

Two new species of *Podosordaria* (Xylariales): *P. cynomys* and *P. cypraea*

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Abstract: Two new species of the infrequently seen genus *Podosordaria*, *P. cynomys* on dung and *P. cypraea* on decaying wood, are described and illustrated. Both species are among the seldom reported *Podosordaria* species characterized by uniperitheciate sessile stromata. In each the orange white/orange grey stromatic tissue envelops a single dark perithecium except for the blackish perithecial ostiolar region which barely emerges above the stromatic tissue. Ascus apices are prominently J+ and ascospore longitudinal germ slits extend the entire length, or nearly so. *Podosordaria* species are generally coprophilous but *P. cypraea* on a woody substrate is unique. No anamorph was observed in either case and attempts to culture were unsuccessful.

Keywords: Coprophilous fungi, wood decaying fungi, Xylariaceae.

Introduction

Our first species of *Podosordaria*, *P. cynomys*, developed on incubated dung in 2014, some three years ago. Despite having studied the coprophilous fungi since 1971, this was the very first time we had encountered a species of sessile *Podosordaria* containing but one perithecium. Very few have ever been recorded and the published illustrations were insufficient in many respects. We were also engaged in the completion of a large publication. Hence at that time we simply catalogued the specimen as being a new species. However, late last year we were fortunate enough to find a second new species on wood, *P. cypraea*, and decided that these two new species could well be published together in the hope that this might encourage further collecting.

Materials and methods

Morphological features were examined in water, aniline blue lactic acid (0.05 g aniline blue in 100 ml lactic acid), Melzer's reagent and Shear's mounting fluid (SMF), see BELL (2005: 63) for formulae of the latter two. Observations were made in brightfield and phase contrast microscopy. SMF and aniline blue lactic acid mounts sealed with nail polish accompany the dried herbarium specimens. At least 20 ascospores were measured from each collection.

Attempts to isolate the specimens in axenic culture from ascospores, centrum contents and stromatic-perithecial fragments were conducted on water agar under ambient conditions.

Taxonomy

Podosordaria cynomys A. Bell & D.P. Mahoney, *sp. nov.* — MycoBank MB 821791, Figs 1–2.

Holotype: On dung of black-tailed prairie dog (*Cynomys ludovicianus*) at Devil's Tower, Wyoming, U.S.A., 20/7/2013, coll. A. Bell, Bell & Mahoney Herb. no. 1221 (PDD 110463).

Etymology: From *Cynomys*, the Latin genus of the prairie dog.

Characteristics from the fresh material. — The dried collected dung was soaked in sterile water and placed on filter paper in glass-lidded dishes and subjected to ambient temperatures and diurnal lighting (BELL, 1983; LUNDQVIST, 1972). The **sessile stromata** did not appear until after a month of incubation. Stromata few in number, clustered, orange white/orange grey coloured (KORNERUP & WANSCHER, 1978), partially exposed on dung surface, each approx. 0.75 mm diam. Each stroma completely encasing a single dark perithecium except for the perithecial centrally-placed, cone-shaped, blackish,

ostiolar region which emerges above the enveloping stromatic tissue (Figs 1A,B; 2A). Stromatic tissue represents approx. 1/3 of the overall diameter. **Stroma** (enveloping tissue) a *textura angularis* of thin-walled cells; the outermost portion darker than the thicker inner portion. **Perithecial wall** constructed of dark brown *textura intricata* (Figs 1D; 2C). **Perithecia** very fertile containing numerous asci and free-ended paraphyses. **Paraphyses** slightly longer than the asci, smooth, hyaline, septate, hyphoid, isodiametric (Fig. 1E). **Asci** cylindrical, each with an apical, prominent, 6 µm diam., J+ ascus ring and containing 8 uniseriately overlapping ascospores (Figs 1E; 2D). Mature **ascospores** single-celled, dark brown, more-or-less symmetrical, ellipsoid-fusoid with lower extremity slightly narrower than upper and a gelatinous sheath, 27–31 × 13–16 µm, each with a prominent germ slit extending the whole length of each spore. Spore wall with a slightly thickened rim around the germ slit, (Figs 1E,F; 2E–H).

Podosordaria cypraea A. Bell & D.P. Mahoney, *sp. nov.* — MycoBank MB 821792, Figs 3–5.

Holotype: On very wet dead wood, Catchpool Loop Track, Rimutaka Forest Park, New Zealand, 31/10/2016, coll. A. Bell, Bell & Mahoney Herb. no. 1288 (PDD 111272).

Etymology: From *Cypraea*, the Latin genus of the cowry shell, referring to the shape of the mature ascospores.

Characteristics from fresh material. — **Stromata** globular, crowded, superficial, orange white/orange grey coloured (KORNERUP & WANSCHER, 1978), with knobby surface, 0.5–0.7 mm diam. Each stroma completely encasing a single dark perithecium except for the perithecial centrally-placed, cone-shaped, blackish, ostiolar region which barely emerges above the enveloping stromatic tissue (Figs 3A; 4A–E). Stromatic tissue represents approx. 1/3 of the overall diameter. **Sections through the stroma** (enveloping tissue) showed that it is composed of large-celled *textura globulosa/angularis* with the perithecial wall tightly affixed to it (Figs 3B; 5A). **Perithecial wall** composed of several layers of dark, irregularly shaped cells with angular to rounded edges (*textura intricata/epidermoidea* to *angularis*) (Figs 3C; 5B). **Perithecia** very fertile, asci and free-ended paraphyses numerous (Figs 3D; 5C). **Asci** cylindrical, short-stalked, approx. 125–150 × 15 µm, each with a prominent J+ ascus ring (funnel-shaped, somewhat wider apically than basally) and containing 8 uniseriately overlapping to biseriate ascospores (Figs 3D; 5D–G). Mature **ascospores** single-celled, dark brown, ellipsoidal but asymmetrical and flattened along one side, upper and lower extremities somewhat umbonate, 20–24 × 8–10 µm, each with a prominent germ slit running along the flattened side (Figs 3E; 5D,E,H–K). No gelatinous sheath observed.

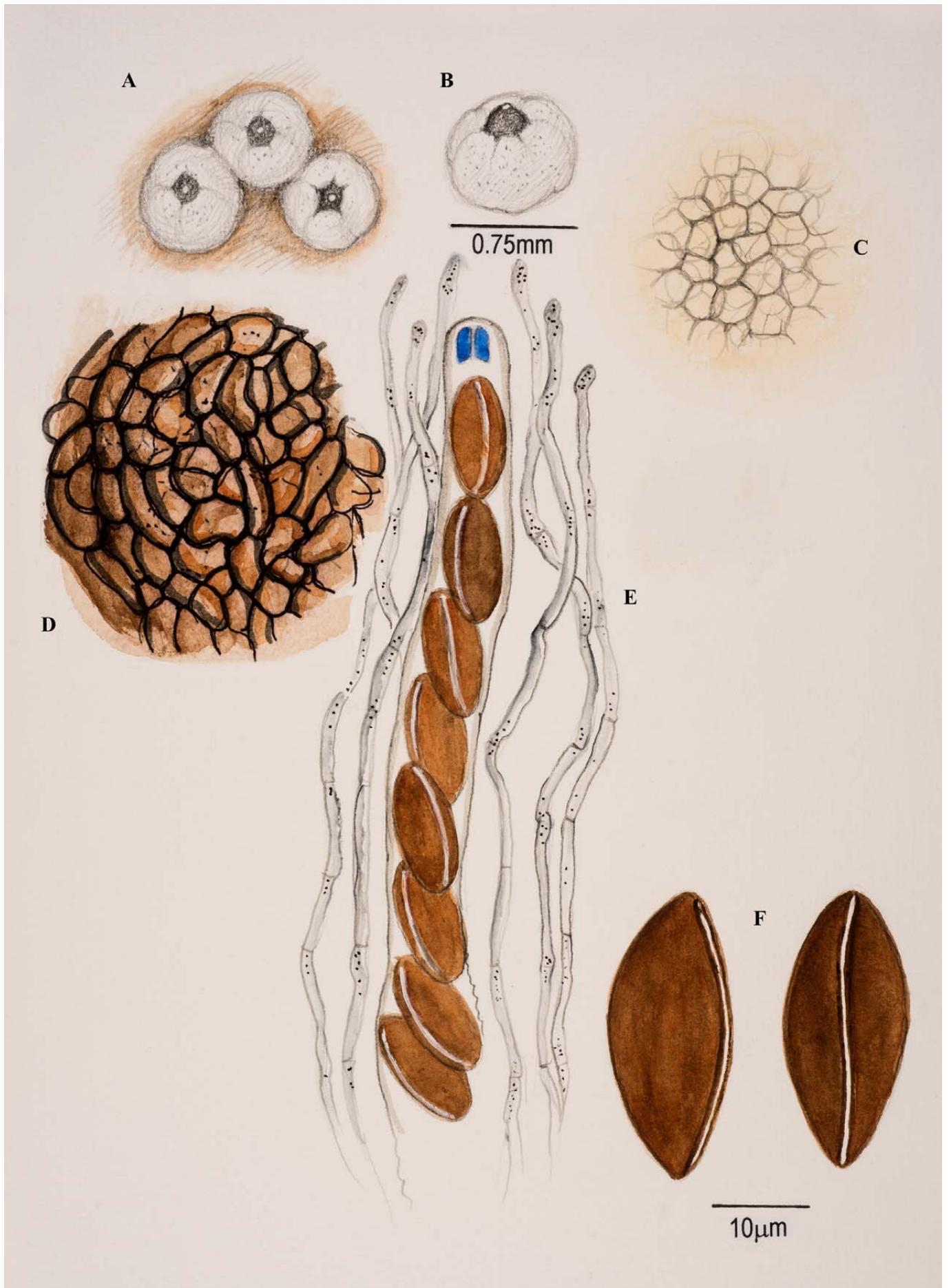


Fig. 1. – *Podosordaria cynomys*

A. Polar view of three perithecia and enveloping stromata. B. Excised single stroma and encased perithecium. C. Detail of stroma texture. D. Cellular detail of perithecial wall. E. A single ascus containing ascospores and surrounding paraphyses. F. Two mature ascospores.

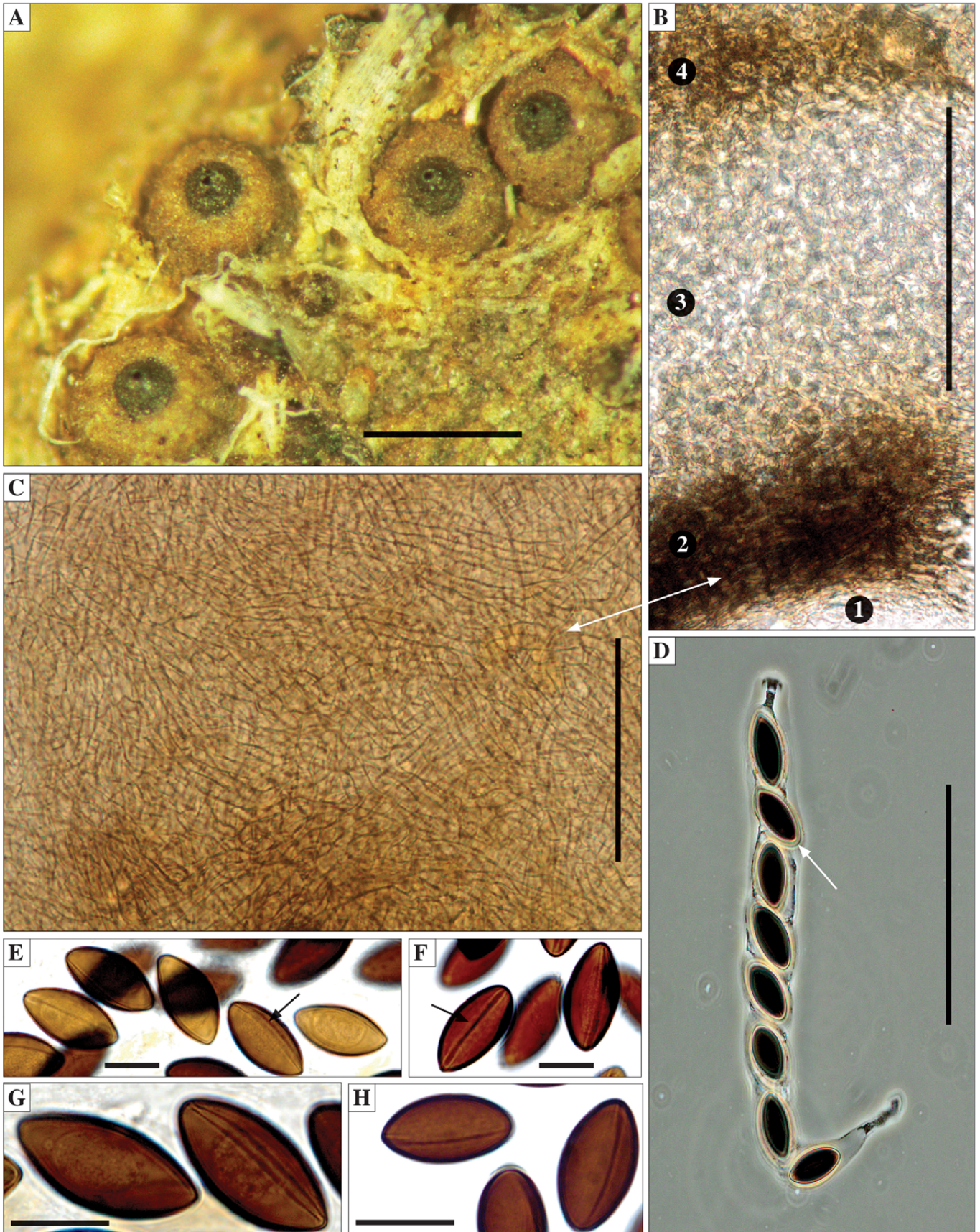


Fig. 2. – *Podosordaria cynomys*

A. Uniperitheciate stromata *in situ* on prairie dog dung. Dried herbarium specimen photograph. B. Stroma/perithecial peridium free-hand cross section. '1', perithecium centrum; '2', dark compressed layers of the perithecial peridium; '3–4', stroma *textura angularis*; '3' lightly pigmented inner stroma; '4', darker ectostroma. C. Perithecial peridium. *Textura intricata*, tangential view. D. Ascus with 8 uniseriately overlapping ascospores. Phase microscopy view, SMF mount. Gelatinous sheath arrowed. E–H. Ascospores. Ellipsoid-fusoid with a thickened rim along the longitudinal germ slit, arrowed. Note germ slit location [longitudinal midline, spore symmetrical (left spore in 'F'); otherwise, slightly asymmetrical (left spore in 'G')]. Scale bars: A = 400 μ m; B, D = 100 μ m; C = 60 μ m; E–H = 15 μ m.

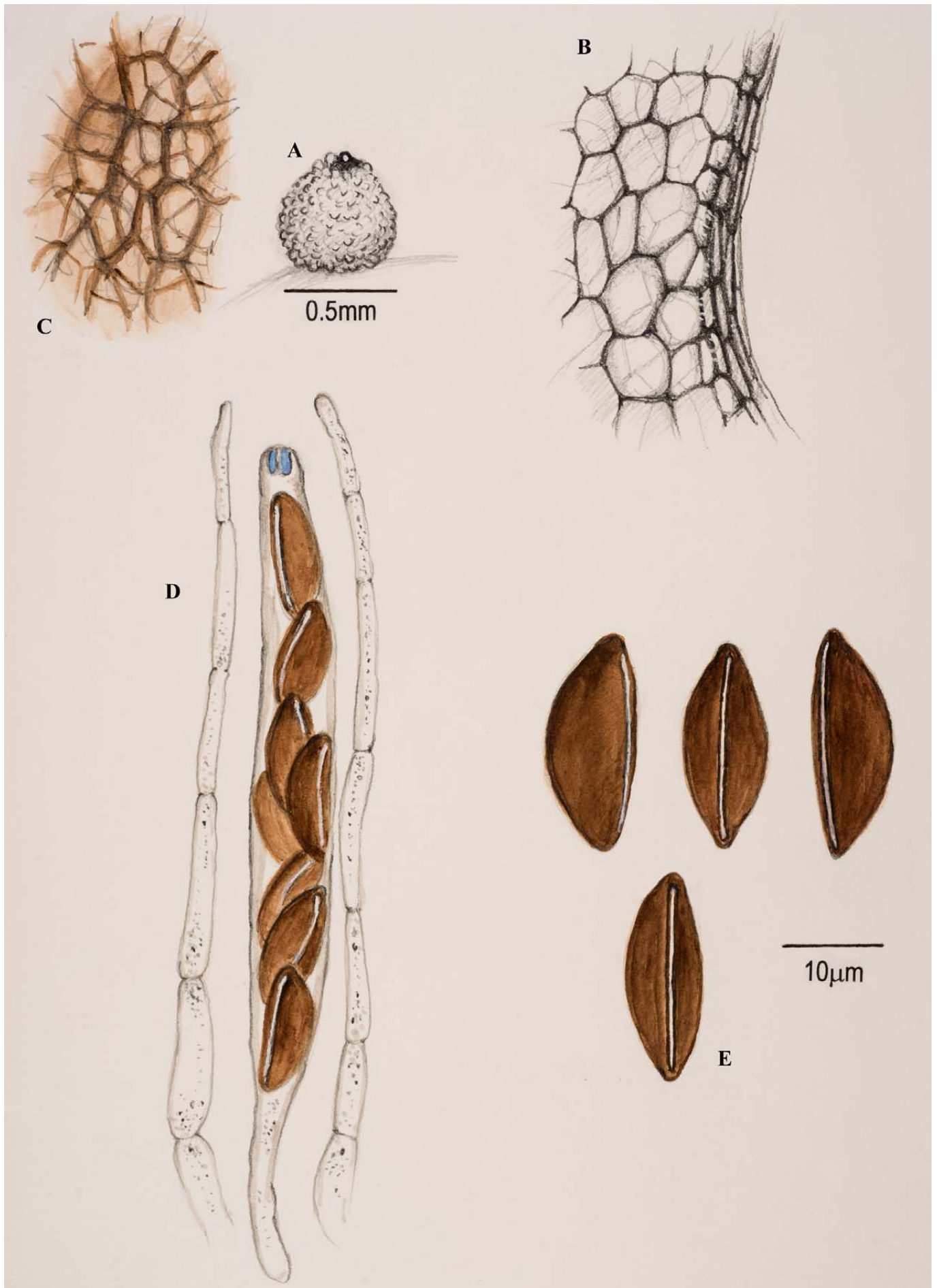


Fig. 3. – *Podosordaria cypraea*

A. Single perithecium with enveloping stroma. B. Free-hand section through stroma and perithecial wall illustrating cellular detail. C. Perithecial wall texture in surface view. D. Ascus and paraphyses. E. Mature ascospores viewed from different angles.

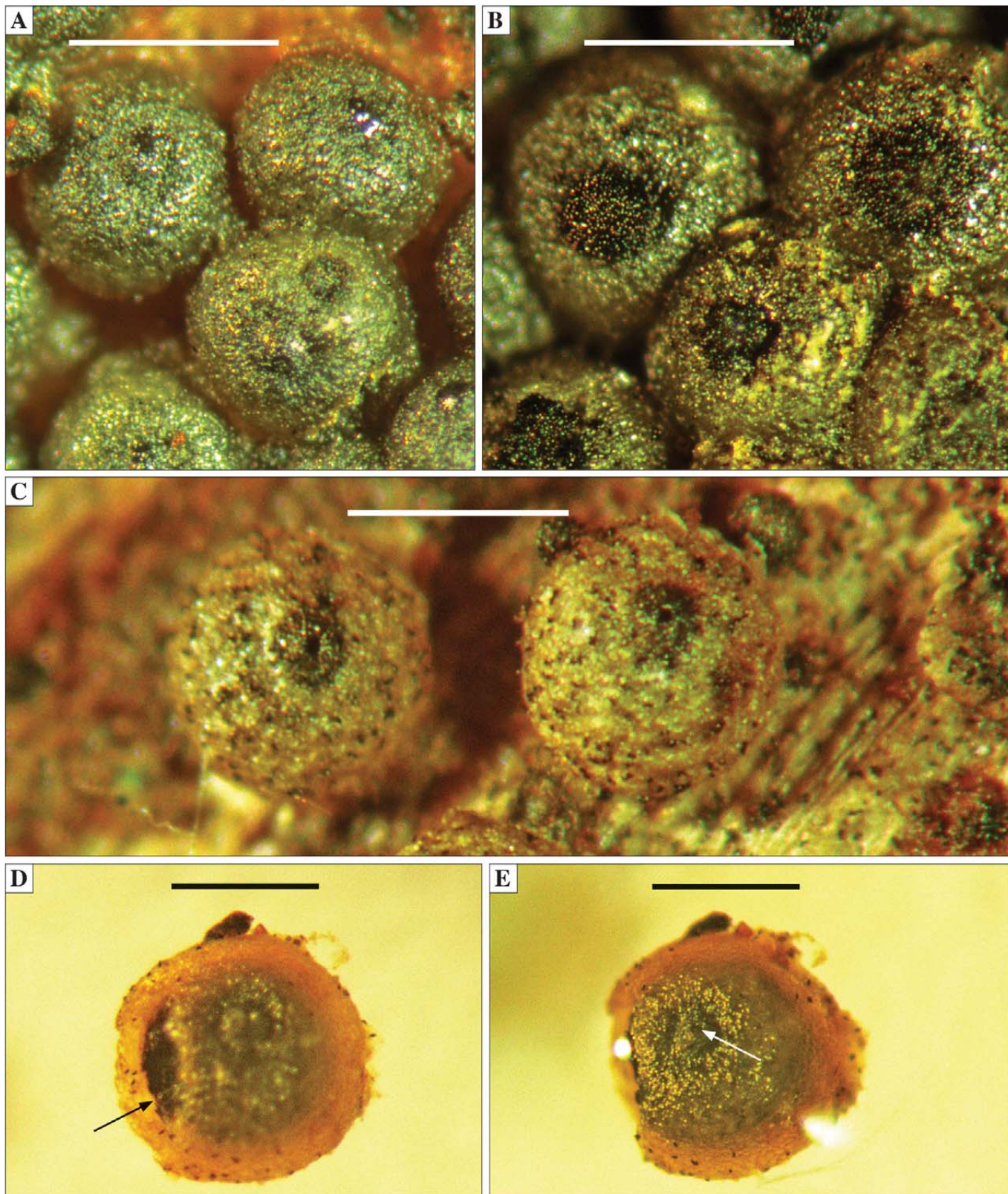


Fig. 4 – *Podosordaria cypraea*

A–E. Uniperitheciate stromata. A–C. *In situ* on dead wood. A. Photograph one day after collection on the wet wood. Stromata are mostly covered with discharged dark ascospores. B. One week later on the wet wood showing recent spore discharge and some yellowish areas that reveal the yellowish stromatic tissue. C. Several stromata dried immediately after collection and photographed one week later. Without as many discharged ascospores, these dry stromata reveal their straw-coloured stromatic tissue. D, E. Different foci of the same fresh stroma photographed in a water mount without coverslip using both reflected and transmitted light. D. Focus on a break in the orangish stroma where the inner black perithecial peridium is apparent (arrowed). E. Focus on the perithecial ostiolar region emergent above the enveloping stromatic tissue. Ostiole arrowed. Scale bars: A, B = 500 µm; C–E = 400 µm.

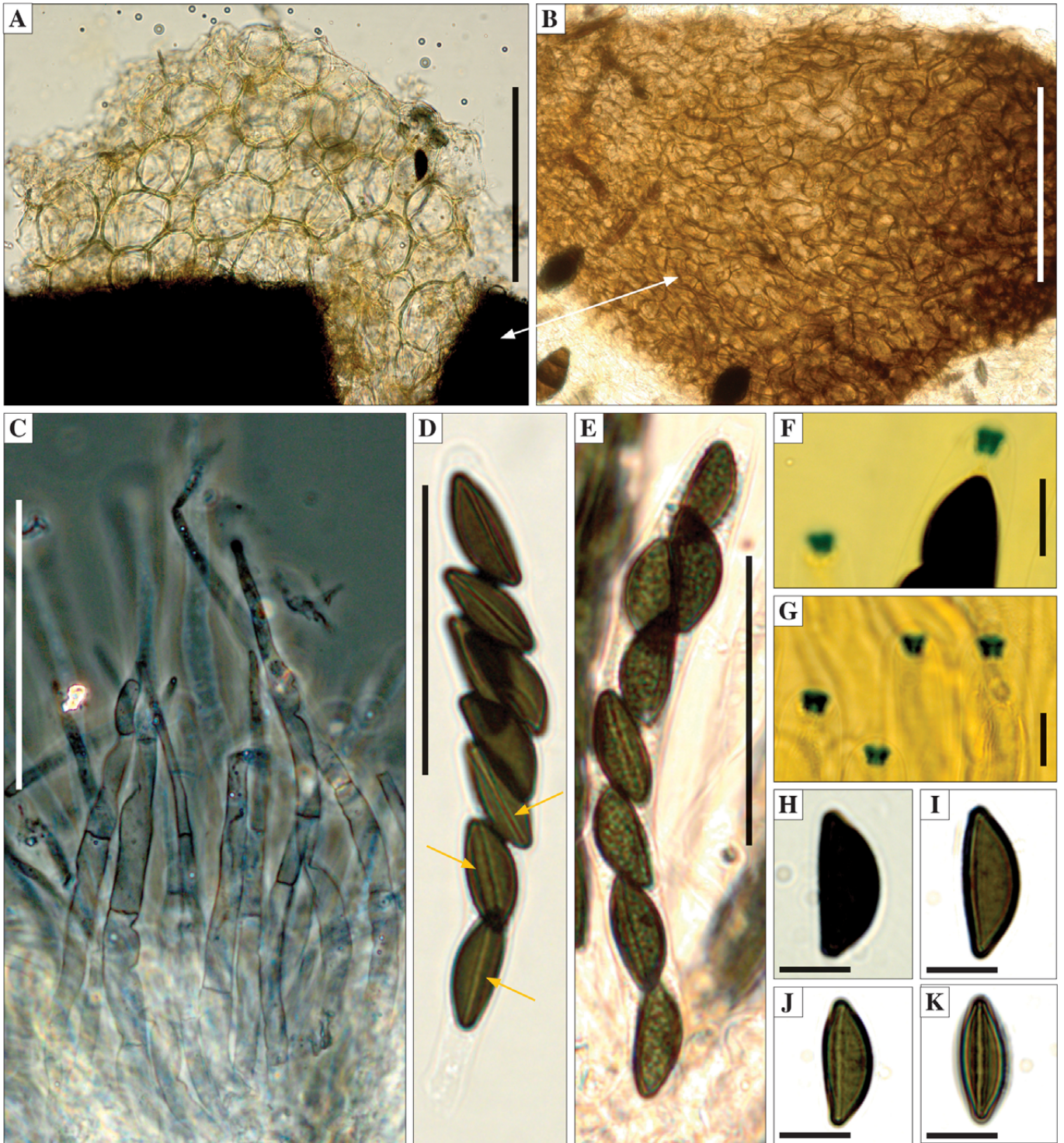


Fig. 5 – *Podosordaria cypraea*

A. Fresh uniperitheciate stroma squash showing dark perithecial peridium and large-celled stromatic tissue. Natural colours. B. Over-exposed perithecial peridium with its compressed layers of *textura angularis* and irregularly swollen *textura intricata*. C. Robust smooth septate tapering paraphyses. D, E. Asci somewhat over-exposed to show ascospore shapes and germ slit positions. Spore wall with a slightly thickened rim along the germ slit (arrowed). F, G. Ascus apices strongly bluing in Melzer's reagent. H–K. Ascospores. Selected to show germ slit locations as if a single spore was shown rolling left to right ('H' to 'K') on its longitudinal axis – 'H', the greatest spore width with the germ slit along the far left (not seen). Note also that the spore extremities are umbonate (especially 'H') and asymmetrical (except 'K' which is symmetrical, narrowest, and with the germ slit running down the middle). Scale bars: A, B, D, E = 50 µm; C = approx. 60 µm; F = 10 µm; G = 7 µm; H–K = 12 µm.

Discussion

Xylariaceous pyrenomycetes which have extensive stromatic tissue associated with their perithecia have received much attention over the years. As a consequence of this, a number of genera have been established based upon such characters as the extent and position of the stromatic tissue (whether it is stalked or not) and the nature of any anamorphs produced. Among the 40+ genera in the *Xylariaceae* alone are *Annulohypoxylon*, *Anthostomella*, *Daldinia*, *Hypocopra*, *Hypoxylon*, *Kretzschmaria*, *Lopadostoma*, *Poronia*, *Rosellinia*, *Xylaria*, in addition to *Podosordaria*. Disregarding the morphological variations of superficial stromatic features and concomitant number of genera, the ascospores within this family bear remarkable morphological similarities being dark (usually 1-celled), ellipsoidal, symmetrical to asymmetrical and with an elongated germ slit of variable length. In preparing this article we were concerned primarily with the changing generic descriptions of *Podosordaria* and *Poronia* and their similarities to some features of *Xylaria*, *Anthostomella* and *Hypocopra*. For a good overview of the earlier work on *Podosordaria* and *Poronia*, especially the coprophilous species, the reader is referred to introductions in KRUG & CAIN (1974) and KRUG & JENG (1995). A more recent discussion that treats a wide range of morphological differences, substrate preferences, ecological considerations, sparsity of collections (and collectors) and phylogenetic relationships can be found in RIBES *et al.* (2011). Presently neither genus has been monographed but both remain valid with *Podosordaria* associated with a *Geniculosporium/Xylaria*-like anamorph and *Poronia* a *Lindquistia* anamorph (see ROGERS *et al.*, 1998). Further phylogenetic information for maintaining both *Podosordaria* and *Poronia* is presented by HSIEH *et al.* (2010).

The genus *Podosordaria* Ellis & Holw. presently comprises both stalked and sessile stromatic species. The latter have received relatively little attention. Keys to coprophilous species can be found in KRUG & CAIN (1974) and KRUG & JENG (1995). Of the 17 species included in the 1995 Krug & Jeng publication only 4 have sessile uniperitheciate stromata — *P. crinita* Krug & Cain, *P. ianthina* Krug & Cain, *P. vinacea* Krug & Cain and *P. phoenicea* Krug & Cain (complete descriptions in KRUG & CAIN, 1974). To these we add two additional species, *P. cynomys* from dung and the first such species from wood, *P. cypraea*.

Using their keys, our new species *P. cynomys* is closest to their *P. phoenicea* and *P. vinacea*, but lacks any violaceous pigments in the stroma and differs with respect to ascospore size (*P. cynomys* somewhat shorter and narrower) and germ slit length (length of spore vs. < spore length).

Podosordaria cypraea does not fit any of the coprophilous species recognized by KRUG & JENG (1995). Furthermore, it is unusual insofar

as it was found on decaying wood rather than dung in a country geographically far removed from other species of *Podosordaria* thus far collected. Unfortunately, like *P. cynomys* and the four other species with uniperitheciate stromata noted above from KRUG & JENG (1995), no anamorph information from *in-situ* collections or cultures is available. Our attempts to culture the two new species described herein were unsuccessful. In light of the importance given to differences in the anamorphs between *Podosordaria* and *Poronia* and the few collections available for species of each, the need for more field work and culturing is obvious. At this point we feel that more field work should be undertaken rather than continually recasting those which are known, under the impression that we are fully conversant with all that evolution has to offer.

Acknowledgements

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