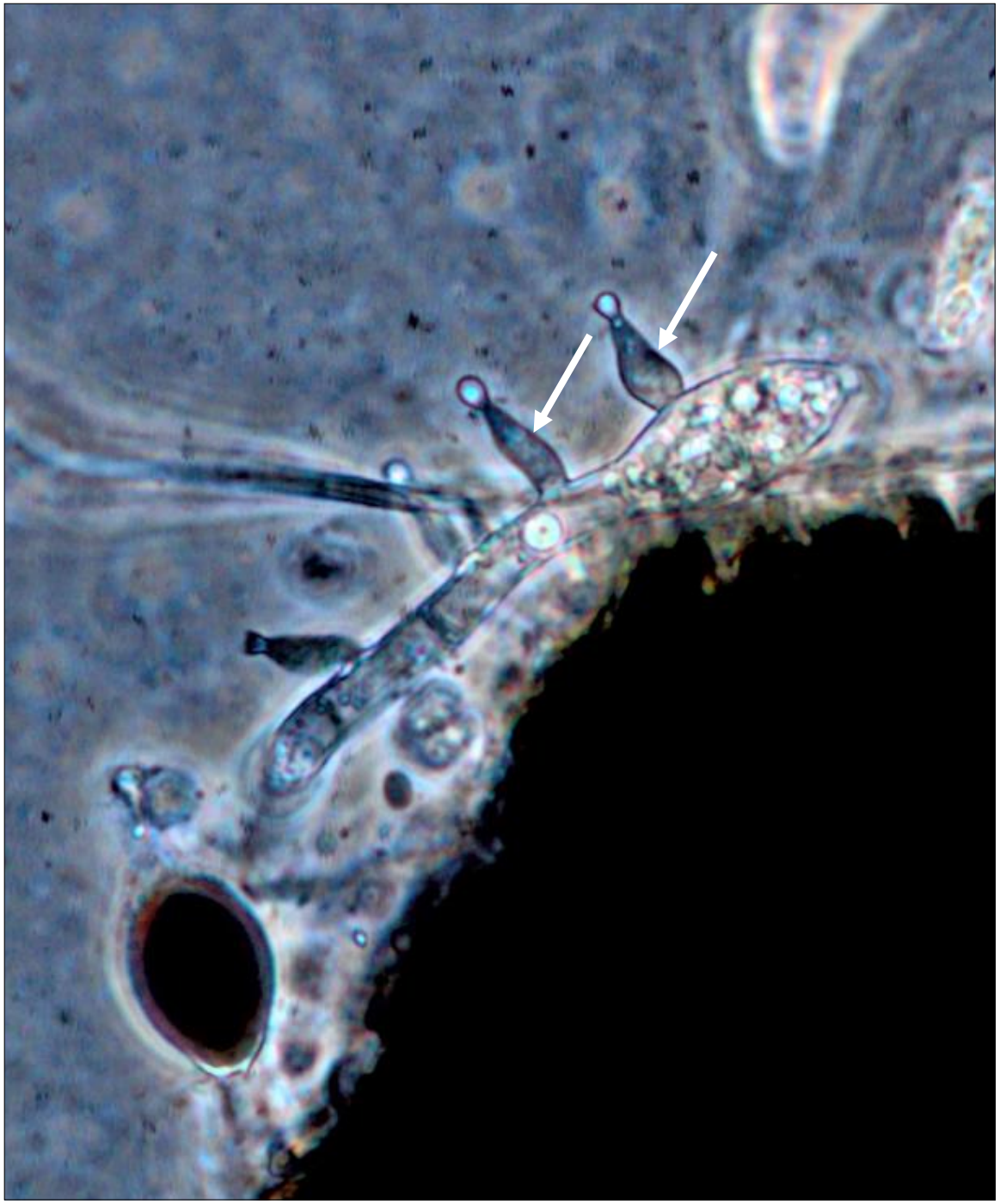
AEB 1360 perithecium. Left photo: water mount (no coverslip), X10 objective, brightfield. 760 × 440 µm. Right 2 photos: same perithecium as left photo but with coverslip added and using the X20 obj. Note the textura angularis peridium with smaller cells basally and larger closer to the neck.



AEB 1360 perithecium. Same perithecium as seen on the previous page but X40 objective and over-exposed to emphasize the short, dark, swollen, agglutinated hairs that cover the neck. Left photo whole neck; right 2 photos cropped to show the left and right sides of the neck (best region seen is outlined).

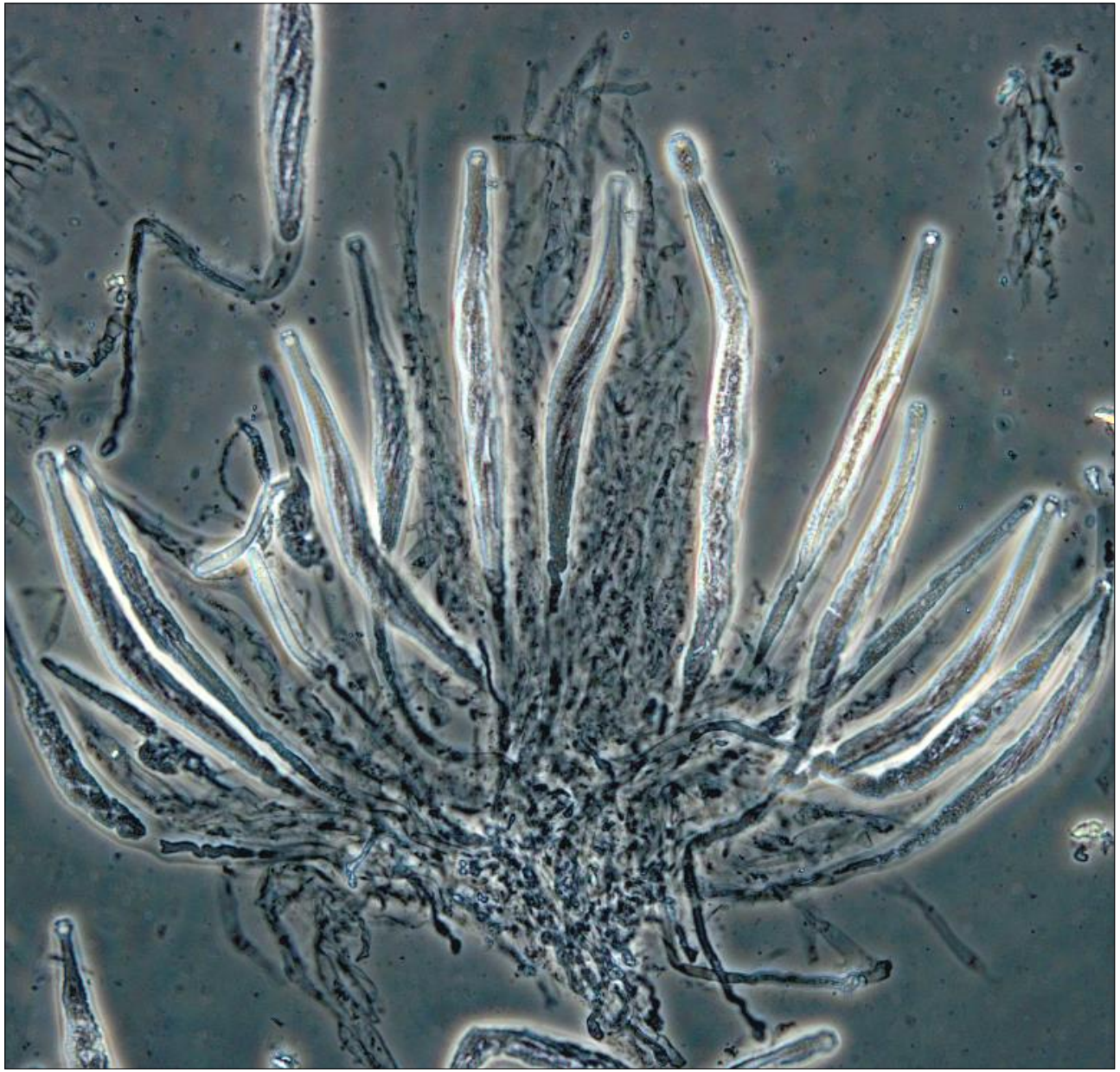


AEB 1360 perithecium squash. A different perithecium than seen on previous pages. Mounted in SMF, X40 objective, brightfield. Showing the short, dark, swollen, agglutinated hairs that cover the neck.



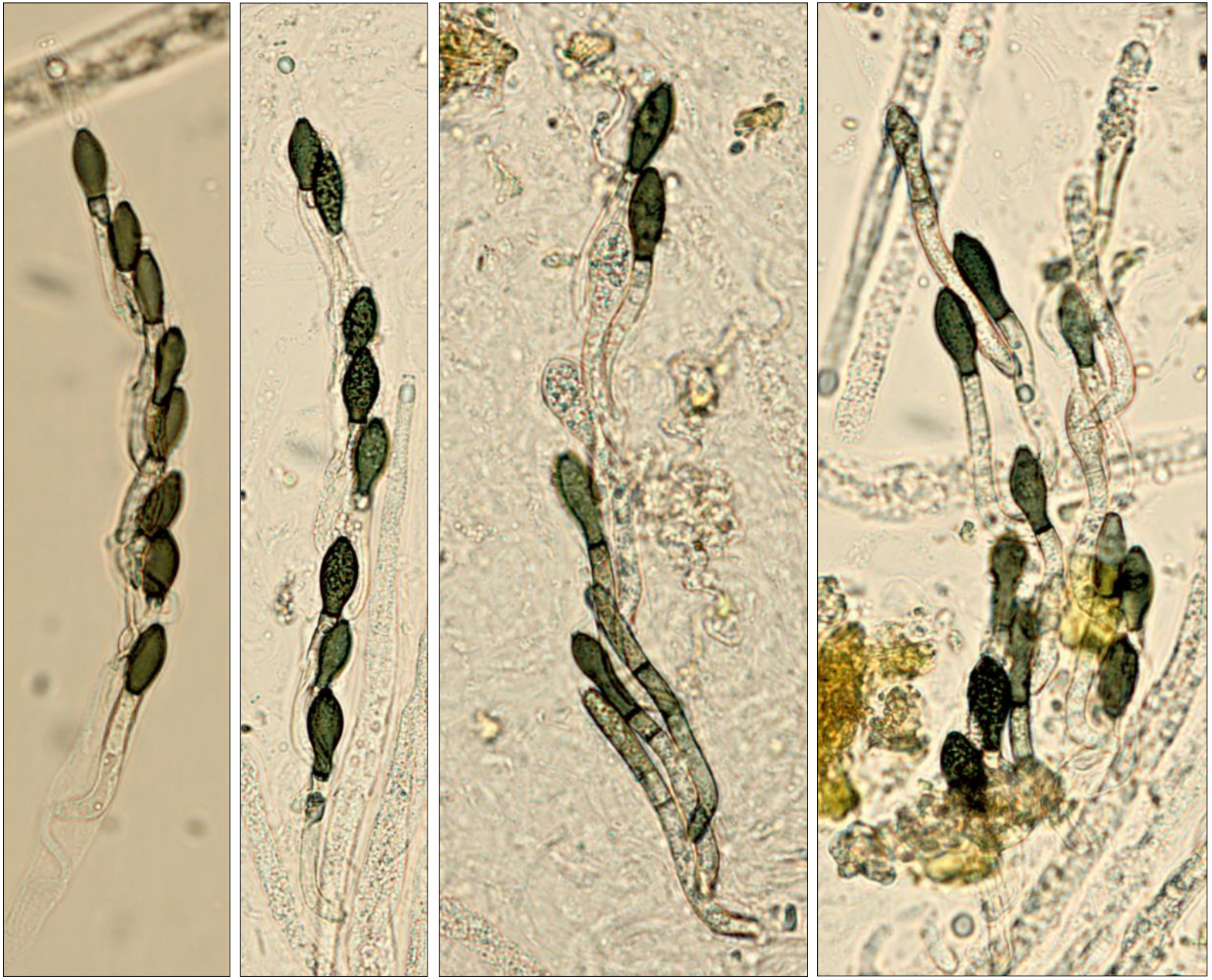
***Cladorrhinum*-like phialides (arrowed) are seen emanating from a *C. mirabilis* ascospore near the perithecium neck apex. Water mount using the X40 objective and phase microscopy.**

The only reference I can find for a similar association with *C. mirabilis* is in Lundqvist 1972 p. 86:
"A thorough study of the ascocarp development and of the cytology and genetics of the Cercophorae has been neglected by practically all authors. Nor do I know of anybody having investigated their ecology, physiology, or spore dispersal. Woronin (1870) seems to be the only one who has touched on the subject and he studied only one species, namely "*C. coprophila*", or what I think must be *C. mirabilis*. He discovered many new things, among others two conidial stages: one in the form of black, setose pycnidia with one-celled, hyaline conidia in a cirrus, the other represented by phialides producing microconidia. The phialides were found to grow both on the mycelium and the spores, and Woronin noticed also that the latter were capable to germinate at their hyaline stage. The last- mentioned phenomenon is an almost exclusive property of the subfamily Lasiosphaerioideae, and the same may be true for the capacity of the spores to directly produce phialides with microconidia. I have seen this ability in *Lasiosphaeria* species, too. Phialides on the mycelium, however, are found in several species of the Podosporoideae and the Sordariaceae s.str. as well."

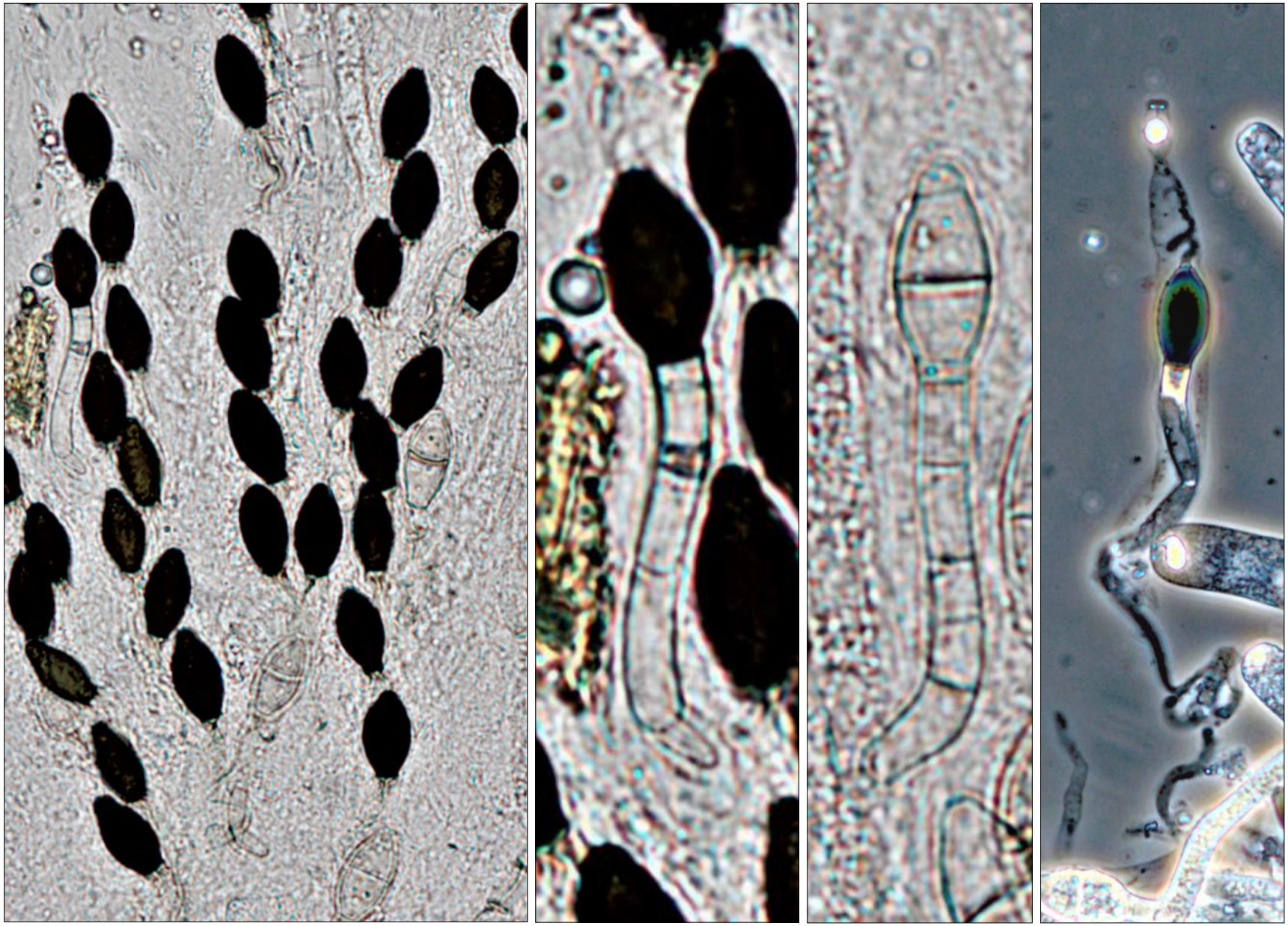


AEB 1360. Young asci and paraphyses mounted in lacto-Fuchsin using the X20 objective and phase microscopy.

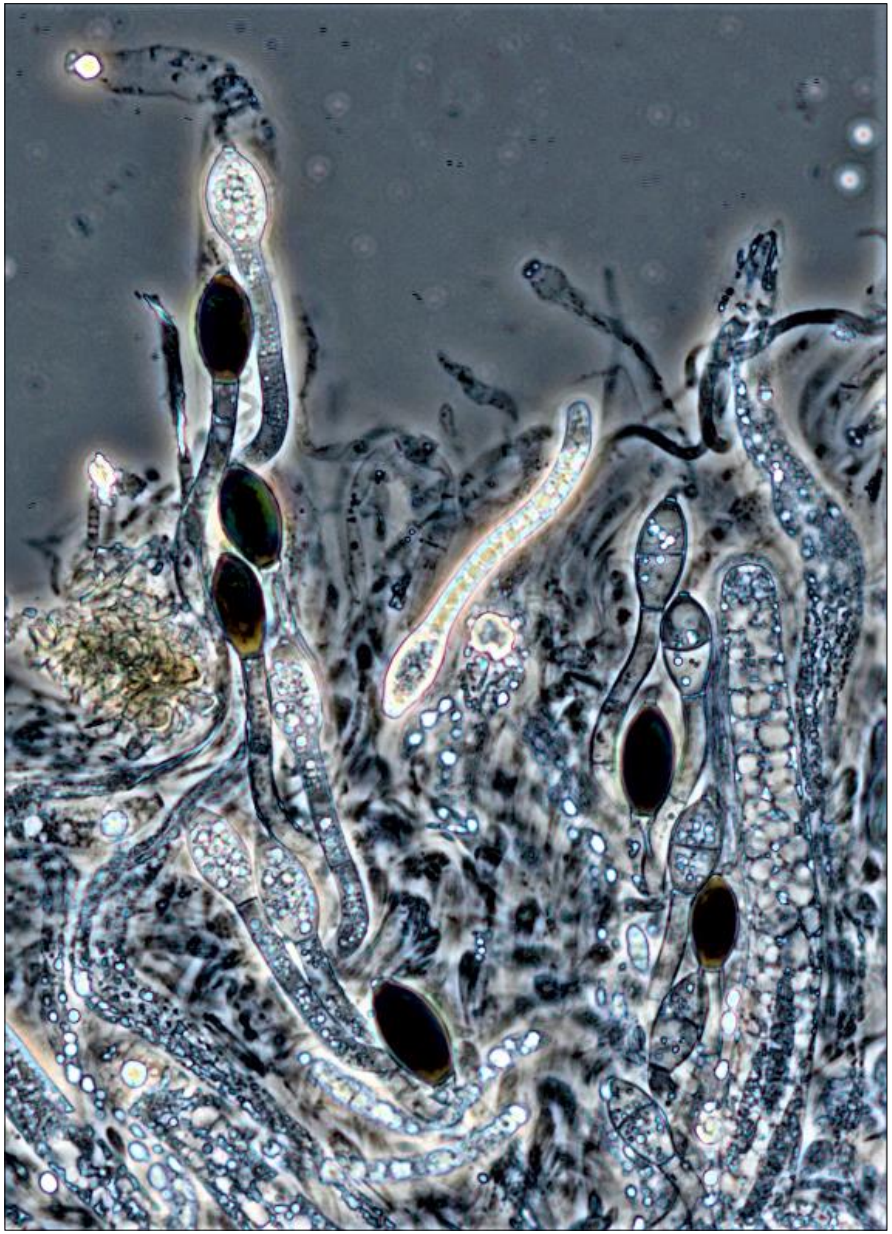
AEB 1360. Young asci emphasizing the ascus apical ring (solid arrows) and roughened subapical globulus (dotted arrows). Left 2 photos: water, X40 objectives & phase. Right photo: water, X100 obj. and brightfield.

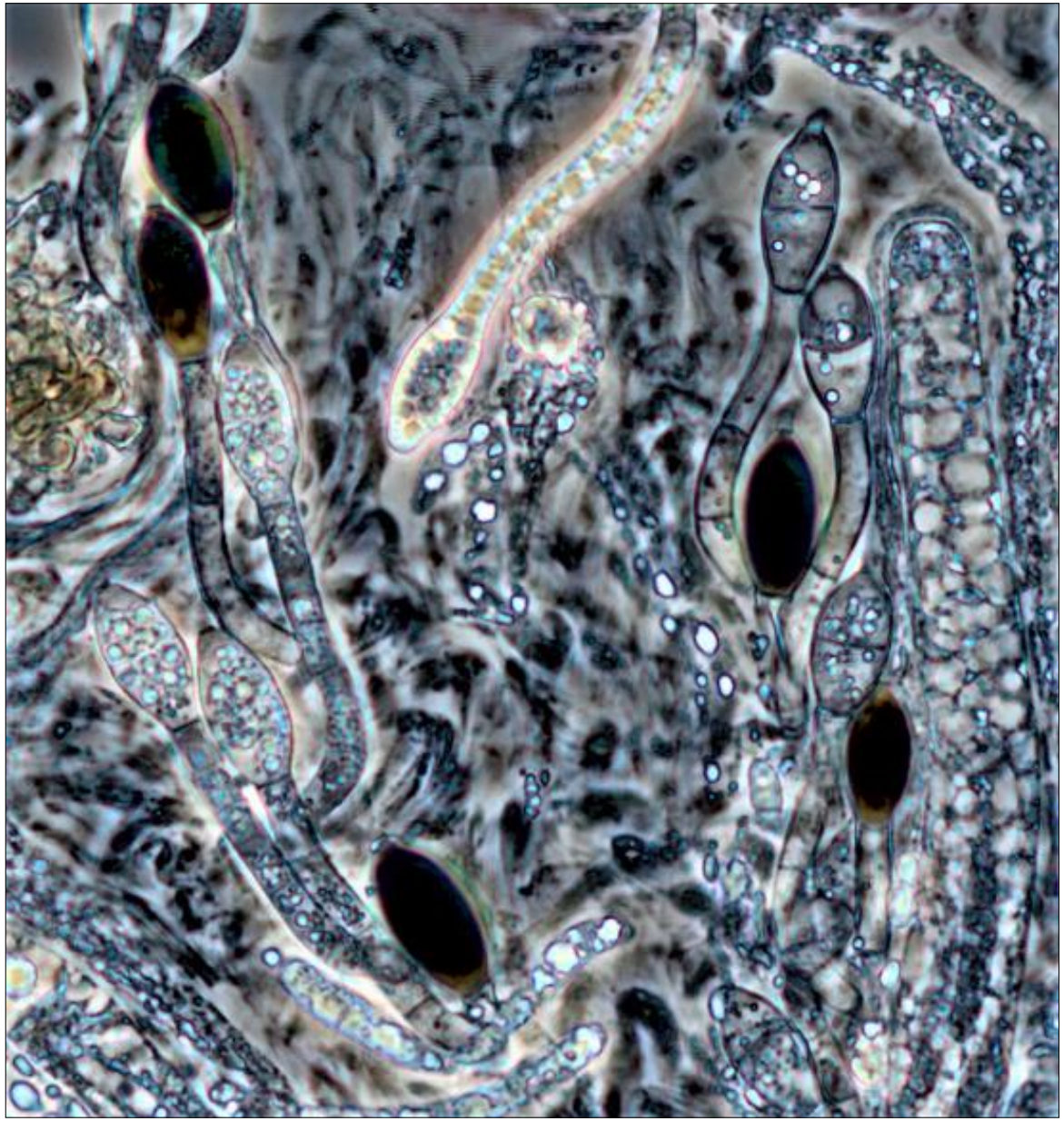


AEB 1360 asci and ascospores. All from water mounts, X40 objectives & brightfield microscopy. Left 2 photos with all 8 spores ca. the same stage of maturity. Right 2 photos with commonly seen different stages of spore maturity.



AEB 1360 ascospore enlargements from cropped X40 objective, water, brightfield views (phase in far-right photo). Note uniform shapes of dark body cells (15–)18–20 × 8–10 µm (immature view, 1(–2) septate), the hyaline, septate, pedicel (geniculate below) & in the phase photo, the fugacious narrow apical & broader basal caudae.





AEB 1360. As shown on the previous page, these 2 photos are ascospore enlargements from cropped X40 objectives & water mounts. These phase views better show the various stages of ascospore maturity and septations.