***Kathistes calyculata* Malloch & M. Blackw. 1990 – PDD 121656 (= AEB 1366) A larger variant of this species**

Substrate: Hereford-Galaway cross beef cattle dung

Collection date: 3 November 2023; **Moist chamber incubation date:** 6 February 2024

Collection site: NZTM = E1770110 N5447412, a residential property surrounded by native bush off Moonshine Hill Road, Upper Hutt

Collector: Ian Flux and Merryl Park; **Identifier:** Dan Mahoney

Voucher materials: No dried herbarium specimen but 2 Shear's mounting fluid (SMF) semi-permanent microscope slides; in-situ photos of fruiting bodies using a Samsung Galaxy A70 smartphone camera, Olympus BX51 microscope photos of a SMF slide using a Samsung Galaxy A70 smartphone camera and Olympus BX51 microscope photos of a SMF slide using a DP28 camera; references consulted.

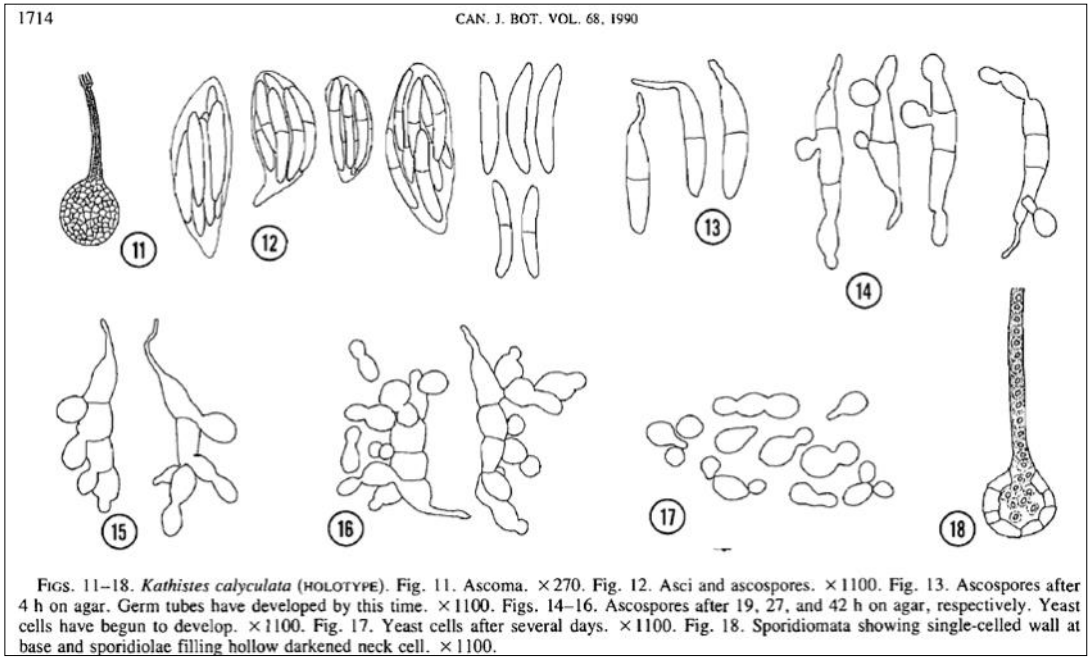
References consulted:

1. Malloch D. & Blackwell M. 1990. *Kathistes*, a new genus of pleomorphic ascomycetes. Can. J. Bot. 68: 1712–1721. Their morphological description of the *Kathistes calyculata* ascosporic state is reproduced on the next page.

2. Maharachchikumbura S.S.N., Hyde K.D., Jones E.B.G., McKenzie E.H.C. et al. 2016. Families of Sordariomycetes. Fungal Diversity 79, 1–317. See pp. 162–164 for a history of the family Kathistaceae which now includes the genera *Kathistes* with 3 ascosporic species that produce a budding yeastlike morph directly from the cells of the ascospores. Asexual conidiomata superficially similar to the ascomata are also seen in habit material but not in cultures. *Kathistes* is the only sexual genus in Kathistaceae, while *Mattirolella* and *Termitariopsis* are asexual genera growing as ectoparasites on different species of termites and ants. These genera also produce conidiomata. For some reason, a third genus on termites (*Termitaria*) is not mentioned although its species are more frequently found – see "Blackwell M., Henk D.A. & Jones K.G. 2003. Extreme morphological divergence: phylogenetic position of a termite ectoparasite. Mycologia 95(6): 987–992".

3. Wilson M.M., Emam A. et al. 2023. Description of a novel termite ectoparasite, *Termitaria hexasporodochia sp*. nov. (Kathistaceae), presenting an unusual six-sectioned infestation, and a key to the fungal family Kathistaceae. Phytotaxa 591 (2): 106–124. See especially p. 118 for termite-infecting genera/species details and p. 119 for *Kathistes* spp. details (the p. 119 Table is labelled "Non-sporodochia forming fungi (Kathistaceae) identification summary" but *Kathistes* spp. produce both sexual and sporodochia forming fungi.

Malloch D. and Blackwell M. 1990. *Kathistes*, a new genus of pleomorphic ascomycetes. Can. J. Bot. 68: 1712–1721. Below is a copy of their morphological description of the *Kathistes* holotype species – *K. calyculata*.
Red inserts in the description refer to measurements and comments for collection AEB1366 (= PDD 121656).



FIGS. 11–18. *Kathistes calyculata* (HOLOTYPE). Fig. 11. Ascoma. ×270. Fig. 12. Asci and ascospores. ×1100. Fig. 13. Ascospores after 4 h on agar. Germ tubes have developed by this time. ×1100. Figs. 14–16. Ascospores after 19, 27, and 42 h on agar, respectively. Yeast cells have begun to develop. ×1100. Fig. 17. Yeast cells after several days. ×1100. Fig. 18. Sporidiomata showing single-celled wall at base and sporidiolae filling hollow darkened neck cell. ×1100.

Ascomata subspherical to spherical, 26–62 µm (112.5–187.5 µm, n=4) in diameter, hyaline and transparent (black & not transparent in my in-situ view), glabrous, thin-walled, provided with a long neck, with hyphal attachments extending into the substrate (attachments not observed). Ascomatal peridium forming a textura angularis (yes) in surface view, composed of flattened cells 1.7–8.8 µm in diameter in surface view and 1.9–3.3 µm in cross section, apparently one cell layer thick (yes, cell sizes not measured). Ascomatal neck 80–120 (350–470 µm, n=5) × 6–11 (width measured at midpoint) (width at/near base 32.5–37.5 µm, n=3; width at/near apex 20–22.5 µm, n=3) , dark reddish brown (blackish to purplish), composed of parallel hyphal elements measuring 7–20 × 1.6–3.4 µm, terminated by incurved (yes) setae 19–30 µm long (length ca 65 µm, width ca 1 µm, hairs septate) to form a cuplike apex, often with a thickened collar-like area ? where joined to the perithecium. Asci (as described but not easily measured; seemingly with an apical ring) ellipsoidal to broadly clavate, with a short stipe or at least narrowed below, 13–22 × 6.5–10.2 µm, thin-walled, evanescent, 8-spored, arranged in a basal fascicle. Interascal filaments lacking. Ascospores narrowly clavate to falcate, 13–20 × 2.3–2.9 µm [(17.5–)20–28(–35) × 4.5–6(–8) µm, n=25], hyaline (the upper larger cell sometimes darker), smooth, often unicellular when first released but later developing first one (in the center) and then three (3, but occasionally 5 or rarely 9 – but variable) transverse septa, without pores or slits, lacking gelatinous or swollen wall layers (some ascospores still within the ascus seem to have a sheath), collecting in droplets at the apex of the ascomatal neck, germinating by repetition to produce budding yeast-like cells (I saw some small yeast-like cells near free floating ascospores). **See the next page for further comments & a brief coverage of spore-like bodies , termed sporidiolae, produced in spherical structures resembling the perithecia called sporidiomata.**

The family *Kathistaceae* includes the genus *Kathistes* & its ectoparasitic termite & ant relatives (*Termitaria*, *Termitariopsis* & *Mattirolella* spp.): All produce spore-like bodies, termed sporidiolae (called conidia by some), produced in structures called sporidiomata (called conidiomata, pycnidia or pycnothyria by some).

***Kathistes* (*K. calyculata*, *K. fimbriata* & *K. analemmoides*):** their 'asexual' sporidiomata/sporidiolae have only been seen accompanied by their sexual ascosporic morphs on the original substrates. Sporidiomata/sporidiolae have not been cultured and their development and life cycle is poorly understood.

***Termitaria* spp. (*T. coronata*, *T. longiphialidis*, *T. macrospora*, *T. rhombicarpa*, *T. snyderi* & *T. thaxteri*) and *Mattirolella* spp. (*M. crustosa* & *M. silvestrii*) – both genera ectoparasitic on termites and *Termitariopsis cavernosa* ectoparasitic on ants:** their 'asexual' sporidiomata/sporidiolae have only been seen on their termite or ant substrates. They have no accompanying sexual morph and are associated with their *Kathistes* relatives only through their sporidiomata similarity and 18 *Termitaria snyderi* & unclassified *Terminaria* spp. nucleotide sequences in Genbank online (accessed March 2025). There are no Genbank sequences online for *Mattirolella* spp. or *Termitariopsis cavernosa*.

Further comments concerning the species of *Kathistes* and especially *K. calyculata*:

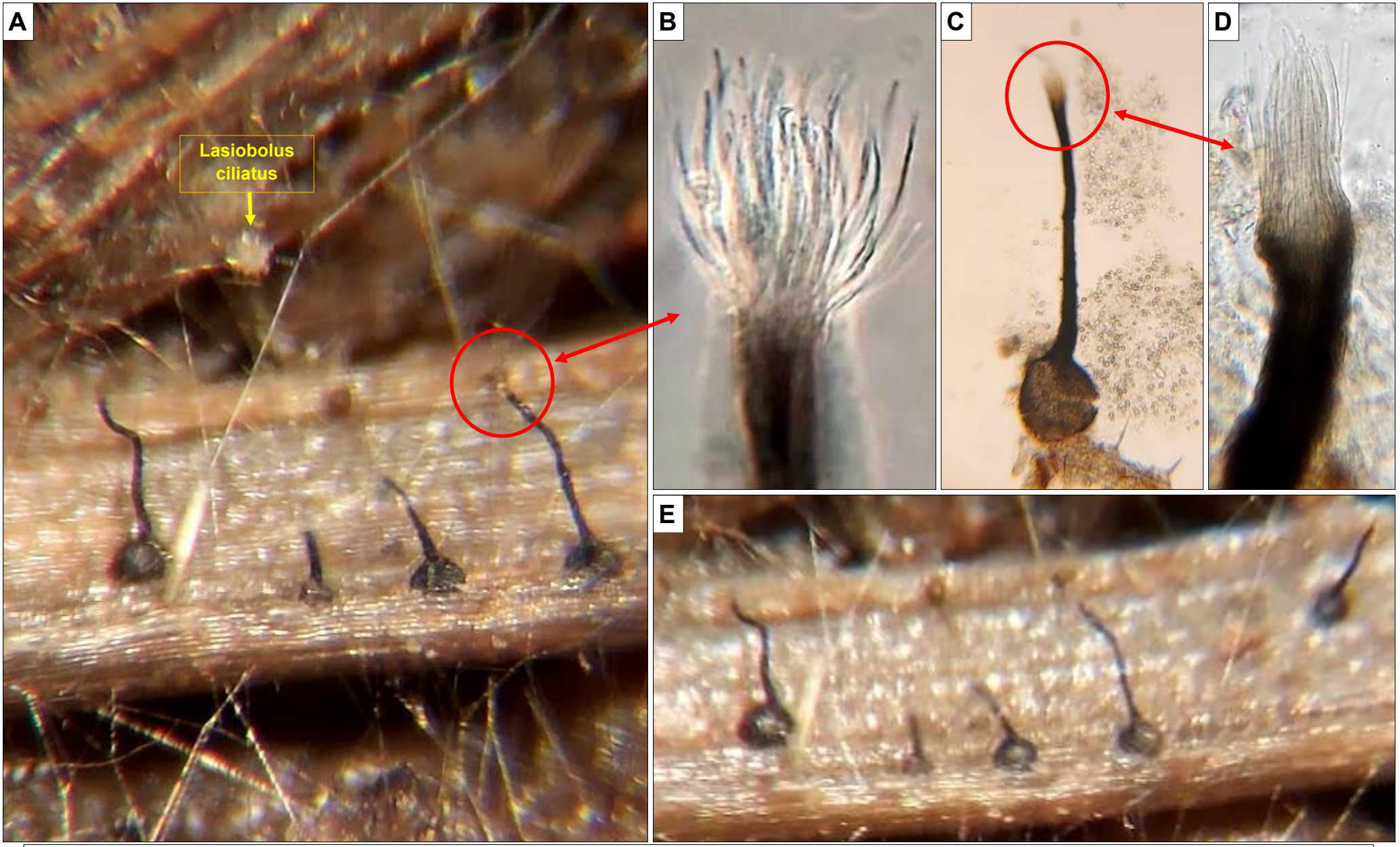
Genbank:

1. *Kathistes calyculata* small subunit ribosomal RNA gene, partial sequence; AF313768.1; from type strain TRTC 51146
2. *Kathistes analemmoides* small subunit ribosomal RNA gene, partial sequence; AF313767.1; from type strain TRTC 51147
3. *Kathistes fimbriata* (no record)

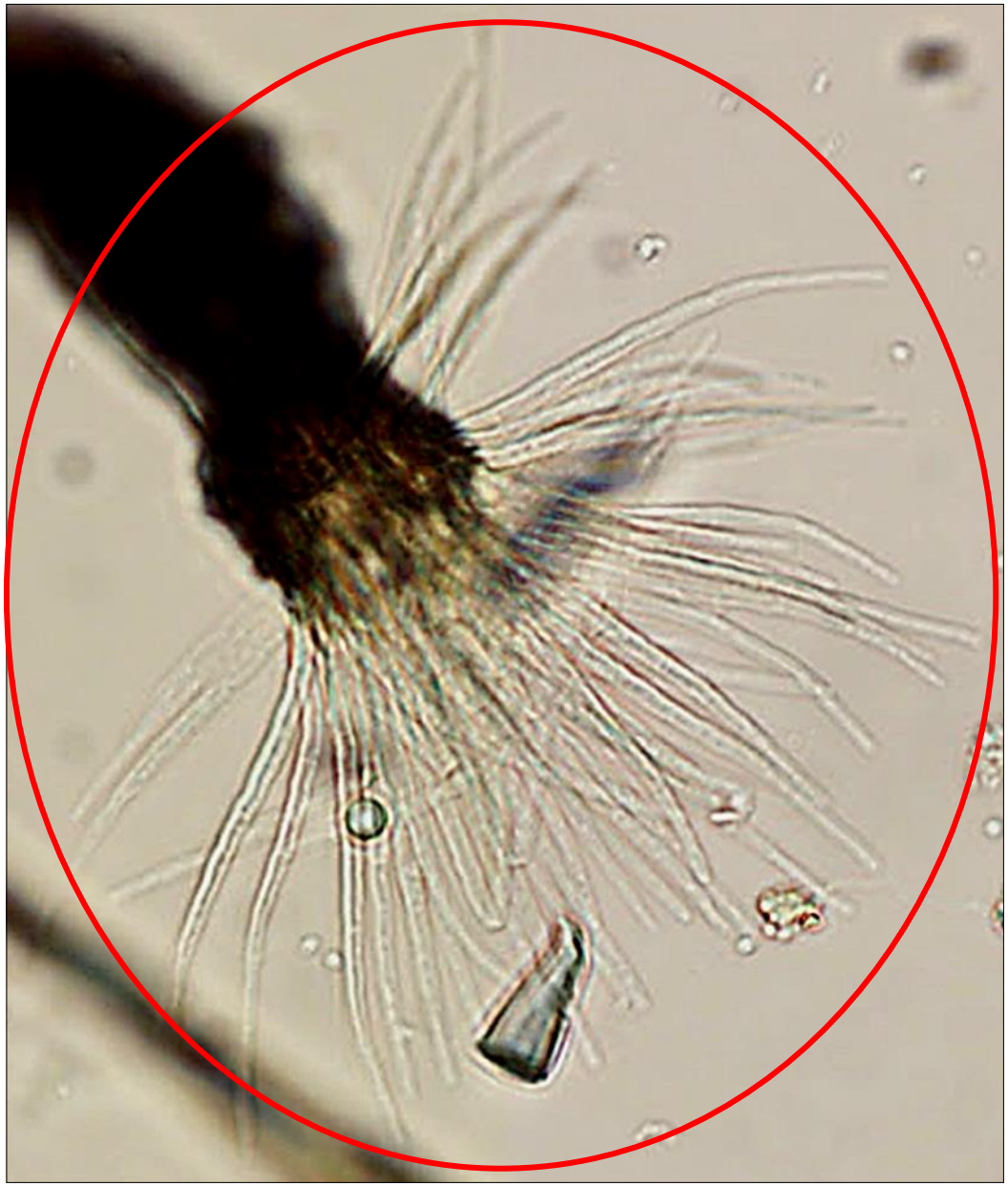
***Kathistes calyculata* holotype and other specimen examined:**

Holotype: Canada, New Brunswick, on moose dung, 27 August 1987, D. Malloch&M. Blackwell (TRTC 51145). No culture?
Other specimen examined and cultures: CANADA, ONTARIO, Algonquin Provincial Park, on moose dung, 24 June 1988, D. Malloch and M. Blackwell (TRTC 51146). A culture derived from TRTC 51146 is deposited at the University of Alberta Microfungus Collection and Herbarium (UAMH 6114) ─ with sequences of the same culture also in Genbank.

Final comment: To my knowledge the present collection [PDD 121656 (= AEB 1366)] is only the 3rd collection worldwide of *Kathistes calyculata*. Whether its treatment here as a larger morphological variant, rather than a new species, remains to be seen.

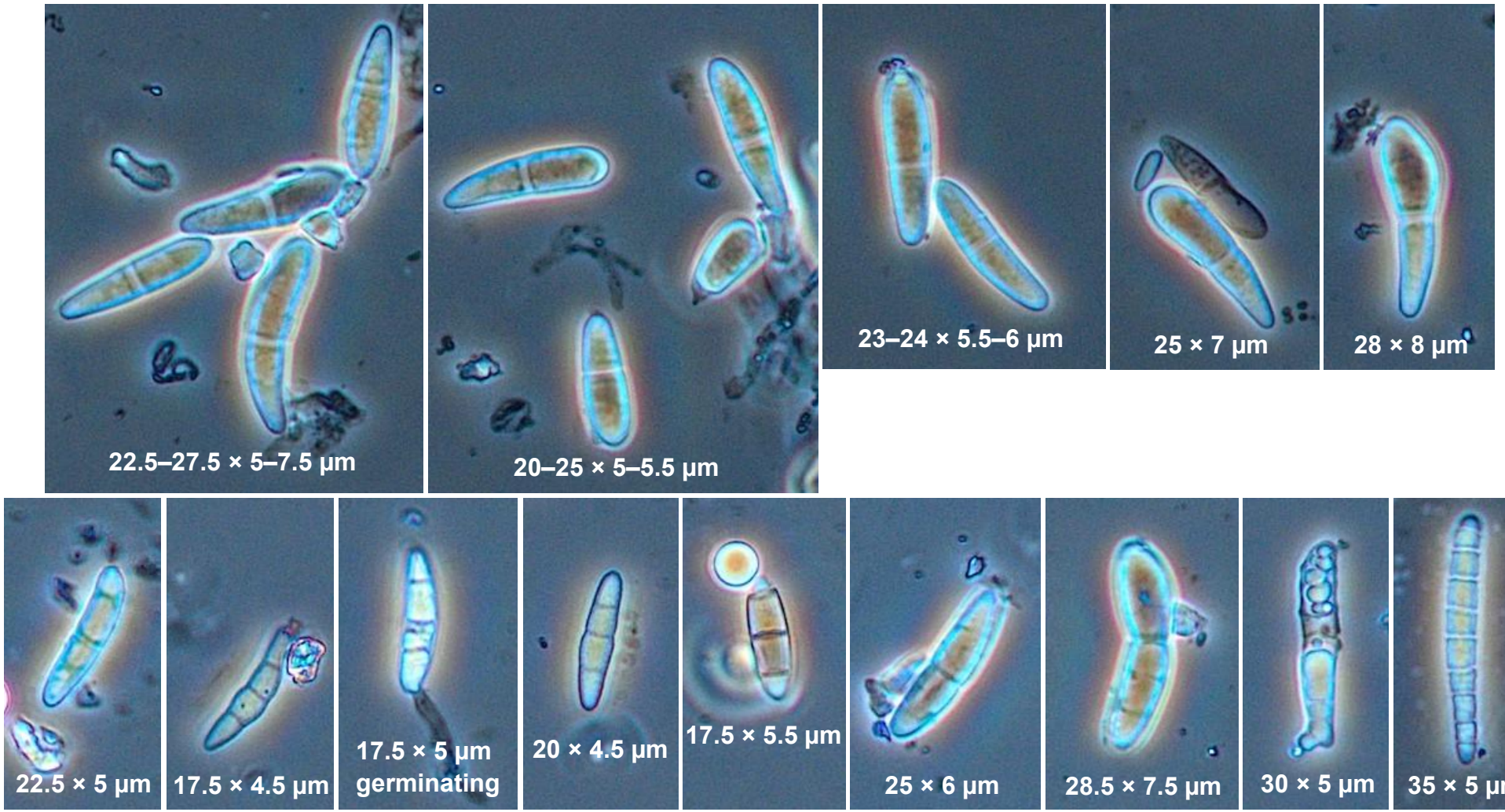


AEB 1366. A,E. In-situ views of perithecia on incubating cattle dung using a Samsung Galaxy A70 smartphone. A,B. red circle = incurved setae at neck apex. B,C,D. Perithecium details using a SMF slide, an Olympus BX51 microscope & a smartphone camera. B. Neck setae. C,D. Another perithecium with tightly packed neck setae.



AEB 1366. Left photo: incurved setae at perithecium neck apex, using a SMF slide and an Olympus BX51 microscope with a DP28 camera. Note individual, relatively hyaline, septate, tapering setae (same red-circled seta areas in both photos). Right photo: cluster of 3 perithecia from slide noted in the left photo.

AEB 1366. All photos from SMF slides using a BX51 Olympus microscope and a Samsung Galaxy A70 smartphone camera. Left photo: Perithecium, emphasis textura angularis venter peridium. Red-ringed area suggests a thickened collar-like area? near the neck base. Right 3 photos are different focuses of the same ascus: Ascospore arrows: solid black – center septum; dotted black – upper half or lower half septum; blue – gelatinous sheath. Ascus tip red arrows: appear to be an ascus apical ring?



AEB 1366. All ascospore photos from a SMF slide (the best of 2, collection voucher slides) using phase microscopy, a BX51 Olympus microscope and a DP28 camera. Ascospore sizes are all shown at the same magnification with an attempt to rotate spores to have their broader rounded upper end (ascus view) uppermost and their narrower tapered lower end downwards. Arrangement beginning at the upper left and continuing left to right above and then left to right below is based on ascospore septation from commonly seen 1-center-septum only, to septations in the upper or lower cell, to 3 septa, to less frequently seen oddballs. Small yeast-like cells were sometimes seen near ascospores but never clearly. Overall, ascospores measured (17.5–)20–28(–35) × 4.5–6(–8) µm, n=25.