

***Sphaeronaemella helvella* (P. Karst.) P. Karst. fungicolous on *Gyromitra infula* (Schaeff.) Quél. AEB 773 (= PDD 77932) – good matches**

Collection date: 9 September 2002

Collection site: along the portage from Snowbank Lake to Flash Lake, 22 miles NE of Ely, Minnesota, U.S.A.

Substrate: on burnt wood, where the U.S. Forest Service had burned piles of dead dismembered trees from a 1999 blow-down in the area.

Collectors and Identifiers: Ann Bell & Dan Mahoney

Voucher materials: dried herbarium specimens of *Gyromitra infula* on which grew numerous ascomata of *Sphaeronaemella helvella* AEB 773 (= PDD 77932) accompanied by 2 semi-permanent aniline blue lactic acid (ABLA) microscope slides that Ann prepared from fresh material in 2002 and Dan rejuvenated with Shear's mounting fluid (SMF) in April 2022; Photos: **1**) a Samsung Galaxy A70 smartphone photo (in 2022) of an original 2002 dried *Gyromitra/Sphaeronaemella* herbarium specimen, **2**) Zeiss MC80 dissecting scope digitized photos (in April 2022) of the *Sphaeronaemella* on the dried *Gyromitra* specimen and **3**) Olympus BX51 (DP25 camera) compound scope digitized photos from the original ABLA microscope slides rejuvenated with SMF; Dan's brief description and comments.

Dan's brief description and comments: Several specimens of *Gyromitra infula* were found among the logs burnt by the U.S. Forest Service. These were growing on moist log undersurfaces or from burnt nearby ground debris. Little vegetation, aside from moss and liverworts in the moister areas, had yet grown in the burnt areas. Most remarkable was the vast quantity of the fungicolous *Sphaeronaemella helvella* over 2 of the older *Gyromitras* – which now serve as the dried herbarium specimens. Although no photos were taken of the in-situ fresh *Gyromitra*, the somewhat shrunken dried specimens and their fresh hymenium 2002 microscope slides with ascospore photos and measurements leave little doubt of its identification as *G. infula*. The presence of the fungicolous *Sphaeronaemella helvella* provides further support for that determination. Although *G. infula* has been reported in Landcare Research PDD online from New Zealand, no collections from NZ (so

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far) are accompanied by *S. helvella*. Most of the attention in this PDF is given to *S. helvella*. Its description and measurements accompany the photos from microscope slides of fresh material. Its conidial state (*Gabarnaudia* sp.), if present, was not recorded.

Comments concerning *S. helvella*: This binomial accompanies nearly all of the collections, descriptions and illustrations (92 records in Mycoportal online). However, according to Index Fungorum (contributor Kew Mycology – 2019), its current name is *Melanospora karstenii* Arx & E. Müll. [as '*karsteni*'], Beitr. Kryptfl. Schweiz 11(no. 1): 146 (1954) with its synonym being *Sphaeronaemella helvella* (P. Karst.) P. Karst., Hedwigia 23(1): 18 (1884). A search for *M. karstenii* online, however, reveals a very limited use of that name – with only two records on Mycoportal (see below):

1) Fungal Records Database of Britain and Ireland
British Mycological Society

Melanospora karstenii Arx & E. Müll.

97925 1976-01-11

United Kingdom, England, 52.28294 -1.78154

Full Record Details

AND

2) University of Arizona, Gilbertson Mycological Herbarium, specimen-based

Melanospora karstenii Arx & E. Müll.

AN 044631Teresa A. Clements 92702664 2021-08-17
United States, Arizona, Apache, Sheep's Crossing in
White Mountains

Full Record Details

GenBank

Identifier: OM980611

Locus:

URL: <https://www.ncbi.nlm.nih.gov/nucleotide/OM980611>

Notes: on *Gyromitra* cf. *infula*

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And another corrected record in Cannon, P.F. & Hawksworth, D.L. 1982. A re-evaluation of *Melanospora* Corda and similar Pyrenomycetes, with a revision of the British species. Botanical Journal of the Linnean Society 84(2): 115–160 (p. 151, in **quoted areas immediately below**):

“*Sphaeronaemella helvellae* (P. Karsten) P. Karsten, Hedwigia, 23: 17 (1884).

SYNONYMS:

Melanospora karstenii v. Arx & E. Muller, Beitrage eur Kryptogamenjora der Schweiz 11(1): 146 (1954).”

“This species (*Sphaeronaemella helvellae*) was reported by Clark (1980: 113 - as *Melanospora karstenii*) occurring in Britain, but a re-examination of his material, on *Fraxinus* from Warwickshire (IMI 200172) showed it to be in fact *Melanospora chionea* (Fr.) Corda. *Sphaeronaemella helvellae* appears to be widespread, but is rarely found. It was described in detail by Malloch (1974), from which the above description has largely been adapted. However, in common with all previous authors, he failed to notice the longitudinal germ slits. These are narrow, develop just before the spores are ready to germinate, and are very difficult to see without the aid of SEM.” **I have not seen any longitudinal germ slits in AEB 773.**

The description, line drawings and comments by Malloch (1974) are worth noting and are reproduced on a following page.

Further publications on *Sphaeronaemella helvellae* include the following:

1) Réblová, M. et al. 2016. Recommendations for competing sexual-asexually typified generic names in Sordariomycetes (except Diaporthales, Hypocreales, and Magnaporthales). IMA FUNGUS 7(1): 131–153.

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Microascales

Use *Sphaeronaemella* P. Karst. 1884 (S) rather than *Gabarnaudia* Samson & W. Gams 1974 (A)

(S) = a name typified by a sexual morph

(A) = a name typified by an asexual morph

The type species of *Sphaeronaemella*, *S. helvellae*, is congeneric with the type species of *Gabarnaudia*, *G. betae*, described as the asexual morph of *S. fimicola* (Samson 1974). Confirmed by molecular data (Hausner & Reid 2004), these generic names are synonyms. Five species of *Gabarnaudia* have been placed in *Sphaeronaemella* (de Beer et al. 2013), a genus with 30 species. *Sphaeronaemella* is most commonly used and has priority, thus we recommend the use of *Sphaeronaemella*. **Continued on the next page**

References noted in the last paragraph on the previous page

Samson RA (1974) *Paecilomyces* and some allied hyphomycetes. *Studies in Mycology* **6**: 1–119.

Hausner G, Reid J (2004) The nuclear small subunit ribosomal genes of *Sphaeronaemella helvella*, *Sphaeronaemella fimicola*, *Gabarnaudia betae*, and *Cornuvesica falcata*: phylogenetic implications. *Canadian Journal of Botany* **82**: 752–762.

de Beer ZW, Seifert KA, Wingfield MJ (2013) A nomenclator for ophiostomatoid genera and species in the *Ophiostomatales* and *Microascales*. *CBS Biodiversity Series* **12**: 245–322.

2) Vakili, N.G. 1992. Sexual Reproduction in *Sphaeronaemella helvella*. *Mycologia* 84(6): 849–856. His culture work revealed its heterothallic nature and *Gabarnaudia* asexual morph.

3) Dung, J., Rogers, J.D., Schroeder, B. & Johnson, D.A. 2010. Observations on *Sphaeronaemella helvella* in culture. *Sydowia* 62(1): 37–49. Includes further culture work with *S. helvella* isolated from potato grown in Montana where it was associated with *Colletotrichum coccodes* (the cause of the black dot disease of potato). Introductory comments include the following:

“Observations on the fungus from pure culture show that ascospores germinate from one or both apices; no germ slits or germ pores are present. The *Gabarnaudia* anamorph produces conidia in chains from conidiogenous cells. Conidiogenesis appears to be phialidic with aspects of the holoblastic mode.” Morphological descriptions and illustrations of the teleomorphic and anamorphic stages are included along with discussions of previous work.

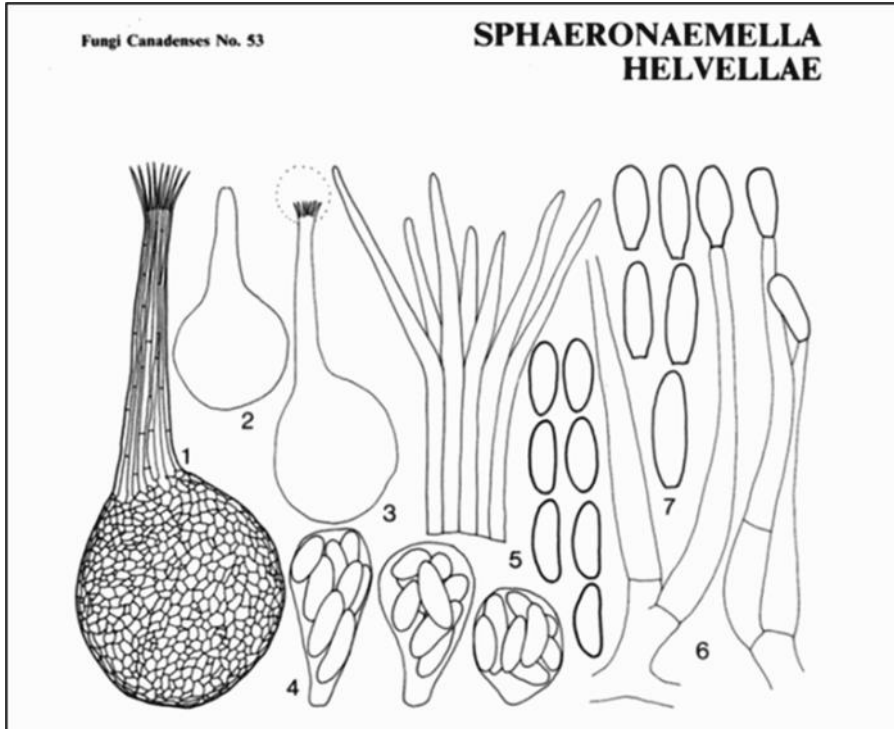
4) Only one culture record for *Sphaeronaemella helvella* is recorded on the Westerdijk Fungal Biodiversity Institute website (the same record appears, also as *S. helvella*, but in a search for *Melanospora* on their website): CBS 114654, Substrate–*Gyromitra infula*, Country–Sweden, Collected by–Leif Källsten 4 Sep 1986, Isolated and Deposited by–O. Constantinescu, UPSC

ONLINE:

Untitled - AscoFrance

<http://www.ascofrance.com> > uploads > forum_file

Fungi Canadenses No. 53. *SPHAERONAEMELLA. HELVELLAE.*



1, ascocarp (x 250); 2, ascocarps, one with outline of spore mass at apex of neck (x 150); 3, ostiolar setae (x 1500); 4, asci (x1500); 5, ascospores (x1500); 6, phialides (x 1500); 7. conidia (x1500).

Sphaeronaemella helvellae (Karsten) Karsten, Hedwigia 23: 17. 1884.

Synonyms:

Sphaeria helvellae Karsten, Fungi Fenn. exs., No. 674. 1867.

Sphaeronaema helvellae (Karsten) Jacz, Nouv. Mem. Soc. Imp. Nat. Moscow 15: 302. 1898.

Melanospora karstenii Arx and Müller (ut nom. nov.), Beitr. Krypt. Schweiz 11: 146. 1954.

ASCOCARPS superficial to semi-immersed in the hymenium of the host, densely gregarious, subglobose to ovoid, bright yellow-orange, glabrous, smooth, 90-250 μ in diam., with a long neck. **ASCOCARP PERIDIUM** about 8.5-17 μ thick at maturity. **PERIDIAL CELLS** relatively thick-walled, and yellowish at the surface, thinner-walled and hyaline toward the interior, forming a *textura angularis* to *textura epidermoidea* in surface view, flattened in side view, 2-124 μ in diam., 1-4 μ thick. **ASCOCARP NECK** composed of vertically parallel hyphae, terminated by a ring of ostiolar setae 20-50 μ long, glabrous, up to 600 μ long. 8.5-30 μ in diam. **ASCI** irregularly disposed, clavate to ovoid, 8-spored, extremely delicate and evanescent, occasionally substipitate, 14-25 x 10.5-16 μ . **ASCOSPORES** hyaline by transmitted light, yellowish in mass, unilaterally flattened-elliptical in side view. elliptical in face view, smooth, lacking gelatinous appendages, lacking germ pores, 8.2-10.6 x 3.3-4.5 μ .

CONIDIA produced on phialides, hyaline, ellipsoidal to ovoid, truncated at one end, smooth, 7-15 x 3.0-4.5 μ . **PHIALOPHORES** short to nearly absent, usually represented only by a short side

branch of the vegetative hyphae. **PHIALIDES** clavate to lanceolate, occasionally with a single septum, rarely with a small collarette, 37-83 x 4.0-5.0 μ , produced singly or in pairs at the apex of the phialophores.

SUBSTRATE: On living ascocarps of *Gyromitra infula* and *G. ambigua* (see *Fungi Canadenses* No. 52 for a description of these hosts).

DISTRIBUTION: Ontario.

COLLECTIONS: Ont., Haliburton Co., 5 miles S of Dorset, on *Gyromitra infula*, 15 Sept. 1967, DAOM 136541 (Malloch), on *G. infula*, 17 Sept. 1969, DAOM 136826 (Malloch); Algoma Dist., Ont. Min. Nat. Res. Station, Agawa Bay, on *G. ambigua*, 14 Sept. 1972, DAOM 145223 (Malloch).

NOTES: *S. helvellae* is easily recognized in the field by the long perithecial necks protruding from the hymenium of the host, giving it a velvety appearance. Although the host ascocarps appear to be withered by the infection, ascospores are always present, indicating that the infection does not occur until host maturity.

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The ecology of this species poses some interesting questions. How, for example, do the ascospores of *S. helvella* get from one host to another? The superficial resemblance of this species to species of *Ceratocystis* (an unrelated genus), with its long-necked perithecia bearing apical masses of sticky spores, suggests dispersal by insects. However, not just any insect will do. If we assume that the insect vector is one that visits any fleshy fungus, it is difficult to imagine its finding a *Gyromitra* on its next or even fiftieth stop. Therefore, I think that we need to find a "*Gyromitra* bug, one that searches out *Gyromitra* ascocarps and, inadvertently, transfers to them some of the spores of the parasite clinging to its body. Alternatively, we might look for a "*Sphaeronaemella* bug", but it is unlikely that such an organism would be visiting uninfected hosts and transmitting the parasite. The final word on the ecology of *S. helvella*, however, can come only after a patient and careful study of the insects visiting the *Gyromitra* hosts.

S. helvella has been reported in North America from Alaska by Wells and Kempton (Mycologia 60: 888-901. 1968) and from New Hampshire, New York and Michigan by Seeler (Farlowia 1: 119. 133. 1943). Seeler (loc. cit.) was also, incidentally, the first to show it to be an Ascomycete, confirming the suspicions of von Höhnelt (Hedwigia 60: 151. 1919). C.T. Rogerson (personal communication) reports additional specimens from Colorado, Idaho and Washington. It is also known from northern Europe, having first been described from Finland.

A second species, *S. fimicola* Marchal, is known from dung and differs from *S. helvella* in producing smaller and more nearly allantoid ascospores. It was studied in detail by Cain and Weresub (Can. J. Bot. 35: 119-131. 1957) who demonstrated it to be parasitic upon certain other fungi (*Eurotium* and *Microascus* species). An isolate identified as *S. fimicola*, reported in detail by Pease (Mycologia 40: 114-124, 1948), has broader and more ellipsoidal spores than the Cain and Weresub material and was isolated from fruits of Cucurbitaceae. Possibly the Pease isolate is conspecific with *Viennotidia spermosphaerici* Negru and Verona (Mycopath. Mycol. Appl. 30: 306. 1966), 'described from seeds of various plants (including *Cucurbita*) in Roumania. Both *V. spermosphaerici* and *V. raphani* Negru and Verona (Mycopath. Mycol. Appl. 30: 307. 1966) undoubtedly belong in *Sphaeronaemella* and are transferred to that genus here as *Sphaeronaemella spermosphaerici* (Negru & Verona) Malloch, comb. nov. and *Sphaeronaemella raphani* (Negru & Verona) Malloch, comb. nov.

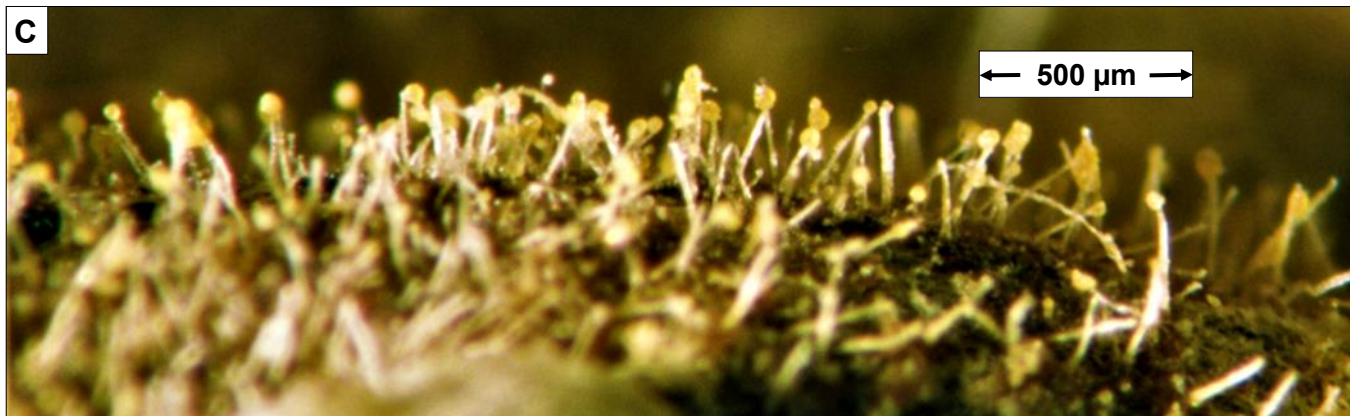
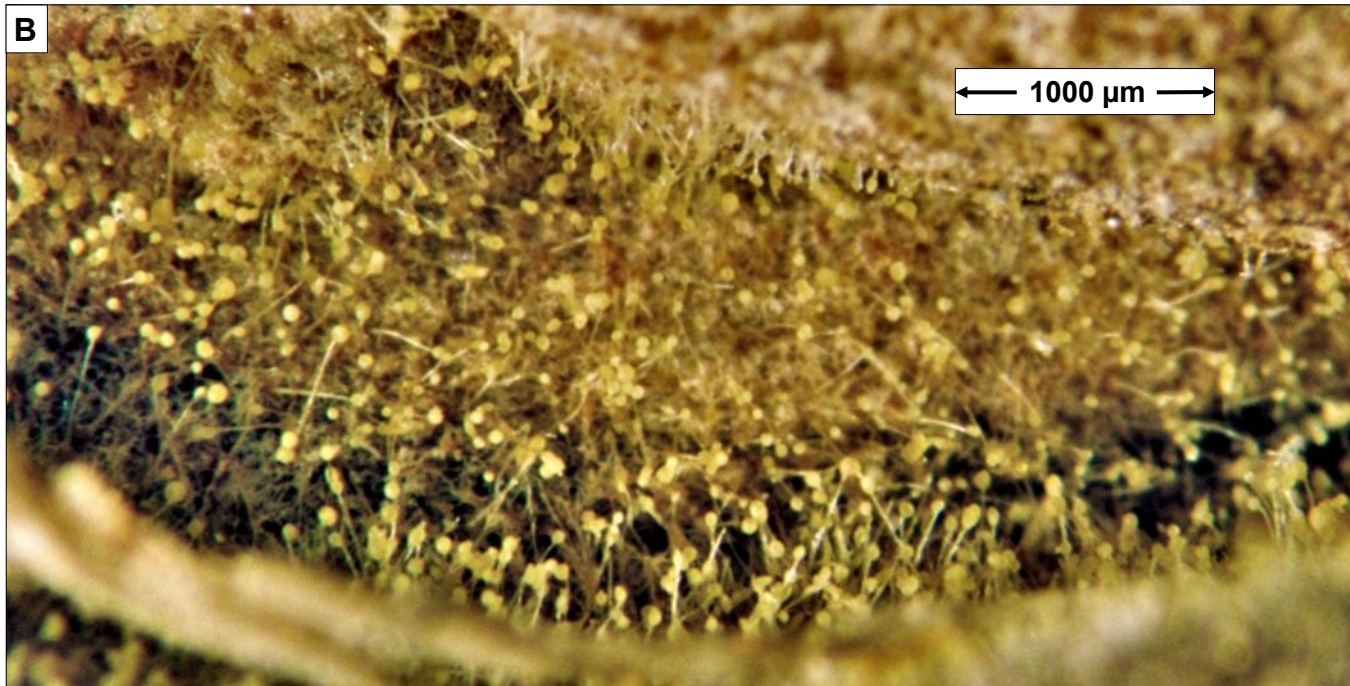
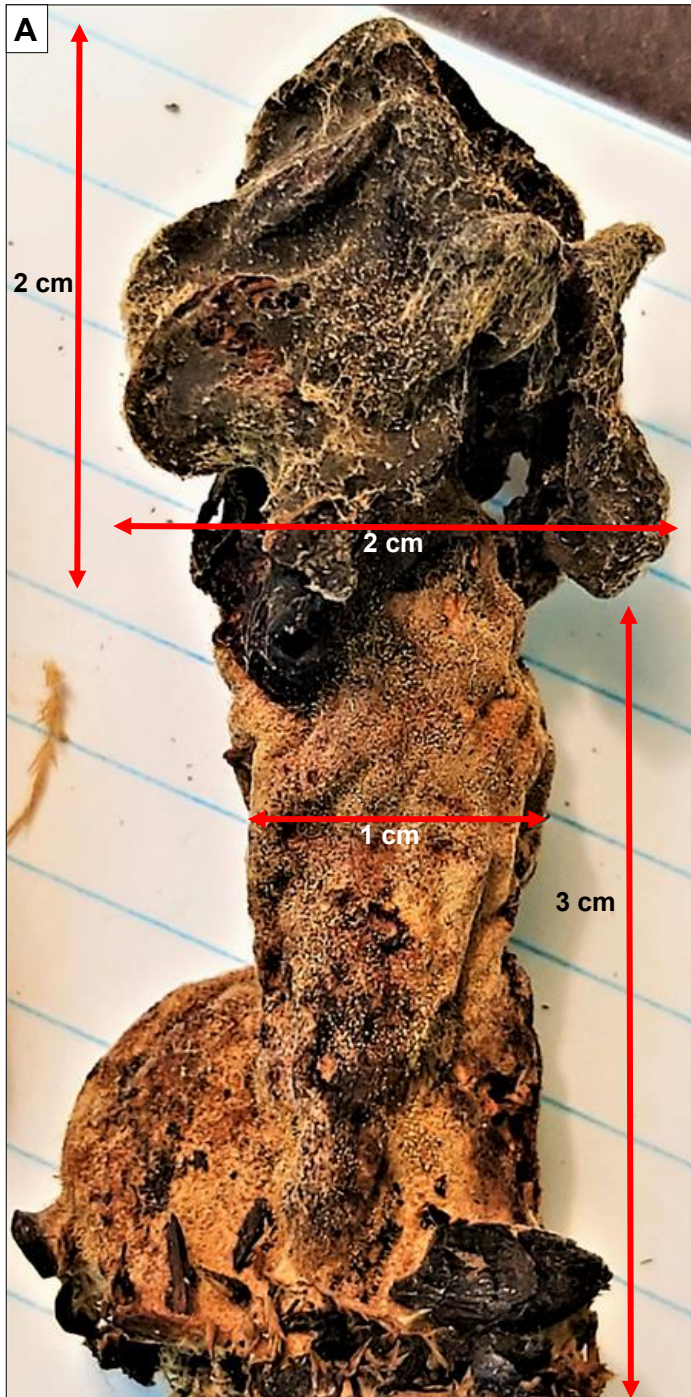
The four species of *Sphaeronaemella* can be separated as follows:

1. Growing on the hymenium of *Gyromitra infula* and *G. ambigua*; ascospores 8-11 x 3.3-4.5 μ*S. helvella*
1. Growing on dung or plant materials; spores usually shorter.....2
 2. Growing on dung; ascospores 6-8 x 2-3 μ*S. fimicola*
 2. Growing on plant materials; ascospores mostly broader than 3 μ ...3
3. Ascospores 4.0-6.5 x 4.0-4.5 μ*S. raphani*
3. Ascospores 5.0-7.0 x 3.0-5.0 μ*S. spermosphaerici*

D. Malloch

National Mycological Herbarium, Biosystematics Research Institute Research Branch, Agriculture Canada Ottawa, Ontario, KIA OC6

December, 1974



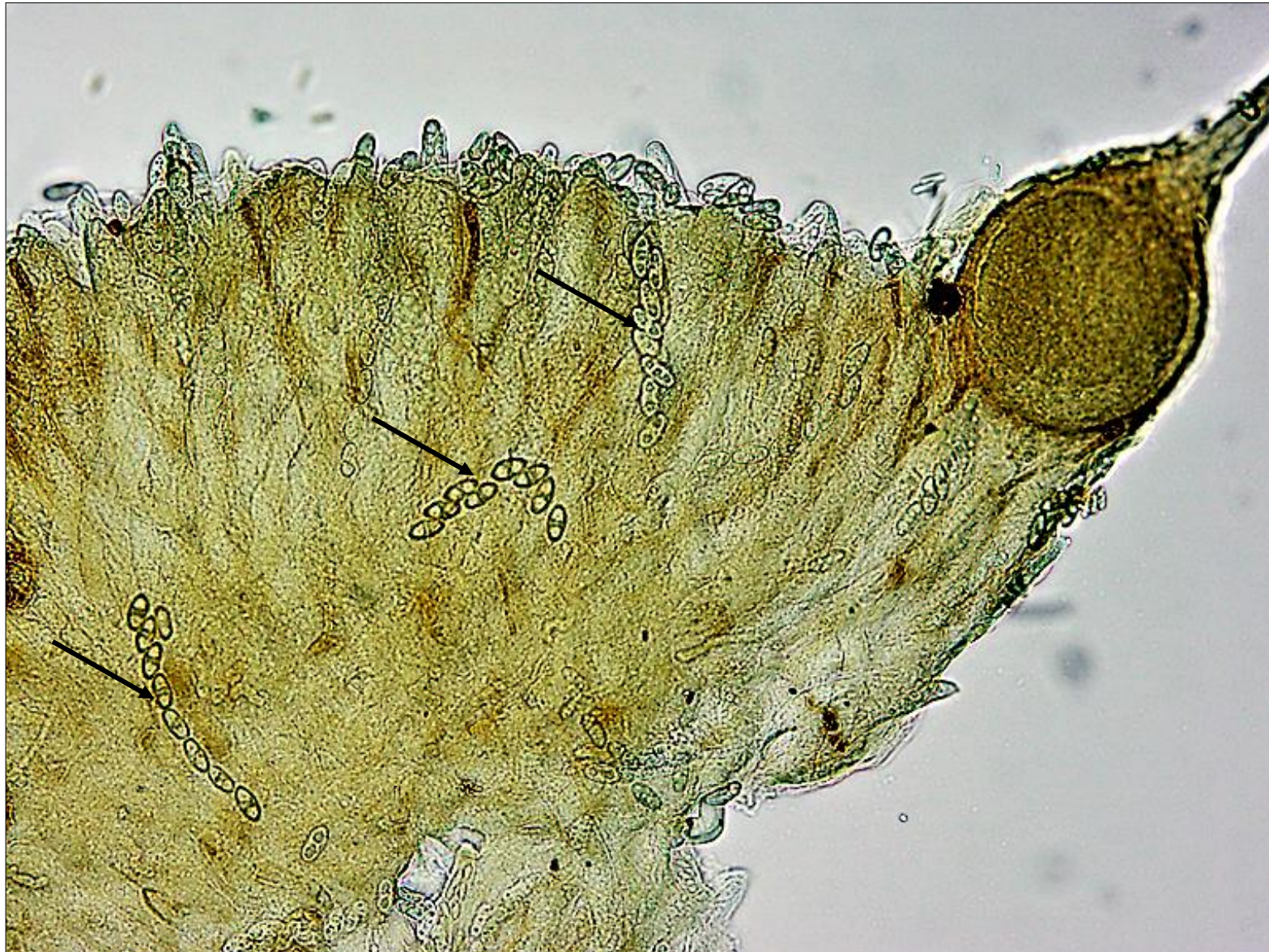
AEB 773. A–C. *Gyromitra infula* & *Sphaeronaemella helvella*. A. 2022 dried *Gyromitra* specimen with its dark reddish-brown, irregularly lobed & shrunken cap (here seen almost black) with lighter brown stalk (light yellow-brown here). Note the burnt wood fragments embedded at the stalk base. The whitish tracks and dots on the cap and the white dots on the stalk represent the fungicolous *S. helvella*. B,C. *Sphaeronaemella helvella* with lower & higher magnified in-situ dissecting scope views of the numerous long white ascomata necks and their apically extruded yellowish ascospore masses. B & C (2022 views) are from the *G. infula* stalk in photo A.



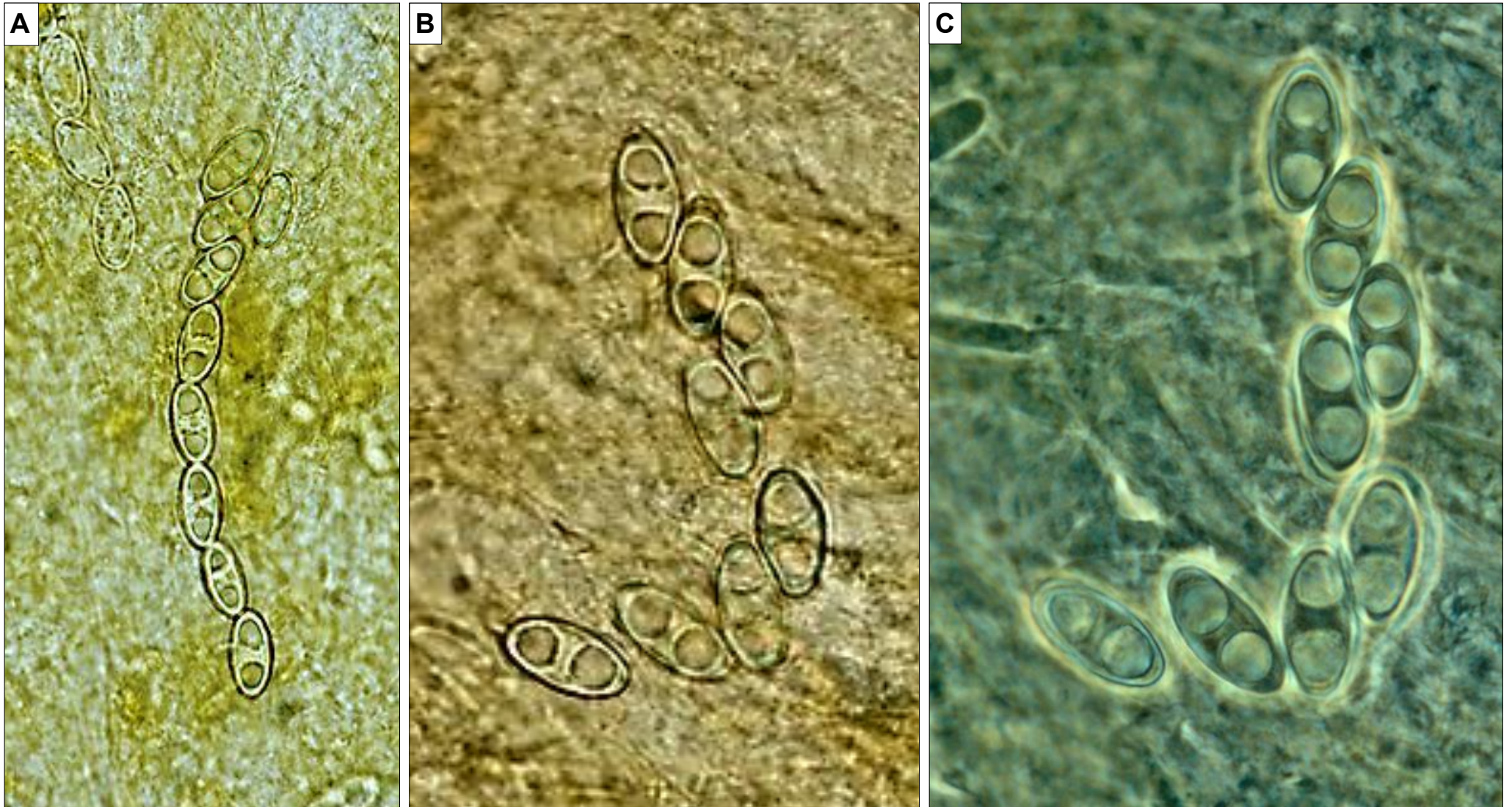
AEB 773. *Sphaeronaemella helvellae* on *Gyromitra infula* cap hymenium. Photos using Ann's 9 September 2002 aniline blue lactic acid slide rejuvenated with SMF on 10 April 2022. Both brightfield: left X20 objective; right X40 obj. & close-up of X20 left-side ascoma venter. That ascoma with venter 125 μm diam, neck 250 μm long with base 25 μm wide & apex (just below the spreading setose crown) 5 μm wide. Note the large hyphae (arrowed) attaching the *S. helvellae* venter to *G. infula* and the obvious ascospores of *G. infula* nearby.



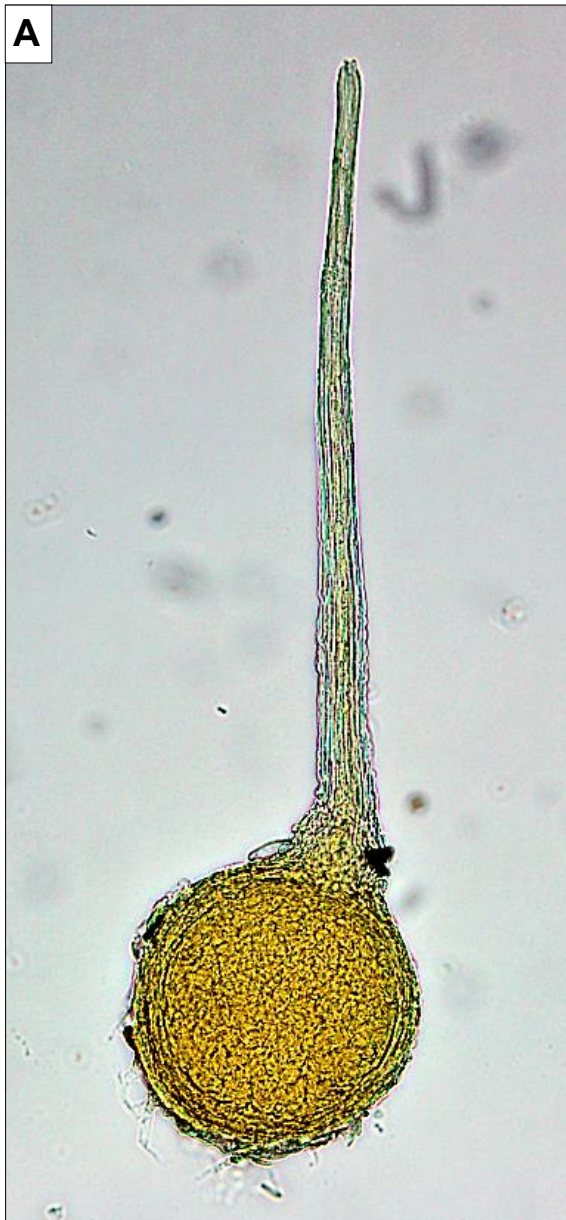
AEB 773. A *Sphaeronaemella helvellae* ascoma detached from its *Gyromitra infula* substrate. Photo using Ann's 9 September 2002 aniline blue lactic acid slide rejuvenated with SMF on 10 April 2022. Both phase: left X20 objective, venter 140 μm diam, neck 460 μm long with base 25 μm wide & apex (just below the spreading setose crown) 5 μm wide; right X40 obj. & close-up of X20 ascoma upper neck & setose crown. In the right photo note the area of small ascospores (solid arrows) of *S. helvellae* and the larger ascospores (dotted arrows) of *G. infula*.



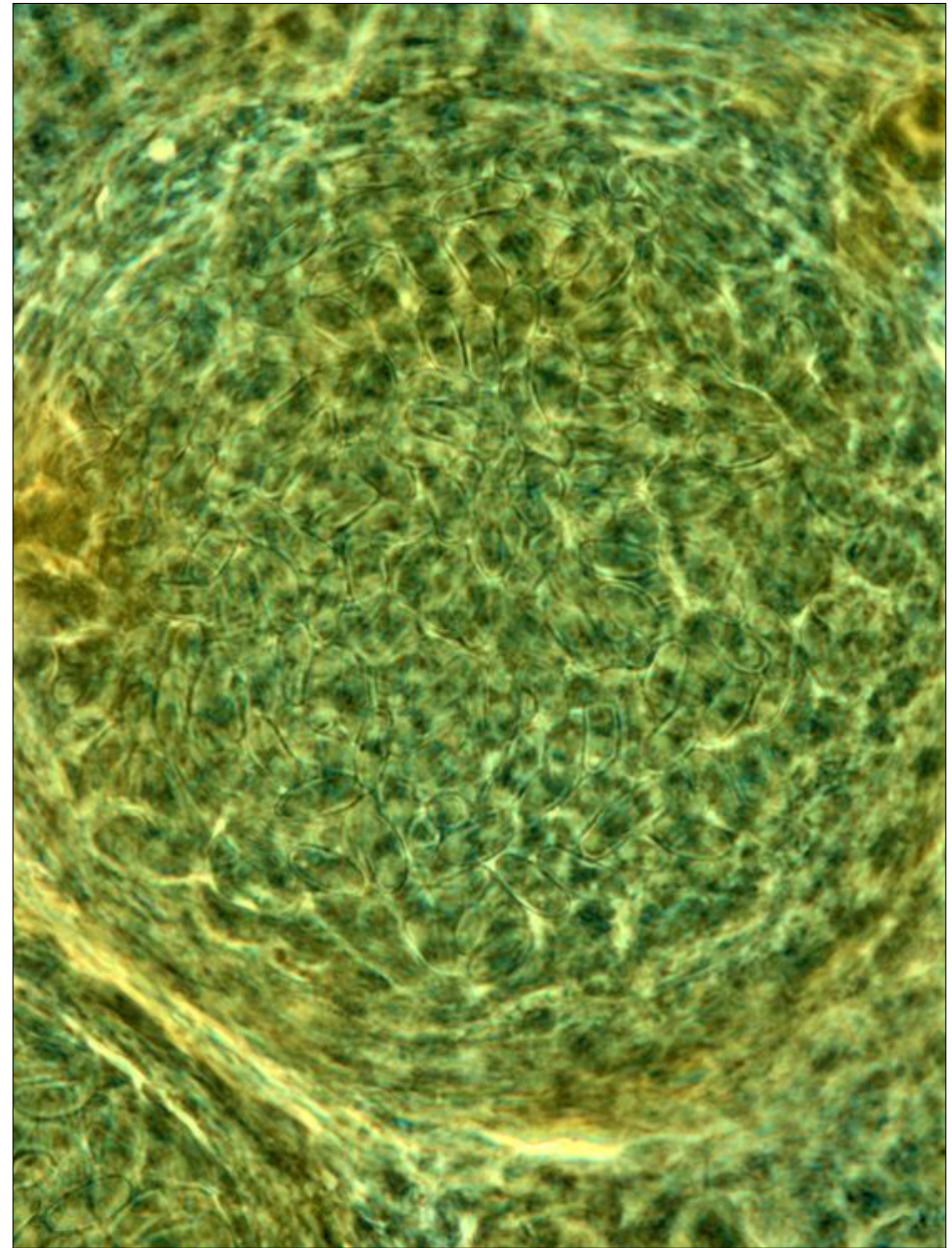
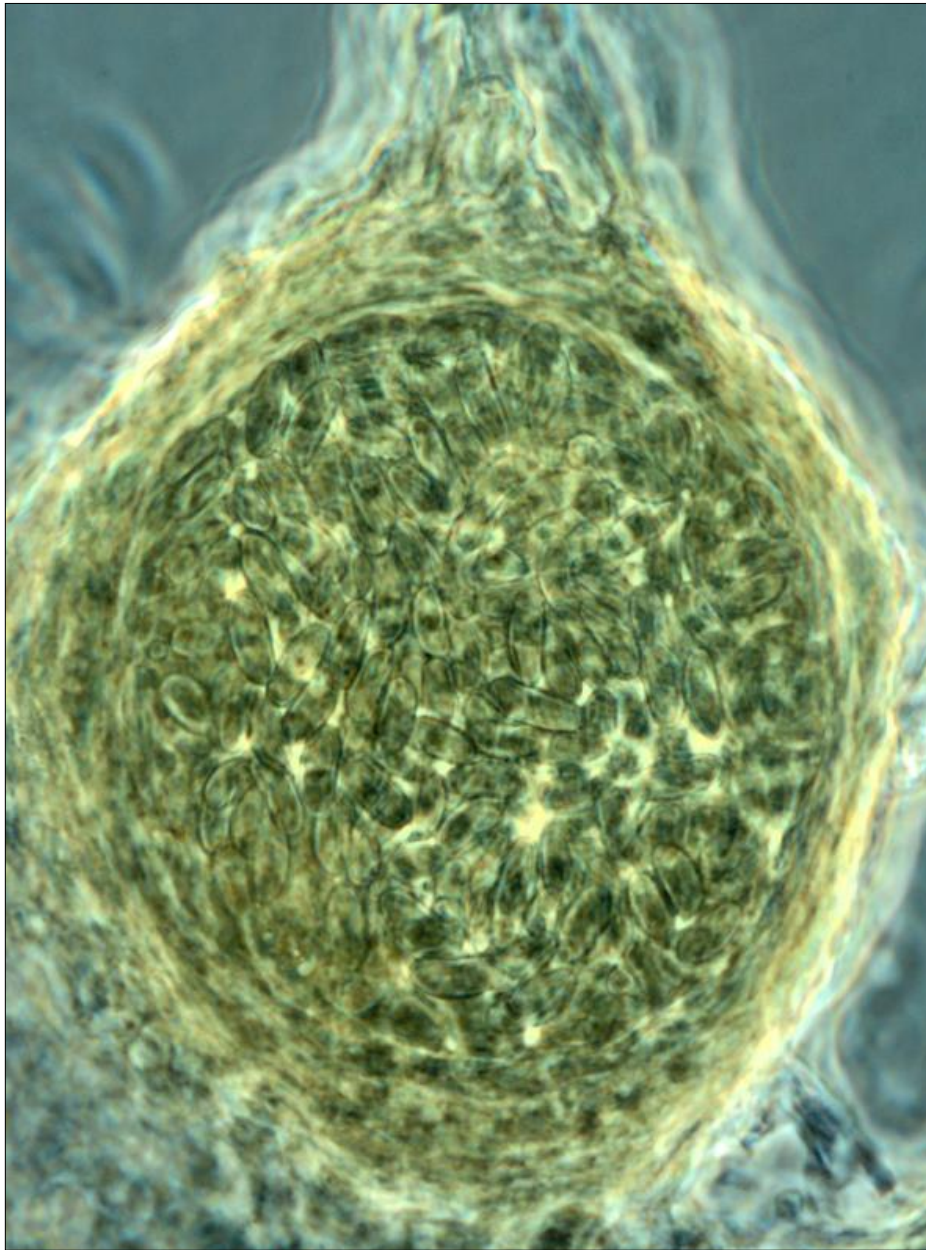
AEB 773. A sectioned view (somewhat squashed) of the fresh 2002 *Gyromitra infula* cap with emphasis on its hymenial surface showing one fertile ascus there and 2 more displaced (see arrows). Of particular interest, however, is the venter portion of an attached *Sphaeronaemella helvellae* ascoma (upper right). Photo from an original slide rejuvenated with SMF using the X20 objective and brightfield microscopy.



AEB 773. A–C. *Gyromitra infula* mature asci from the previous page. A. Left-hand arrowed ascus, previous page. Photo X40 objective, brightfield. B,C. Same ascus, the re-oriented middle-arrowed ascus from the previous page. B. X40 obj. enlarged, brightfield. C. X100 obj., phase. Ascospores 19–20 × 10 μm (n=16). Note the large vacuoles.



AEB 773. A–C. *Sphaeronaemella helvella* ascomata. A,B. X20 objective, brightfield. A. Venter 140 μm diam; neck 390 μm long, base 25 μm wide, apex 10 μm wide. B. Venter 130 μm diam; neck 350 μm long including apical setae. C. X40 obj., brightfield; venter 130 μm diam; neck 225 μm long, base 25 μm wide, apex 8 μm wide.



AEB 773. Two different *Sphaeronaemella helvellae* ascomata venters with ascospores visible inside. Although some ascospores were clustered, no clear asci were visible. Both photos X100 objective using phase microscopy.



AEB 773. *Sphaeronaemella helvellae* ascospores. All X100 objectives using phase microscopy. Ascospores mostly 8–11 × 3.5–6 μm.