

***Bactridium flavum* Kunze AEB 841 (= PDD 78000)**

Substrate: dead wet decorticated *Populus* wood (*P. tremuloides* most likely)

Collection date: August 21, 2003

Collection site: piles of cut aspen logs behind cabin #1, U.S. Forest Service summer lease lot, Snowbank Lake, N. Minnesota, 22 miles NE of Ely

Collector: Ann Bell; **Identifier:** Dan Mahoney

Voucher material: dried herbarium specimen AEB 841 (= PDD 78000) accompanied by one Shear's mounting fluid (SMF) microscope slide prepared 21 August 2003, various in-situ fresh sporodochia photos and compound scope photos of the conidia.

***Bactridium flavum* – References consulted. Listed in chronological order:**

Hughes S.J. 1966. New Zealand Fungi: 8. *Bactridium* Kunze. New Zealand Journal of Botany, 4(4): 522–532.

Tubaki K. 1970. Notes on the Japanese Hyphomycetes. IV, Japanese species of *Bactridium*. Trans. Mycol. Soc. Japan. 11: 49–52.

Carmichael J.W., Kendrick W.B., Conners J.L. & Singler L. 1980. Genera of Hyphomycetes. Alberta Press, Edmonton. The species pictured in Carmichael et al., p. 293, is listed as *B. flavum* but has more highly septate and longer, less clavate conidia than *B. flavum*. This record and the illustrations seem to indicate that Carmichael et al. have illustrated another species of *Bactridium* (but not *B. flavum*).

Berch S.M. 1982. *Bactridium xathertum* anam sp. nov. from the West Indies. Mycotaxon 14(1): 227–232.

Ellis M.B. & Ellis J.P. 1985. Microfungi on land plants: An identification handbook. Macmillan Publ. Co, New York. 818 pp.

Barnett H.L. & Hunter B.B. 1998. Illustrated Genera of Imperfect Fungi. 4th Edition, APS Press, St. Paul, 218 p. The keys and drawings in Barnett and Hunter easily placed our specimen in the genus *Bactridium* and in their illustrated species *B. flava* (all others record this species as *B. flavum*).

Seifert K., Morgan-Jones G., Gams W. & Kendrick B. 2011. The Genera of Hyphomycetes. CBS Biodiversity Series no. 9: 1–997. CBS-KNAW Fungal Biodiversity Centre, Utrecht, Netherlands. See pp. 99 & 735. Like Carmichael et al., the species pictured on p. 735 is listed as *B. flavum* but has more highly septate and longer, less clavate conidia than *B. flavum*.

Brief description: This sporodochial fungus was easily viewed by the naked eye as discrete yellow to yellow-orange hemispherical bodies on the wet, dead, corticated (or decorticated) *Populus* logs –especially on or near their sawed ends. Closer examination revealed large conidia covering each hemisphere. Conidia were produced singly as blastospores at the apices of crowded, hyaline, branched, anastomosing, septate conidiophores. Conidiophores arose from the basal cushions of intricately and compactly woven hyphae. Fresh conidia in water mounts were longish clavate, rounded apically and narrowly truncate basally, smooth, with 2–4 transverse septa located so as to produce unequally sized cells [the largest and yellowish to yellowish orange pigmented cell was the middle cell (when 2 or 4 septate) or either one of the interior cells (when 3 septate)]. The basal and apical cells were hyaline to faintly pigmented. Conidia mounted in Shear's mounting fluid lost their pigment differences over time and when viewed later showed the same sizes and septations but not the fresh pigmentation seen in water mounts. Conidia were variable in size but most fell within the range 160–190 × 57.5–75 µm – n=28.

Comments: For identification I referred first to Barnett & Hunter's 4th ed. of "Illustrated Genera of Imperfect Fungi" and to Carmichael et al.'s "Genera of Hyphomycetes". The keys and drawings in Barnett and Hunter easily placed the specimen in the genus *Bactridium* and in their illustrated species *B. flava* (all others record this species as *B. flavum*). The species pictured in Carmichael et al., p. 293, is listed as *B. flavum* but has more highly septate and longer, less clavate conidia than those figured in Barnett and Hunter. Berch in Mycotaxon 14: 227-232 (1982) has a table listing the sizes, # of transverse septa and literature citations for 18 species. Here she records *B. flavum* as 4-septate and 160-200 X 35-44 µm, using the measurements given in Tubaki, K. 1970. Japanese species of *Bactridium*. Trans. Mycol. Soc. Japan 11: 49-52. Ellis and Ellis. 1985. in their "Microfungi on Land Plants: An Identification Handbook" show 4 septa in their figures of *B. flavum* and record pale yellow conidia 100-200 X 40-50 µm. These records and the illustrations in Barnett and Hunter seem to indicate that Carmichael et al. have illustrated another species of *Bactridium* (perhaps *B. clavatum*, but not *B. flavum*).

Over all the conidia in our collection fit well within *B. flavum* but are slightly wider than those reported for that species. Conidial septation is not more than 4 although 2- and 3-septate conidia are common.

A brief look at the genus *Bactridium* and its species:

Hughes S.J. 1966. p. 522

“Species of *Bactridium* are typically sporodochial with crowded conidia produced singly as blown-out ends of crowded, branched, anastomosing, septate, hyaline conidiophores produced over the surface of a pseudostromatic basal cushion of intricately and compactly woven hyphae. The conidia are large, transversely septate, varying from ellipsoidal to oval, sub-cylindrical or clavate, or rhomboidal; they form a rounded, somewhat waxy layer which is pale yellow to golden to orange-brown.”

Berch S.M. 1982. Table 1, p. 231; References, p. 232

Table 1: <i>Bactridium</i> in the literature.			
Species	Conidial Septa	Conidial Dimensions (µm)	Reference
<i>acutum</i>	1 – 3	?	6
<i>americanum</i>	6	140–220 x 40–45	7
<i>atrovirens</i>	1 – 2	?	6
<i>bonaerense</i> (= <i>fulvellum</i>)	6 – 9	138–185 x 33–41	3
<i>candidum</i>	?	?	6
<i>carneum</i>	?	?	6
<i>clavatum</i>	10 – 12	up to 415 x 28–48	3
<i>effusum</i>	?	?	6
<i>ellisii</i>	3	?	6
<i>flavum</i>	4	160–200 x 35–44	9
<i>fulvellum</i>	up to 10	up to 277 x 33–46	3
<i>helminthosporum</i>	5 – 7	35–40 x 4–6	8
<i>helvellae</i>	6 – 7	60–65 x ?	6
<i>magnum</i> (= <i>clavatum</i>)	5 – 9	300 x ?	3
<i>minutum</i>	6	78–84 x 5–5.5	7
<i>novae-zelandiae</i>	5	125–257 x 39–59	3
<i>versicolor</i>	?	?	5
<i>xathertum</i>	5 – 13	13–60 x 4–6	

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Acknowledgements: The author appreciates the support and participation of Dr. Bryce Kendrick, Dr. Bernard Boivin for correcting the latin description, and Dr. S.J. Hughes for suggesting generic affinities of the specimen.

References:

1. Ainsworth, G.C., P.W. James, & D.L. Hawksworth. 1971. Dictionary of the Fungi. 6th. Commonw. Mycol. Inst. Kew.
2. Ellis, M.B. 1963. Dematiaceous Hyphomycetes. V. Mycological Papers, No. 93.
3. Hughes, S.J. 1966. New Zealand Fungi. 8. *Bactridium* Kunze. N.Z. Journ. Bot. 4: 522–532.
4. Kendrick, W.B. & T.R. Nag Raj. 1979. Morphological Terms in Fungi Imperfecti. Chpt. 5. The Whole Fungus. Nat. Mus. Can.
5. MacAlpine. 1897. Proc. Linn. Soc. N.S. Wales 14: 1123.
6. Saccardo, P.A. 1886. Sylloge Hyphomycetum. Vol. IV, p. 691.
7. ———. 1906. Not. Myc. VIII, Ann. Myc. IV, p. 277
8. ———. 1915. Not. Myc., Ann. Myc. XIII, p. 137.
9. Tubaki, K. 1970. Notes on the Japanese Hyphomycetes. IV. Japanese species of *Bactridium*. Trans. Mycol. Soc. Japan. 11: 49–52.

Berch uses the measurements for *B. flavum* given in Tubaki, K. 1970. Measurements for several other species listed in Table 1 were gathered from the references provided. However, no keys to these or to others among the 30 species and varieties presently recorded (March, 2022) in Index Fungorum have been published.

Seifert K., Morgan-Jones G., Gams W. & Kendrick B. 2011. The Genera of Hyphomycetes. CBS Biodiversity Series no. 9: 1–997. CBS-KNAW Fungal Biodiversity Centre, Utrecht, Netherlands. See pp. 99 & 735 below. Unfortunately, one of the few errors in this most widely used reference on Hyphomycetes is noted here. The illustrations of *Bactridium flavum* on pages 99 & 735 are different. Conidia on p. 735 are, perhaps, those of *B. clavatum*.

BACTRIDIDIUM Kunze 1817 : Fr. — In Kunze & Schmidt, Mykol. Hefte 1: 5 (no illus.) : Fries, Syst. mycol. 1: xl, 1821 / *B. flavum* Kunze 1817 : Fr. 1832

= *Ericianella* Brond. 1828, *fide* Fries 1849

?= *Damnosporium* Corda 1842, *fide* Saccardo 1886

= *Podobactridium* Penz. & Sacc. ex Petch 1916, *fide* Hughes 1966

CDM: sporodochia (or synnemata), yellow. SET: none. CPH: sparingly branched, hyaline. CGC: monoblastic, hyaline. CDA: phragmo, hyaline, single, dry, schizo.

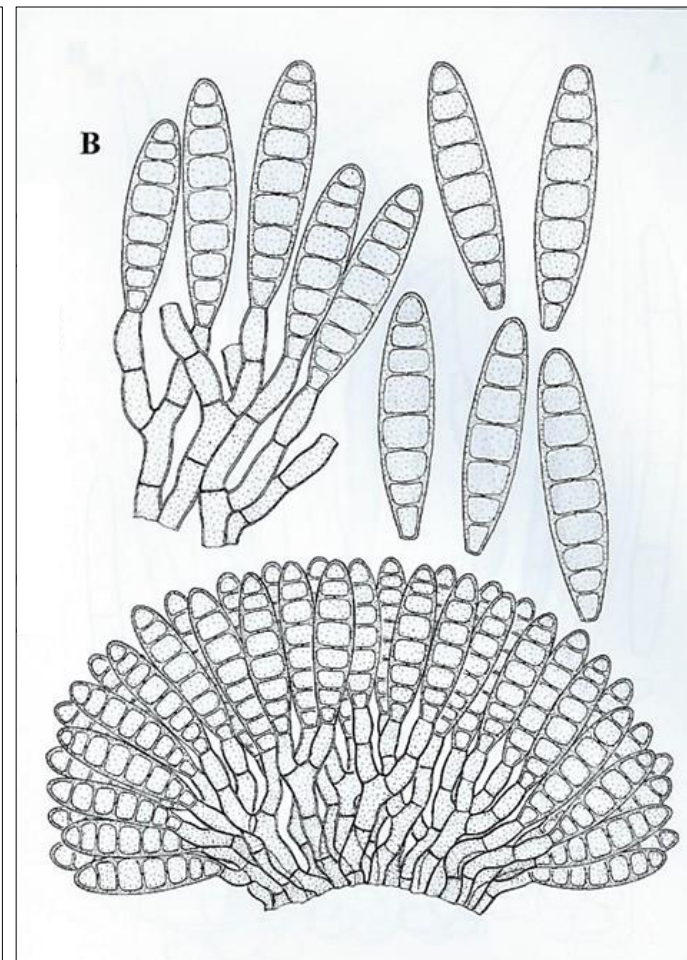
Figs 9A, 104, Pl. 253B. On wood and bark: Cosmopolitan. About 15 species.

Notes: Compare with *Lichenobactridium*, *Bactrodesmium*. For *B. lichenicola* see *Fusarium*, for *B. gymnosporangii* see *Cylindrocarpon*. See also notes under *Rotaea*.

Refs: Keissler, Rabenh. Kryptog. Fl. 2. Aufl., 8: 637, 1930 (lichenicolous spp.). — Hughes, N. Z. J. Bot. 4: 522–532, 1966 (revis.). — Tubaki, Trans. mycol. Soc. Japan 11: 49–52, 1970 (illus.). — Tubaki & Okada, Trans. mycol. Soc. Japan 22: 55–59, 1981 (n. sp.). — Berch, Mycotaxon 14: 227–232, 1982 (n. sp.). — Ellis & Ellis, *Microf. Land Plants*, pp. 134, 252, 1987 (repr. 1997) (Fig. 1137). — Sutton, Sydowia 41: 330–343, 1989 (n. sp.). — Seifert, Mem. N. Y. bot. Gdn 59: 109–154, 1990 (illus.). — Muntañola-Cvetković *et al.*, Revta catal. Micol. 20: 199–212, 1997 (illus.).



Fig. 104. *Bactridium flavum*, conidia.



Page 735. Plate 253.

B. *Bactridium flavum*

***Bactridium flavum*: Online information of interest**

Based on my online searches, *Bactridium flavum* is by far the most frequently recorded, described and illustrated species in its genus. It is found worldwide and in September 2023 had 444 records on the Mycoportal website. Unfortunately, most of these records provide only basic information (collector, identifier, site, substrate, etc.) but not descriptions, measurements or illustrations. The latter are provided on Google images by individuals, small fungal groups or websites like “Fungi of Great Britain and Ireland”. Ironically, New Zealand has not recorded it although Australia has [Atlas of Living Australia (ala.org.au)].

Perhaps most noteworthy is the lack of information on its biology and ecology. I have seen no record of any conidium germination or culturing. Its sexual stage is unknown and only recently has the sequencing from its ‘spore mats’ on dead wet wood suggested where that stage might lie. In that regard, two publications by workers on the Pezizomycetes deserve attention:

- 1) Healy R.A., Smith M.E., Bonito G.M., Pfister D.H., Ge Z.-W., Guevara G.G., Williams G., Stafford K., Kumar L., Lee T., Hobart C., Trappe J., Vilgalys R. & McLaughlin D.J. 2013. High diversity and widespread occurrence of mitotic spore mats in ectomycorrhizal Pezizales. *Molecular Ecology* 22(6): 1717–1732. **Here the importance of mitotic spore mat collection is discussed, but no information on *Bactridium* is presented.**
- 2) Healy R.A., Arnold A.E., Bonito G., Huang Y.-L., Lemmond B., Pfister D.H. & Smith M.E. 2022. Endophytism and endolichenism in Pezizomycetes: the exception or the rule? *New Phytologist* 233(5): 1974–1983. **Spore mat information places *Bactridium* in the Pyronemataceae. The Supporting Information for their publication includes the following:**

Fig. S27 Phylogeny based on ITS of Pyronemataceae (pro parte) for placement of endophytes and endolichenic fungi analyzed with Maximum Likelihood. ***Bactridium* & *B. flavum* entries in the phylogram are outline in red.**



Google online: Centro de Estudios Micológicos Asturianos

Bactridium flavum Kunze





AEB 841. Left photo: Fresh in-situ sporodochia near the sawed-edge surface of a dead *Populus* branch. Right photo: A close up of two sporodochia from the left photo. Here, the many conidia covering the sporodochium surface are clearly evident.





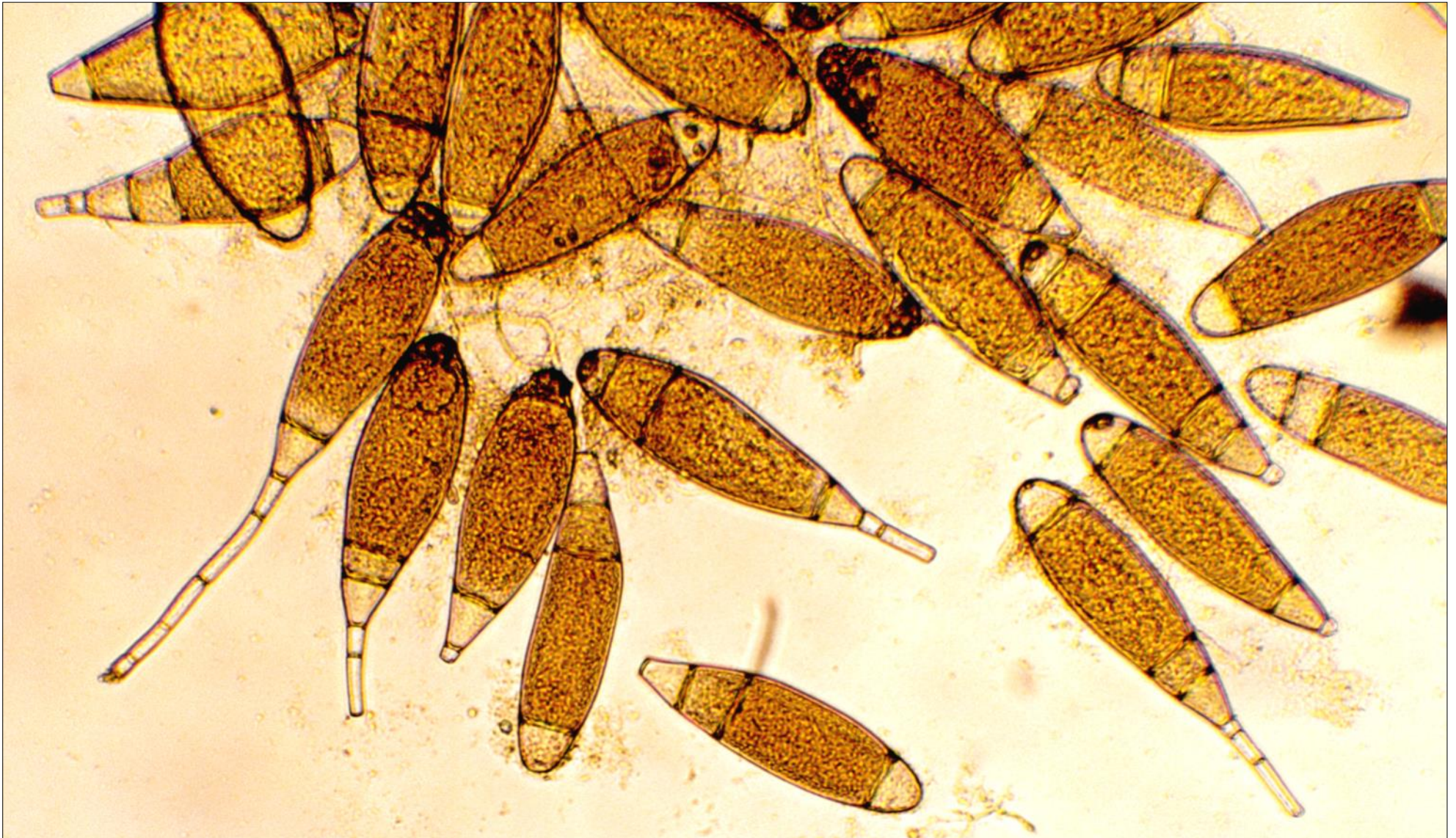
AEB 841. Fresh in-situ sporodochia on a dead *Populus* log. Their conidia are readily apparent.



AEB 841. Fresh in-situ sporodochia on a dead *Populus* log. Their conidia are readily apparent.



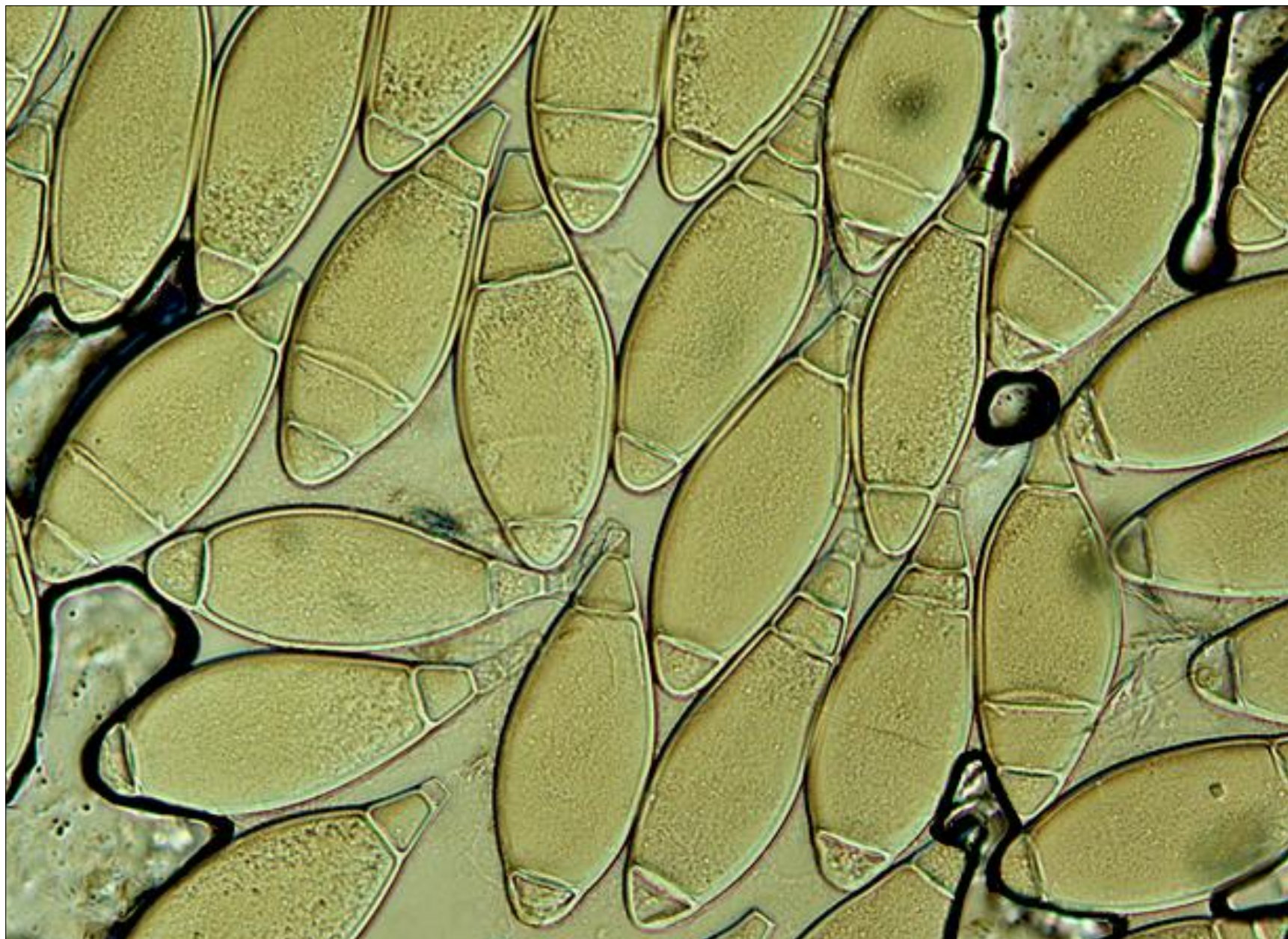
AEB 841. Another close up of 2 fresh in-situ sporodochia on a dead *Populus* log.



AEB 841. Fresh conidia in a water mount. Note that many still have a portion of their conidiophore stalks attached. The 2–4 transverse septa are located so as to produce unequally sized cells [the largest and yellowish to yellowish orange pigmented cell is median (when 2 or 4 septate) or either one of the interior cells (when 3 septate)]. The basal and apical cells were usually hyaline to faintly pigmented.



AEB 841. Two typical fresh conidia in a water mount – one 2-septate, the other 4-septate. Both still are attached to the small apical cell of the conidiophore which bore them.



AEB 841. Conidia photographed 8 March 2022 using the original SMF slide, prepared in 2003, that accompanies the dried herbarium specimen. Sizes & septation are the same but over time the pigmentation has faded.



AEB 841. Conidia photographed 8 March 2022 using the original SMF slide, prepared in 2003, that accompanies the dried herbarium specimen. Sizes & septation are the same but over time the pigmentation has faded.



AEB 841. Conidia photographed 8 March 2022 using the original SMF slide, prepared in 2003, that accompanies the dried herbarium specimen. Sizes & septation are the same but over time the pigmentation has faded.