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The genera *Aniptodera*, *Halosarpheia*, *Nais* and *Phaeonectriella* from freshwater habitats

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The generic concepts in *Aniptodera*, *Halosarpheia*, *Nais* and *Phaeonectriella* are discussed and those species occurring in freshwater are described, some with illustrations. Five new species: *Aniptodera lignicola*, *A. mauritaniensis*, *A. megalospora*, *A. palmicola*, *Phaeonectriella appendiculata* are also described. A key to the freshwater species in the above genera and a synoptic diagram of their ascospores are provided.

Key Words——freshwater fungi; Halosphaeriaceae; taxonomy; tropics.

Since 1990, the senior author has been investigating fungi occurring on submerged wood in tropical freshwater streams and during this time he has collected many species in the genera *Aniptodera* Shearer et M. A. Mill., *Halosarpheia* Kohlm. et E. Kohlm., *Nais* Kohlm. and *Phaeonectriella* R. A. Eaton et E. B. G. Jones. Some of these correspond to previously described species, while *Aniptodera lignatilis* K. D. Hyde, *Halosarpheia aquatica* K. D. Hyde, *H. heteroguttulata* S. W. Wong, K. D. Hyde et E. B. G. Jones and *Nais aquatica* K. D. Hyde have been described as new (Hyde, 1992a, b, c; Wong et al., 1998). We also have several collections of these fungi that do not correspond to previously described species. These fungi are, therefore, treated below, including descriptions of four new species of *Aniptodera*, and one new species of *Phaeonectriella*.

When described *Aniptodera* and *Halosarpheia* were considered to be discrete genera (Shearer and Miller, 1977; Kohlmeyer and Kohlmeyer, 1979; Shearer, 1989). *Halosarpheia* is typified by *H. fibrosa* Kohlm. et E. Kohlm. (Kohlmeyer and Kohlmeyer, 1977), while *Aniptodera* is typified by *A. chesapeakensis* Shearer et M. A. Mill. (Shearer and Miller, 1977). Briefly, in *Halosarpheia* ascomata were brown to black, while the persistent asci were thick-walled below the apex, lacking any ring structures, and there was no retraction of the plasmalemma behind the apex (Kohlmeyer and Kohlmeyer, 1979). In *Aniptodera* ascomata were hyaline to light brown, while the persistent asci were thick-walled and refractive at the apex, and provided with a simple pore. Retraction of the plasmalemma also occurred behind the apex (Shearer and Miller, 1977; Kohlmeyer and Kohlmeyer, 1979). Ascospores in both *H. fibrosa* and *A. chesapeakensis* were ellipsoidal, hyaline and two-celled, although with relatively thick walls in the latter species. Bipolar filamentous appendages were found in *H. fibrosa*, but these were reported as absent in the original description of *A. chesapeakensis*. Ascospore appendages were, however, reported in subsequent collections (Shearer and Crane, 1980; Koch, 1982; Farrant, 1986; Shearer, 1989). The presence or absence of appendages is, therefore, not a reliable criterion for the delineation of genera, especially as some are ephemeral.

Successive additions to *Aniptodera* and *Halosarpheia*, some of which are discussed below, have blurred the distinctions between these genera. Shearer and Crane (1980) amended *Halosarpheia* to include hyaline or dark ascomata, and asci that are persistent or deliquescent before or at maturity. They described *H. cincinnatula* Shearer et J. L. Crane and *H. retorquens* Shearer et J. L. Crane and transferred three other species (viz. *H. spartinae* (E. B. G. Jones) Shearer et J. L. Crane, *H. viscidula* (Kohlm.) Shearer et J. L. Crane and *H. viscosa* (I. Schmidt) Shearer et J. L. Crane). In two further additions to *Halosarpheia* (viz. *H. ratnagiriensis* S. D. Patil et Borse and *H. marina* (Cribb et J. Cribb) Kohlm.) the asci were provided with a thickened refractive apex with a simple pore and probable retraction of the cytoplasm below the apex (Patil and Borse, 1982; Kohlmeyer, 1984). In *H. aquadulcis* S. Y. Hsieh, H. S. Chang et E. B. G. Jones (Hsieh et al., 1995) ascomata were light coloured, asci were thickened at the apex with a simple pore and retraction of the cytoplasm below the apex and ascospores were provided with bipolar filamentous appendages.

In discussing *Aniptodera* species, Shearer (1989) described three new species, *A. fusiformis* Shearer, *A. limnetica* Shearer and *A. margarition* Shearer. All had hyaline ascomata and relatively thick-walled ascospores lacking appendages. Asci were thin-walled, deliquescent and provided with an apical pore and cytoplasm retracted below the ascus apex, except in *A. margarition*. In *A. mangrovei* K. D. Hyde (Hyde et al.,1986) ascomata were brown to black, asci had a thickened apex and a simple pore, but lacked retraction of the cytoplasm below the apex. In *A. lignatilis* K. D. Hyde (1992a) ascomata

were light-coloured, asci had a thickened apex with a simple pore and the cytoplasm was retracted behind the apex. In both *A. lignatilis* and *A. mangrovei* the ascospores had well-developed polar filamentous appendages.

There are many other additions to both of these genera, but one can gather from the above that the delineation between these genera is confused. The only rule that seems to have stood time, is that if it has relatively thick-walled ascospores and/or appendages are lacking, then it is an *Aniptodera*. If the asci lack a simple pore and deliquesce early then it is a *Halosarpheia*. Both Volkmann-Kohlmeyer and Kohlmeyer (1994) and Jones (1995) are of the opinion that *Aniptodera* should be for species with thick-walled hyaline ascospores lacking polar appendages. Unfortunately, this narrow sense of *Aniptodera* would exclude species such as *A. palmicola* K. D. Hyde, W. H. Ho et K. M. Tsui, described in this paper, on the base of a single character, the poorly developed appendage.

Phaeonectriella was described from test blocks exposed in a number of water cooling towers by Eaton and Jones (1970). New material became available from Taiwan and Jones (1995) discussed and re-illustrated the species. *Phaeonectriella lignicola* R. A. Eaton et E. B. G. Jones was considered to be similar to species of *Aniptodera*, the genera differing only in the former having brown ascospores lacking polar appendages. Three collections of *Phaeonectriella* from Mauritius, Philippines and South Africa discussed in this paper have polar appendages and therefore the only difference between *Phaeonectriella* and *Aniptodera* is ascospore pigmentation. Perhaps these genera should also be placed in synonymy.

It would be possible at this stage to discuss the merits of each of the characters delineating these genera and suggest strict guidelines based on the type species. This would mean transferring several species and possibly introducing new genera. We feel that this would be counter productive at this stage. We therefore prefer, to conclude that these genera are in disarray and await the outcome of molecular studies in progress, which may shed some light on this tangled group.

In describing species in this group occurring on wood submerged in freshwater, we need, however, to have guidelines as to the differences between *Aniptodera*, *Halosarpheia* and *Phaeonectriella*. We have, therefore, followed as closely as possible, the concept for *Aniptodera* in the sense of Shearer (1989). In *Aniptodera* we consider ascomata to be mostly light-coloured, asci to be persistent with a refractive apical thickening and a simple pore, with retraction of the plasmalemma below the apex, and ascospores to be relatively thick-walled with or without appendages and hyaline. In *Halosarpheia* we consider that the ascomata should be mostly dark-coloured, the asci should deliquesce early and lack a pore at the apex, and lack retraction of the cytoplasm below the apex, while ascospores are relatively thin-walled, always appendaged and hyaline. In *Phaeonectriella* we consider the ascomata to be light-coloured, asci to be persistent with a refractive apical thickening and a simple pore, with retraction of the plasmalemma below the apex, and ascospores to be relatively thin-walled, brown and with or without appendages. Some species do not conform to any of these genera and therefore we have used our judgement to place them in one genus or another.

The genus *Nais* Kohlm. is also similar and is included here for comparison. In *Nais inornata* Kohlm., the ascomata are black and the neck is hyaline or sub-hyaline, asci are deliquescent at maturity and ascospores are typical of *Halosarpheia* except that they lack appendages and have a refractive band of inner wall ornamentation at the polar regions and arround the septum (Shearer and Crane, 1978).

Halosarpheia viscosa, *H. retorquens* and *Nais inornata* are marine species that have also been reported from freshwater habitats and are therefore included below.

Key to *Aniptodera*, *Halosarpheia*, *Nais* and *Phaeonectriella* species from freshwater

1. Ascospores lacking appendages 2
1. Ascospores with polar appendages 8

2. Ascospores relatively thick-walled (greater than 1 μm thick) 3
2. Ascospores relatively thin-walled (less than 1 μm thick) 6

3. Ascospores fusiform, mostly longer than 24 μm 4
3. Ascospores ellipsoidal, mostly shorter than 24 μm 5

4. Ascospores 21-37 × 7-15 μm, with rounded ends ..... *Aniptodera chesapeakensis*
4. Ascospores 19-28 × 8-12 μm, with acute ends ..... *Aniptodera fusiformis*

5. Ascospores 18-24 × 8-11 μm, ellipsoid, frequently allantoid ..... *Aniptodera limnetica*
5. Ascospores 15-24 × 9-13 μm, broadly to oblong ellipsoid ..... *Aniptodera margarition*

6. Ascospores more than 21 μm long, some with an equatorial band of refringent globules 7
6. Ascospores less than 21 μm long, without an equatorial band of refringent globules ..... *Aniptodera lignicola*

7. Ascospores less than 32 μm long ..... *Nais inornata*
7. Ascospores longer than 32 μm ..... *Nais aquatica*

8. Ascospores relatively thick-walled (greater than 1 μm thick) 9
8. Ascospores relatively thin-walled (less than 1 μm thick) 14

9. Ascospores mostly longer than 35 μm 10
9. Ascospores mostly less than 35 μm long 13

10. Ascospores lacking a distinct polar pore, appendages well-developed and persistent 11
10. Ascospores with fine ephemeral appendages extruded through a polar pore 12

11. Ascospores less than 55 μm long, 35–55 × 11.5–17 μm ..... *Aniptodera lignatilis*
11. Ascospores longer than 55 μm, 55–82 × 10–12 μm ..... *Aniptodera megalospora*

12. Ascospores less than 16 μm wide ..... *Aniptodera palmicola*
12. Ascospores wider than 16 μm ..... *Aniptodera inflatiascigera*

13. Ascospores with a mean length/width ratio of 2.3, 22–26 × 11–13 μm ..... *Aniptodera mauritaniensis*
13. Ascospores with a mean length/width ratio of 3, 21–37 × 7–15 μm ..... *Aniptodera chesapeakensis*
13. Ascospores with a mean length/width ratio of 3.8, 27–37 × 7.5–10 μm ..... *Halosarpheia aquadulcis*

14. Ascospores hyaline at maturity with rounded ends 15
14. Ascospores light brown at maturity with acute ends 19

15. Ascospores mostly longer than 33 μm, 33.5–64 × 7–10 μm ..... *Halosarpheia aquatica*
15. Ascospores mostly less than 33 μm long 16

16. Basal cell of ascospore containing numerous small oil globules ..... *Halosarpheia heteroguttulata*
16. Both cells of ascospore containing one or two large lipid globules 17

17. Ascospores mostly less than 25 μm long, 19–27 × 7.5–9.5 μm ..... *Halosarpheia viscosa*
17. Ascospores mostly longer than 25 μm 18

18. Ascospores mostly less than 10 μm wide, 20.5–33.5 × 7–10.8 μm ..... *Halosarpheia retorquens*
18. Ascospores mostly wider than 10 μm, 26.5–38.5 × 9.5–14.5 μm ..... *Halosarpheia lotica*

19. Ascospores longer than 30 μm, 32-42 × 10-12 μm ..... *Phaeonectriella appendiculata*
19. Ascospores less than 30 μm long, 26-30 × 9.5-11 μm ..... *Phaeonectriella lignicola*

Aniptodera, Halosarpheia, Nais and _Phaeonectriella_ species from freshwater

Aniptodera chesapeakensis Shearer et M. A. Mill., Mycologia **69**: 894. 1977. Figs. 1–10

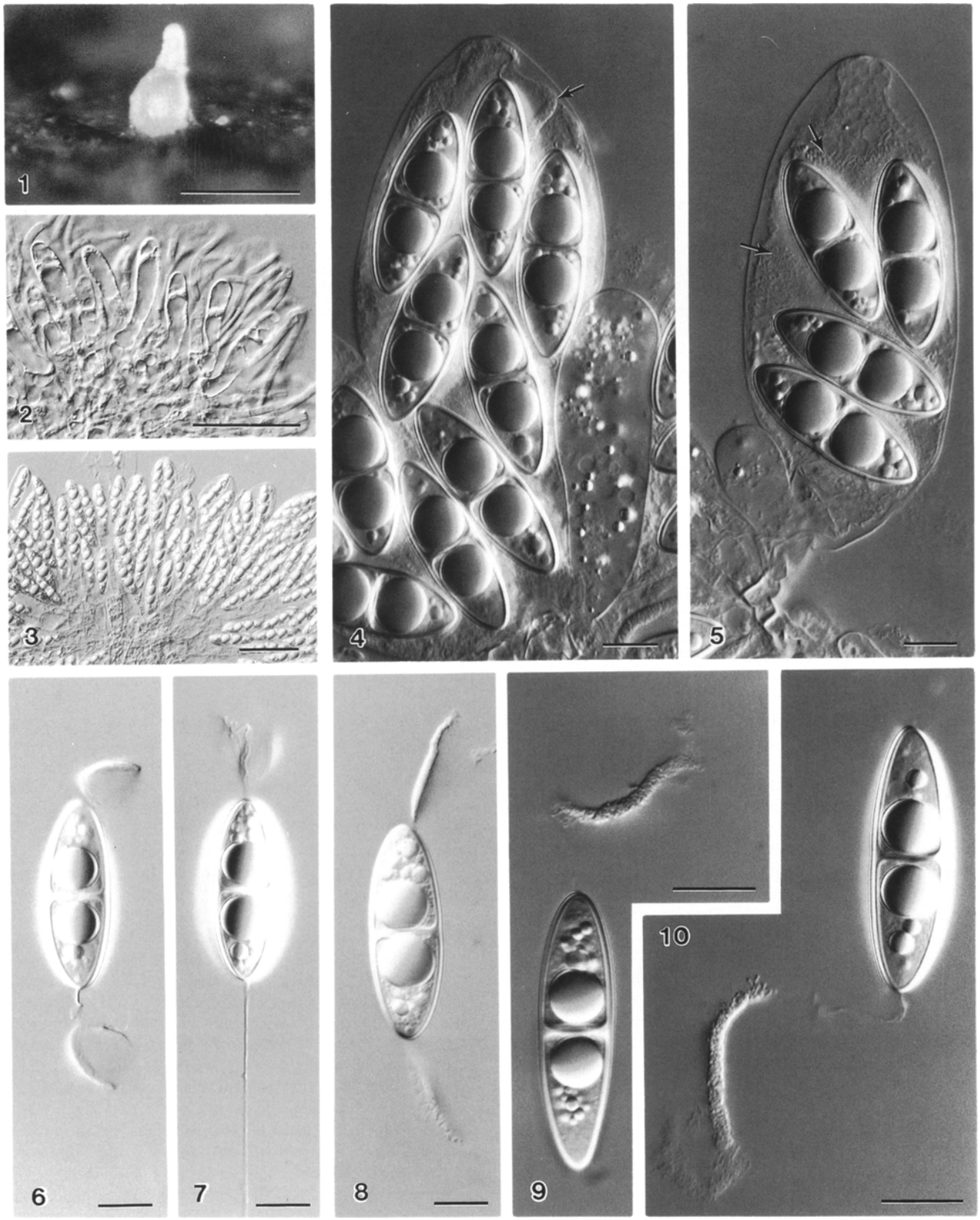
Illustrations: Shearer and Miller, 1977; Shearer and Crane, 1980; Farrant, 1986; Shearer, 1989.

Ascomata 130–325 μm in diam, globose to subglobose, partly immersed or superficial, hyaline to greyish brown, membraneous, ostiolate, periphysate (Fig. 1). Peridium of textura angularis. Catenophyses present (Fig. 3). Asci 64–116 × 14–38 μm, 8-spored, clavate, pedicellate, thin-walled, apically rounded and slightly thickened, with apical pore and cytoplasm retracted below the ascus apex, deliquescent at maturity (Figs. 2–5). Ascospores 21–37 × 7–15 μm, hyaline, ellipsoidal to fusiform, bicelled, not constricted at the septum, relatively thick-walled, lacking bipolar filamentous appendages. Appendages were reported in later collections (Figs. 6–10).

Habitat: Saprobic on submerged woody material.

Distribution: This appears to be a cosmopolitan species.

Materials examined: Australia, north Queensland, Crystal Cascades, on submerged wood, 28 Apr. 1996, K. D. and T. M. Hyde CC53 (HKU(M) 2787); near Ravenshoe, ca. 20 km along the Tully Falls Rd to Koombooloba Dam, small river, Mar. 1997, K. D. Hyde and C. Pearce RH21 (HKU(M) 5122); ibid., (HKU(M) 5149); ibid., (HKU(M) 5167); Brunei, Temburong, Sungai Sitam, on submerged wood, 24 Oct. 1995, W. H. Ho and K. D. Hyde (HKU(M) 2930); Hong Kong, New Territories, Plover Cove Reservoir, on submerged wood, K. D. Hyde and M. Wong PC25 (HKU(M) 3339); Tai Po Kau Forest Stream, on submerged wood, 10 Dec. 1995, W. H. Ho (HKU(M) 2947); ibid., 29 Mar. 1977 (HKU(M) 6070); (There are more than 100 collections in Hong Kong); Malaysia, Kuala Lumpur, State Negara, Lipur Lentang Nature reserve, on submerged wood, 24 Oct. 1995, K. D. Hyde (HKU(M) 2899); Mauritius, near Tamarin,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Black River, on submerged wood, Aug. 1995, K. D. Hyde and A. Poonyth MAUR50 (HKU(M) 2421); South Africa, Durban, Palmiet River, on submerged wood, Nov. 1994, K. D. Hyde and T. Steinke SAPR5 (HKU(M) 2205); Hong Kong, Tai Po, Lam Tsuen River, on submerged wood, 28 Sep. 1996, K. M. Tsui KM61 (HKU(M) 4621); Hong Kong, Lantau Island, Tung Chung River, on submerged wood, 28 Jul. 1997, K. M. Tsui KM61 (HKU(M) 8036).

Aniptodera fusiformis Shearer, Mycologia **81**: 140. 1989.

Illustrations: Shearer, 1989.

Ascomata 75–139 μm in diam, globose, partly immersed or superficial, hyaline, membraneous, ostiolate, periphysate. Peridium of textura angularis. Catenophyses present. Asci 35–60 × 19–35 μm, 8-spored, subglobose, thin-walled, apically rounded and possibly slightly thickened, with an apical pore, and cytoplasm retracted below the ascus apex, deliquescent. Ascospores 19–28 × 8–12 μm, hyaline, fusiform, bicelled, not constricted at the septum, relatively thick-walled.

Habitat: Saprobic on submerged woody material.

Distribution: USA (Illinois).

This description is modified from Shearer (1989).

Aniptodera inflatiascigera K. M. Tsui, K. D. Hyde et I. J. Hodgkiss, Sydowia **49**: 187–192. 1997.

Illustrations: Tsui, Hyde and Hodgkiss, 1997.

Ascomata 160–300 μm in diam, globose, subglobose or pyriform, partly immersed or superficial, hyaline to greyish brown, membraneous, ostiolate, periphysate, neck yellowish. Peridium composed of an outer layer of textura angularis and an inner layer of compressed cells. Catenophyses present. Asci 135–200 × 50–87 μm, 8-spored, clavate, becoming balloon-shaped or swollen, pedicellate, thin-walled, apically rounded, with apical thickening, pore not observed, and cytoplasm retracted below the ascus apex, somewhat persistent. Ascospores 32–46 × 15–22 μm, hyaline, ellipsoidal, bicelled, not constricted at the septum, relatively thick-walled (2–3 μm thick), usually lacking appendages, occasionally with delicate appendages released from the pores at the ascospore tips.

Habitat: Saprobic on submerged woody material.

Distribution: Hong Kong, Philippines.

Materials examined: Hong Kong, New Territories, Tai Po, Lam Tsuen River, on submerged wood, 27 Nov. 1996, K. M. Tsui KM127 (HKU(M) 4682); ibid., (HKU(M) 4684); Philippines, Negros Occidental, Bario Alagria, Lot 1320, Lupit River, on submerged wood, 27 Apr. 1997, K. D. Hyde, V. L. and L. Arimas (HKU(M) 5176); ibid., (HKU(M) 5179).

Aniptodera lignatilis K. D. Hyde, Aust. Syst. Bot. **5**: 111. 1992. Figs. 11–22

Illustrations: Hyde, 1992a.

Ascomata 160–400 μm in diam, globose, subglobose or occasionally pyriform, immersed, partly immersed or superficial, hyaline to cream coloured, membraneous, ostiolate, periphysate. Peridium of textura angularis (Figs. 11, 12). Catenophyses present (Fig. 15). Asci 128–171 × 28–39.5 μm, 8-spored, clavate, pedicellate, thin-walled, apically rounded or truncate and thickened, with an apical pore and cytoplasm usually retracted below the ascus apex, persistent (Figs. 13, 14). Ascospores 35–55 × 11.5–17 μm, hyaline, fusiform, bicelled, not constricted at the septum, relatively thick-walled, with well developed bipolar filamentous appendages (Figs. 16–22).

Habitat: Saprobic on submerged woody material.

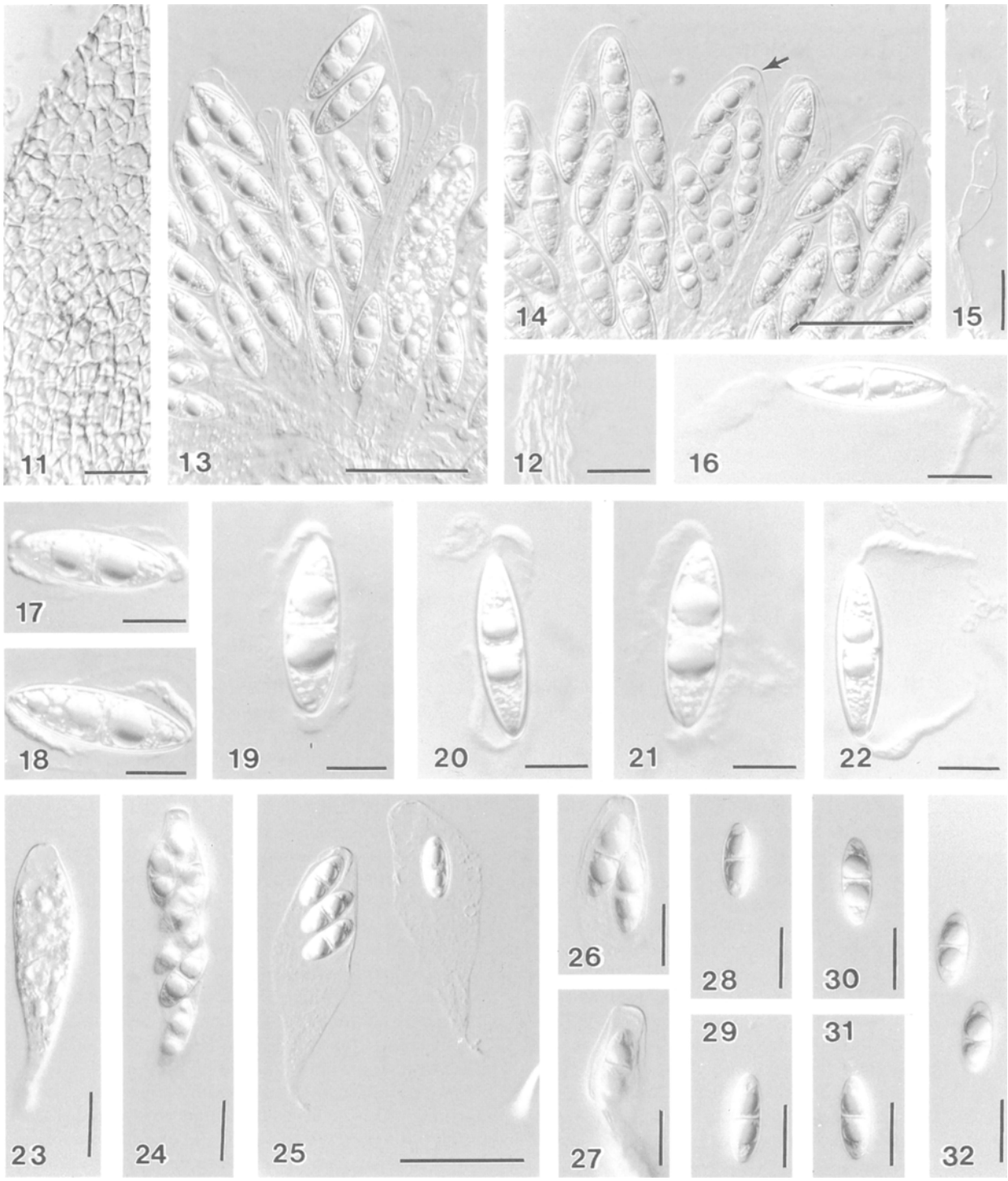
Distribution: Australia, Hong Kong, Mauritius, Philippines, Seychelles, South Africa.

Materials examined: Australia, north Queensland, Millaa Millaa Falls, on submerged wood, 1 Jan. 1990, K. D. Hyde (BRIP 17156, holotype); Clohesy River, on submerged wood, June 1991, K. D. and T. M. Hyde CC15 (HKU(M) 3232); Hong Kong, Tai Po Kau Forest Stream, on submerged wood, 27 June 1996, K. D. Hyde (HKU(M) 4534); ibid., 21 Sep. 1996, W. H. Ho and K. M. Tsui (HKU(M) 4596); ibid., 29 Dec. 1996, W. H. Ho and S. Y. Ho (HKU(M) 5908); ibid., (HKU(M) 5927); ibid., (HKU(M) 5949); Tai Po, Lam Tsuen River, on submerged wood, 25 Mar. 1997, K. M. Tsui KM 144 (HKU(M) 5434); ibid., (HKU(M) 5460); Mauritius, near Tamarin, Black River, on submerged wood, Aug. 1995, K. D. Hyde and A. Poonyth MAUR11 (HKU(M) 2389); Philippines, Luzon, Laguna, Los Baños, Mt Maquiling, on wood submerged in a freshwater stream, Sep. 1995, K. D. Hyde and T. Umali PHIL1 (HKU(M) 2552); Seychelles, Mahe, Riveire St Mare Louise, on submerged wood, Aug. 1996, K. D. Hyde and V. Arimas SEY14 (HKU(M) 3163); South Africa, Durban, Palmiet River, on submerged wood, Nov. 1994, K. D. Hyde and T. Steinke SAPR62 (HKU(M) 2223); ibid., SAPR66 (HKU(M) 2224).

Aniptodera lignatilis differs from *A. chesapeakensis* as its ascospores are larger and the ascospore appendages are well developed (Figs. 16–22). The ascus apical pore is distinct and the cytoplasm is retracted below the ascus apex in the type (Figs. 13, 14). This also occurs in *A. chesapeakensis* (Figs. 4, 5). In the collections from Mauritius, Philippines and South Africa the retraction of the plasmalemma below the ascus apex was not clear, although the pore was distinct. The ascospore shape and the well developed appendages were, however, similar. It may be that these are different species, but many more collections are required to confirm this.

Figs. 1–10. *Aniptodera chesapeakensis* (from HKU(M) 6134).

1. Hyaline ascoma on wood. 2. Squash of ascomatal contents illustrating immature asci and catenophyses. 3. Squash of ascomatal contents illustrating mature asci. Note that the catenophyses have deliquesced. 4. A mature and an immature ascus. Note the appendages of ascospores (arrowed). 5. Ascus with ascospores discharged. Note the appendages of the ascospores remaining in the ascus have unfurled (arrowed). 6–10. Ascospores with appendages unfurling at different degree. Scale bars: 1 = 500 μm; 2 = 20 μm; 3 = 50 μm; 4–10 = 10 μm.



Figs. 11–22. *Aniptodera lignatilis* (from holotype).
11. Hyaline peridium of ascoma. 12. Section through peridium. 13, 14. Squash of ascomatal contents illustrating mature asci. Note the thickened truncate apex with a pore (arrowed in Fig. 14). 15. Catenophyses. 16–22. Ascospores with appendages unfurling at different degree.
Figs. 23–32. *Aniptodera lignicola* (from holotype).
23–27. Asci. 28–32. Ascospores.
Scale bars: 11, 12, 15, 16, 26, 27 = 20 μm; 13, 14, 25 = 40 μm; 17–24, 28–32 = 15 μm.

Aniptodera lignicola K. D. Hyde, W. H. Ho et K. M. Tsui, sp. nov. Figs. 23–32

Ascomata 160–240 μm diam, globosa vel subglobosa, immersa vel superficialia, hyalina, nigra ad maturitatem, membranacea, ostiolata, papillata, periphysata, catenophysata. Asci 50–64 × 14–18.5 μm, 8-spori, cylindrici vel clavati, pedicellati, apparatu apicali praediti, persistentes. Ascosporae 16–21.5(–26) × 6.5–7.5(–8) μm, hyalinae, ellipsoideae, bicellulares.

Etymology: From *Lignum* and *cola*, in reference to the habitat on wood.

Ascomata 160–240 μm in diam, globose to subglobose, partly immersed or superficial, hyaline, becoming black at maturity, membraneous, ostiolate, papillate, periphysate. Peridium of compressed cells. Catenophyses present. Asci 50–64 × 14–18.5 μm, 8-spored, cylindrical to clavate, pedicellate, thin-walled, apically truncate and thickened, with an apical pore and cytoplasm retracted below the ascus apex, persistent (Figs. 23–27). Ascospores 16–21.5(–26) × 6.5–7.5(–8) μm, hyaline, ellipsoidal, bicelled, not constricted at the septum, relatively thin-walled (< 1 μm thick) (Figs. 28–32).

Habitat: Saprobic on submerged woody material.

Distribution: Australia, Brunei, Malaysia, Philippines.

Materials examined: Australia, Crystal Cascades, on submerged wood, 28 Apr. 1996, K. D. and T. M. Hyde CC18 (HKU(M) 2863, holotype); Brunei, Temburong, Kuala Belalong Field Studies Centre, Sungai Esu, on wood submerged in a stream, 28 Jan. 1994, K. D. Hyde SE18 (HKU(M) SE18); ibid., SE36 (HKU(M) 1995); Sungai Sitam, on submerged wood, 24 Oct. 1995, K. D. Hyde and W. H. Ho (HKU(M) 2923); Malaysia, State Negara, Lipur Lentang Nature Reserve, on submerged wood, 7 Sep. 1995, K. D. Hyde (HKU(M) 2879); ibid., (HKU(M) 2882); ibid., (HKU(M) 2886); ibid., (HKU(M) 2888); ibid., (HKU(M) 2890); ibid., (HKU(M) 2893); ibid., (HKU(M) 2899); Philippines, Luzon, Laguna, Los Baños, Mt. Maquiling, on wood submerged in a freshwater stream, Sep. 1995, K. D. Hyde and T. Umali PHIL42 (HKU(M) 2584).

This species is somewhat similar to *A. limnetica*, but differs as ascospores in *A. lignicola* are never allantoid and have thin walls. It is probably a tropical species.

Aniptodera limnetica Shearer, Mycologia **81**: 140. 1989.

Illustrations: Shearer, 1989.

Ascomata 139–208 μm in diam, globose to subglobose, partly immersed or superficial, hyaline, membraneous, ostiolate, periphysate. Peridium of textura angularis. Catenophyses present. Asci 50–70 × 12–17 μm, 8-spored, cylindrical to clavate, pedicellate, thin-walled, with apical pore and cytoplasm retracted below the ascus apex, deliquescent. Ascospores 18–24 × 8–11 μm, hyaline, ellipsoidal, frequently allantoid, bicelled, not constricted at the septum, relatively thick-walled (1.5–3 μm).

Habitat: Saprobic on submerged woody material.

Distribution: USA (Illinois, New York).

This description is modified from Shearer (1989). The apical shape and thickening of the ascus is not mentioned or illustrated, and may not have been observed since asci deliquesce early.

Aniptodera margarition Shearer, Mycologia **81**: 142. 1989.

Illustrations: Shearer, 1989.

Ascomata 99–218 μm in diam, globose, partly immersed or superficial, hyaline, membraneous, ostiolate, periphysate. Peridium of textura angularis. Catenophyses present. Asci 48–70 × 19–35 μm, 8-spored, obovoid to pyriform, thin-walled, apically rounded, without an apical thickening, pore or retraction of the plasmalemma below the apex, deliquescent. Ascospores 15–22(–24) × 9–13 μm, hyaline, broadly ellipsoidal to oblong ellipsoidal, bicelled, not constricted at the septum, relatively thick-walled (1.5–3 μm).

Habitat: Saprobic on submerged woody material

Distribution: UK (Cornwall), USA (Illinois).

This description is modified from Shearer (1989).

Aniptodera mauritaniensis K. D. Hyde, W. H. Ho et K. M. Tsui, sp. nov. Figs. 33–40

Ascomata 170–280 μm diam, globosa, subglobosa, vel ellipsoidea, immersa vel semi-immersa, hyalina vel cinerea, membranacea, ostiolata, papillata, periphysata. Asci 80–95 × 22–28 μm, 8-spori, clavati, pedicellati, tenuiparietales, apicale truncati, apparatu apicali praediti. Ascosporae 22–26 × 11–13 μm, hyalinae, ellipsoideae, bicellulares, crassiparietales (1.2–1.8 μm crassae), appendiculatae.

Etymology: In reference to the occurrence of this taxa in Mauritius.

Ascomata 170–280 μm in diam, globose, subglobose or ellipsoidal, immersed or partially immersed, hyaline to greyish, membraneous, ostiolate, papillate, periphysate. Peridium of compressed cells. Catenophyses present. Asci 80–95 × 22–28 μm, 8-spored, clavate, pedicellate, thin-walled, apically truncate and thickened, with an apical pore and cytoplasm retracted below the ascus apex, persistent (Figs. 33, 34). Ascospores 22–26 × 11–13 μm, hyaline, broadly ellipsoidal, bicelled, not constricted at the septum, relatively thick-walled (1.2–1.8 μm thick), with fine appendages extruded through a pore at each end (Figs. 35–40).

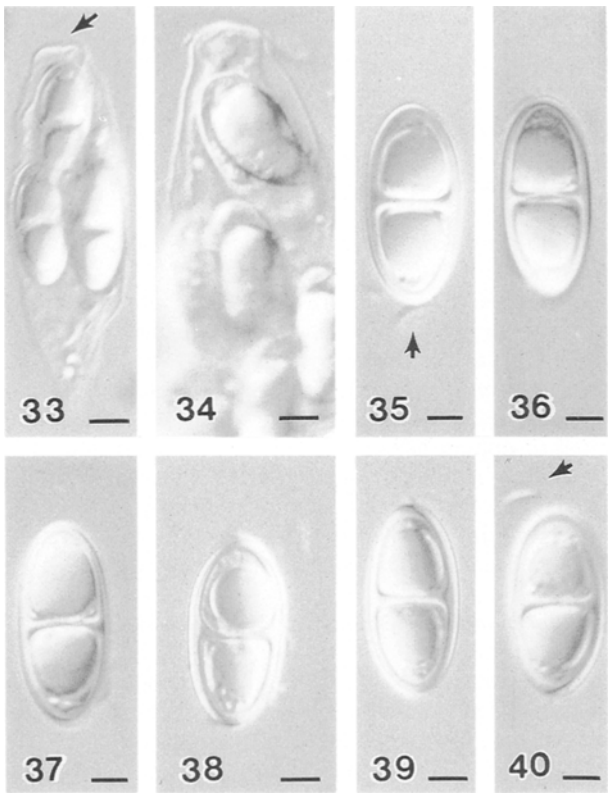
Habitat: Saprobic on submerged woody material.

Distribution: Mauritius.

Material examined: Mauritius, near Tamarin, Black River, on submerged wood, Aug. 1995, K. D. Hyde and A. Poonyth MAUR47 (HKU(M) 2616, holotype).

Aniptodera megalospora K. D. Hyde, W. H. Ho et K. M. Tsui, sp. nov. Figs. 41–55

Ascomata 100–350 μm diam, ellipsoidea vel globosa, immersa, hyalina vel pallide brunnea, membranacea, ostiolata, papillata, periphysata. Asci 120–150 × 37–50 μm, 8-spori, clavati, pedicellati, apparatu apicali praediti, deliquescentes. Ascosporae (42–)55–82 × 10–12(–15) μm, 2-3-seriatae, hyalinae, fusiformes, bicellulares, appendiculatae.



Figs. 33–40. *Aniptodera mauritaniensis* (from holotype). 33, 34. Asci. Note the thickened truncate apex with a pore (arrowed in Fig. 33). 35–40. Ascospores. Note the ephemeral appendages (arrowed in Figs. 35, 40). Scale bars: 33 = 8 μm; 34–40 = 5 μm.

Etymology: in reference to the large ascospores.

Ascomata 100–350 μm in diam, ellipsoidal or globose, immersed or partly immersed, hyaline to pale brown, membraneous, ostiolate, periphysate, with neck at one end and curving upwards (Figs. 41, 42). Peridium up to 10 μm wide, comprising a few layers of compressed cells (Fig. 43). Catenophyses present (Fig. 44). Asci 120–150 × 37–50 μm, 8-spored, clavate, pedicellate, thin-walled, apically rounded and indistinctly thickened, apical pore not seen, with retraction of the plasmalemma below the apex, deliquescent (Fig. 45). Ascospores (42–)55–82 × 10–12(–15) μm, 2-3-seriate, hyaline, cylindric-fusiform, bicelled, not constricted at the septum, relatively thick-walled (1.5 μm thick), with polar appendages (Figs. 46–55).

Habitat: Saprobic on submerged woody material.

Distribution: Brunei, Hong Kong, Malaysia.

Materials examined: Malaysia, State Negara, Lipur Lentang Nature Reserve, on submerged wood, 7 Sep. 1995, K. D. Hyde M27 (HKU(M) 2885, holotype); Brunei, Temburong, Kuala Belalong Field Studies Centre, Sungai Esu, on wood submerged in a stream, 28 Jan. 1994, K. D. Hyde SEA36 (HKU(M) 1995); Sungai Esu Anak, Jan. 1994, K. D. Hyde SEA13 (HKU(M) 1989); Sungai Sitam, on submerged wood, 24 Oct. 1995, K. D. Hyde and W. H. Ho B14 (HKU(M) 2914); Hong Kong, Tai Po Kau Forest Stream, on submerged *Machilus velutina* baits, 23 June 1996, W. H. Ho H171 (HKU(M) 4841).

Aniptodera megalospora cannot be confused with any other *Aniptodera* species as it has much larger ascospores.

Aniptodera palmicola K. D. Hyde, W. H. Ho et K. M. Tsui, sp. nov. Figs. 56–68

Ascomata 200–350 μm diam, globosa vel subglobosa, immersa vel subimmersa, hyalina vel cinerea, membranacea, ostiolata, papillata, periphysata. Asci 100–140 × 38–60 μm, 8-spori, clavati, pedicellati, tenuiparietales, truncati, apparatu apicali praediti. Ascosporae 34–44 × 14–16 μm, hyalinae, ellipsoideae, bicellulares, crassiparietales (2–2.5 μm crassae), appendiculatae.

Etymology: In reference to the palm habitat.

Ascomata 200–350 μm in diam, globose to subglobose, immersed or partially immersed, hyaline to greyish, membraneous, ostiolate, papillata, periphysate. Peridium of textura angularis (Fig. 56). Catenophyses present. Asci 100–140 × 38–60 μm, 8-spored, clavate, pedicellate, thin-walled, apically truncate and thickened, with an apical pore and cytoplasm retracted below the ascus apex (Figs. 57–60). Ascospores 34–44 × 14–16 μm, hyaline, ellipsoidal, bicelled, not constricted at the septum, relatively thick-walled (2–2.5 μm thick), with fine appendages that appear to be extruded through a pore at each end (Figs. 61–68).

Habitat: Saprobic on submerged *Raphia* (Arecaceae).

Distribution: South Africa.

Material examined: South Africa, Kwa Zulu-Natal, Mt Unzini, The National Monument, on submerged rachis of *Raphia australia*, Nov. 1994, K. D. Hyde and T. Steinke SARA8 (HKU(M) 2205, holotype).

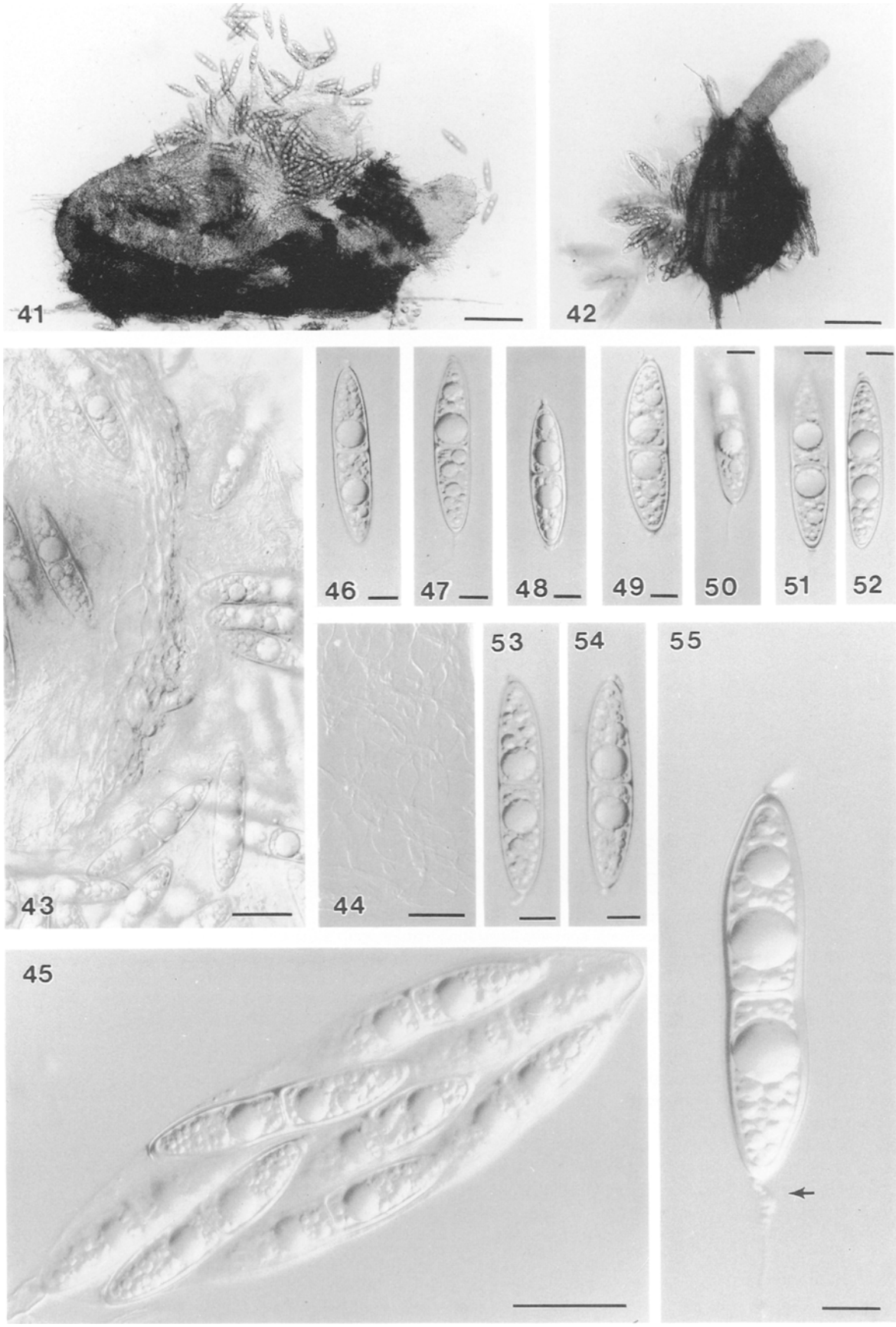
Aniptodera palmicola is most likely to be confused with *A. chesapeakensis*, but differs in having larger, broadly ellipsoidal ascospores with acute ends. In *A. chesapeakensis* ascospores are smaller and ellipsoidal to fusiform, with less acute ends.

Halosarpheia aquadulcis S. Y. Hsieh, H. S. Chang et E. B. G. Jones, Mycol. Res. **99**: 49. 1995. Figs. 69–75

Illustrations: Hsieh et al., 1995.

Ascomata 140–405 μm in diam, globose or subglobose, immersed or superficial, creamy to light brown, membraneous, ostiolate, periphysate, neck elongated (Fig. 59). Peridium of textura angularis. Catenophyses present. Asci 75–130 × 18-32 μm (mean = 93.4 ×

Figs. 41–55. *Aniptodera megalospora* (44, 45, 55, from holotype; 41–43, 46–54, from HKU(M) 1995). 41, 42. Ascomata. 43. Peridium. 44. Catenophyses. 45. Ascus. Note the indistinctly thickened truncate apex. 46–55. Ascospores. Note the thick walls and appendages which are thick and cord-like at the base (arrowed in Fig. 55). Scale bars: 41, 42 = 100 μm; 43 = 20 μm; 44–55 = 10 μm.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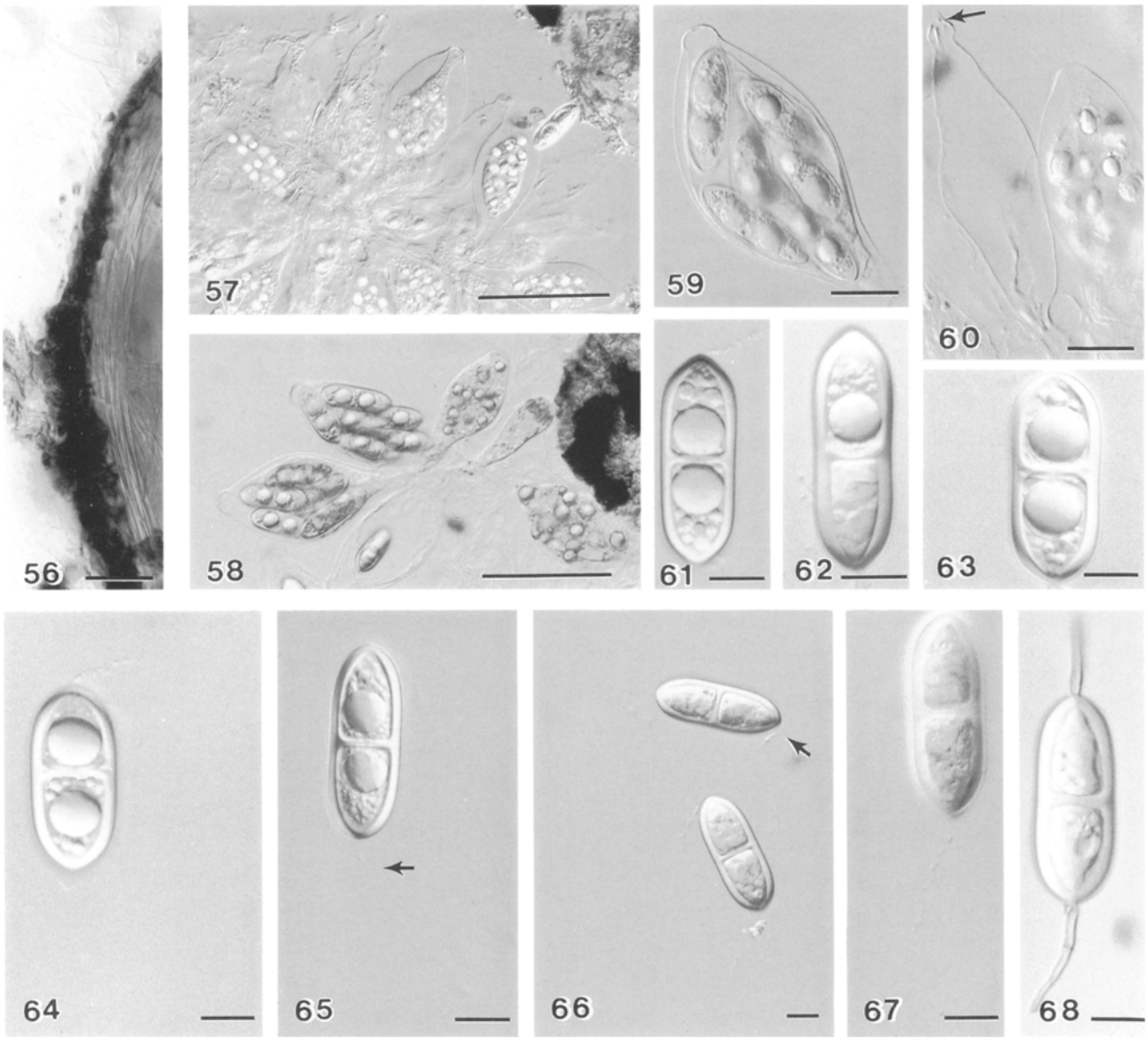


Figs. 56–68. *Aniptodera palmicola* (from holotype).
56. Peridium. 57-59. Squash of ascomatal contents illustrating mature asci. Note the thickened truncate apex with a pore. 60. Ascus which has released its ascospores. Note the break in the ascus where the pore originally occurred (arrowed). 61–67. Ascospores. Note the thick walls and ephemeral polar appendages (arrowed in Figs. 65, 66) which are released through a fine pore. 68. Germinated ascospores. The germ tubes are produced from the pores at the tips of the ascospores. Scale bars: 56 = 20 μm; 57, 58 = 100 μm; 59, 60 = 25 μm; 61–68 = 10 μm.

25.1 μm, n = 25), 8-spored, clavate, pedicellate, thin-walled, apically rounded or truncate and thickened, with an apical pore and cytoplasm retracted below the ascus apex, persistent or semi-persistent (Figs. 70–72). Ascospores 27–37 × 7.5–10 μm (mean = 32.2 × 8.8 μm, n = 40), hyaline, ellipsoidal with acute ends, bicelled, not constricted at the septum, relatively thin-walled, with well developed bipolar filamentous appendages (Figs. 73–75).

Habitat: Saprobic on submerged woody material.

Distribution: Hong Kong, Taiwan.

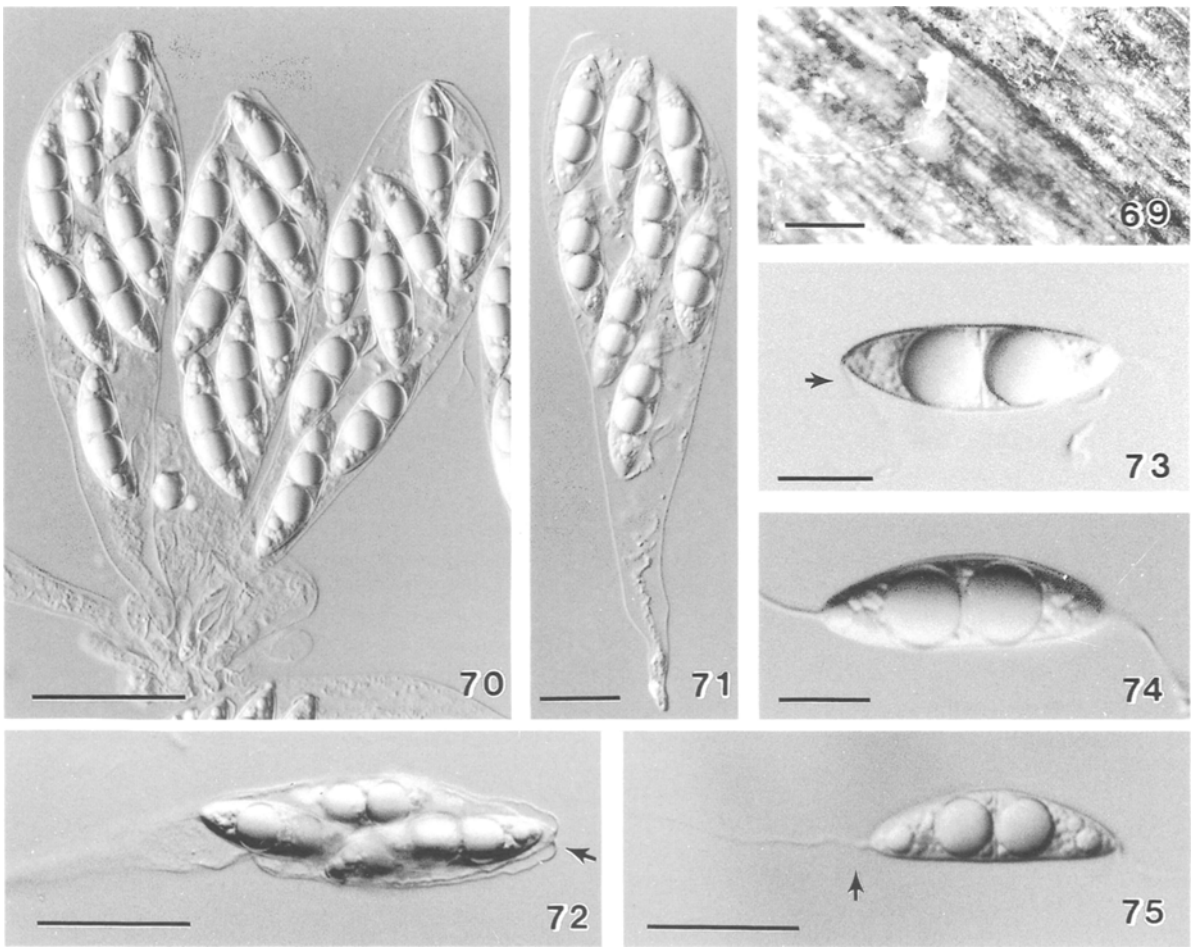
Materials examined: Hong Kong, Tai Po, Lam Tsuen River, on submerged wood, 27 Dec. 1996, K. M. Tsui KM166 (HKU(M) 5365); 22 Jan. 1997, K. M. Tsui KM166 (HKU(M) 5379); ibid., (HKU(M) 5398).

This species is intermediate between *Aniptodera* and *Halosarpheia*.

Halosarpheia aquatica K. D. Hyde, Aust. Syst. Bot. **5**: 407. 1992. Figs. 76–81

Illustrations: Hyde, 1992c.

Ascomata 140–205 μm in diam, subglobose or pyriform, immersed or partly immersed, light brown or brown, membraneous, ostiolate, with a long neck,



Figs. 69–75. *Halosarpheia aquadulcis* (from HKU(M) 5365).
69. Ascoma on host surface. 70–72. Asci. Note the slightly thickened truncate apex with a pore (arrowed in Fig. 72). 73–75. Ascospores. Note the polar appendages (arrowed in Figs. 73, 75). Scale bars: 69 = 400 μm; 70, 72 = 30 μm; 71 = 15 μm; 73, 74 = 10 μm; 75 = 20 μm.

periphysate (Fig. 76). Peridium of textura angularis. Catenophyses present. Asci 56 × 30 μm, 8-spored, saccate, pedicellate, thin-walled, lacking an apical pore or thickening, deliquescent (Fig. 77). Ascospores 33.5–64 × 7–10 μm, hyaline, fusiform or cylindrical, bicelled, septum sub-medial, slightly constricted at the septum, relatively thin-walled, with well developed bipolar filamentous appendages (Figs. 78–81).

Habitat: Saprobic on submerged woody material.

Distribution: Australia.

Materials examined: Australia, north Queensland, Atherton Tablelands, Clohesy River, on submerged wood, Dec. 1991, K. D. Hyde (HKU(M) 865); Cow Bay, on submerged wood, Apr. 1995, T. M. and K. D. Hyde (HKU(M) 2269); near Ravenshoe, ca. 20 km along the Tully Falls Rd to Koomboolooba Dam, small river, Mar. 1997, K. D. Hyde and C. Pearce RH34 (HKU(M) 5128); ibid., RH60 (HKU(M) 5121); ibid., (HKU(M) 5153); ibid., (HKU(M) 5167).

Halosarpheia heteroguttulata S. W. Wong, K. D. Hyde et E. B. G. Jones, Can. J. Bot. 1858. 1998.

Figs. 100–107

Illustrations: Wong et al., 1998.

Ascomata 112–168 μm in diam, globose or subglobose, immersed, semi-immersed or superficial, black, membraneous, ostiolate, papillate, periphysate (Fig. 100). Peridium thin, comprising compressed cells. Catenophyses present. Asci 8-spored, clavate, pedicellate, thin-walled, lacking an apical pore or thickening, deliquescent. Ascospores 27–37 × 12.5–17.5 μm, hyaline, ellipsoidal, bicelled, not constricted at the septum, thin-walled, with bipolar hamate appendages, which unravel in water to form long filamentous threads, apical cells with a large lipid globule, basal cells with numerous small guttules (Figs. 101–107).

Habitat: Saprobic on submerged woody material.

Distribution: Australia (north Queensland), Brunei, Hong Kong, Mauritius, Philippines, South Africa.

Materials examined: Australia, north Queensland, Crystal Cascades, on submerged wood, Jan. 1992, K. D. Hyde (HKU(M) 893); 28 Apr. 1996, T. M. and K. D. Hyde

CC64 (HKU(M) 2383); ibid., (HKU(M) 2385); ibid., (HKU(M) 2393); ibid., (HKU(M) 2394); ibid., (HKU(M) 2422); Atherton Tablelands, Lake Barrine, on submerged wood, Apr. 1996, K. D. Hyde (HKU(M) 4905); Brunei, Temburong, Kuala Belalong Field Studies Centre, Sungai Esu, on wood submerged in a stream, 28 Jan. 1994, K. D. Hyde (HKU(M) 2792); ibid., (HKU(M) 2806); Hong Kong, New Territories, Plover Cove Reservoir, on submerged wood, 15 Nov. 1996, K. D. Hyde and M. Wong PC24 (HKU(M) 3305); ibid., (HKU(M) 3306); Tai Po, Lam Tsuen River, on submerged wood, 1 Oct. 1997, K. M. Tsui KM134 (HKU(M) 8111); ibid., (HKU(M) 8112); Mauritius, Tamarin, Black River, on submerged wood, Aug. 1995, A. Poonyth and K. D. Hyde MAUR20 (HKU(M) 2383); ibid., (HKU(M) 2393); ibid., (HKU(M) 2394); Philippines, Mindanao, Bukidnon, Impalatao, Natigbasan Creek, on submerged wood, Jan. 1994, K. D. Hyde (HKU(M) 2175); Negros Occidental, Bario Alagria, Lot 1320, Lupit River, on submerged wood, 27 Apr. 1997, K. D. Hyde, V. L. and L. Arimas (HKU(M) 5180); South Africa, Durban, Palmiet River, on submerged wood, 15 Nov. 1994, K. D. Hyde and T. Steinke SAPR20 (HKU(M) 2175).

Halosarpheia lotica Shearer, Mycotaxon **20**: 505. 1984. Figs. 82–92

Illustrations: Shearer, 1984.

Ascomata (140–)208–396 μm in diam, globose to subglobose, immersed, partially immersed, or superficial, hyaline to greyish brown, membraneous, ostiolate, papillate, periphysate. Peridium up to 16 μm wide, comprising compressed cells. Catenophyses present (Fig. 89). Asci 86–137 × 34–43 μm, 8-spored, clavate to cylindrical, thin-walled, lacking an apical pore or thickening, swelling in water, deliquescent (Figs. 82, 83, 88). Ascospores 26.5–38.5 × 9.5–14.5 μm, hyaline, ellipsoidal, bicelled, slightly constricted at the septum, relatively thin-walled, with well developed bipolar filamentous appendages (Figs. 84–87, 90–92).

Habitat: Saprobic on submerged woody material.

Distribution: Australia, Hong Kong, Mauritius, Philippines, South Africa, USA.

Materials examined: Australia, north Queensland, Atherton Tablelands, Clohesy River, on submerged wood, Dec. 1991, K. D. Hyde (HKU(M) 887); Hong Kong, New Territories, Tai Po Kau Nature Reserve, on submerged wood in a stream, May 1995, K. D. Hyde (HKU(M) 2812); Plover Cove Reservoir, on submerged wood, 15 Nov. 1996, K. D. Hyde and M. Wong (HKU(M) PC68); Tai Po, Lam Tsuen River, on submerged wood, 27 Nov. 1996, KM136 (HKU(M) 4683); ibid., (HKU(M) 4684); Mauritius, near Tamarin, Black River, on submerged wood, Aug. 1995, K. D. Hyde and A. Poonyth MAUR34 (HKU(M) 2420); Philippines, Negros Occidental, Bario Alagria, Lot 1320, Lupit River, on submerged wood, 27 Apr. 1997, K. D. Hyde, V. L. and L. Arimas (HKU(M) 5179); ibid., (HKU(M) 5180); South Africa, Durban, Palmiet River, on submerged wood, Nov. 1994, K. D. Hyde and T. Steinke SAPR5 (HKU(M) 2179, *A. chesapeakensis* also on this sample); ibid., (HKU(M) 2217); ibid., (HKU(M) 2218); ibid., (HKU(M) 2220).

The ballooning of the asci is particularly noticeable in the tropical collections and partly apparent in a figure provided by Shearer (1984).

Halosarpheia retorquens Shearer et J. L. Crane, Bot. Mar. **23**: 608. 1980. Figs. 93–99

Illustrations: Shearer and Crane, 1980.

Ascomata 150–366 μm in diam, globose to subglobose, immersed or superficial, hyaline at first becoming black, membraneous, ostiolate, periphysate. Peridium of textura angularis (Fig. 99). Catenophyses present (Fig. 98). Asci 53–144 × 14.4–24 μm, 8-spored, clavate, thin-walled, lacking an apical pore or thickening, deliquescent. Ascospores 20.5–33.5 × 7–10.8 μm, hyaline, ellipsoidal, bicelled, not constricted at the septum, relatively thin-walled, with well-developed bipolar filamentous appendages (Figs. 93–97).

Habitat: Saprobic on submerged woody material.

Distribution: Mauritius, Philippines, South Africa, USA (Illinois).

Materials examined: Mauritius, near Tamarin, Black River, on submerged wood, Aug. 1995, K. D. Hyde and A. Poonyth MAUR10 (HKU(M) 2385); Philippines, Luzon, Laguna, Los Baños, Mt. Maquiling, on wood submerged in a freshwater stream, Sep. 1995, K. D. Hyde and T. Umali (HKU(M) PHIL6); South Africa, Kwa Zulu-Natal, Mt. Ubatuba, on submerged rachis of *Raphia australia*, Nov. 1994, T. Steinke SARAM8 (HKU(M) 2214).

Description modified from Shearer and Crane (1980).

Halosarpheia viscosa (I. Schmidt) Shearer et J. L. Crane, Bot. Mar. **23**: 608. 1980. Figs. 108–115

Illustrations: Shearer and Crane, 1980.

Ascomata 140–230 μm in diam, globose, subglobose or ellipsoidal, immersed, semi-immersed or superficial, black, membraneous, ostiolate, periphysate. Peridium up to 10 μm wide, comprising compressed cells (Fig. 115). Catenophyses present. Asci 62–75 × 17–20 μm, 8-spored, clavate, pedicellate, lacking an apical pore or thickening, deliquescent. Ascospores 19–27 × 7.5–9.5 μm, hyaline, ellipsoidal, 2-celled, not constricted at the septum, thin-walled, with bipolar hamate appendages, which unravel in water to form long filamentous threads (Figs. 108–114).

Habitat: Saprobic on submerged woody material.

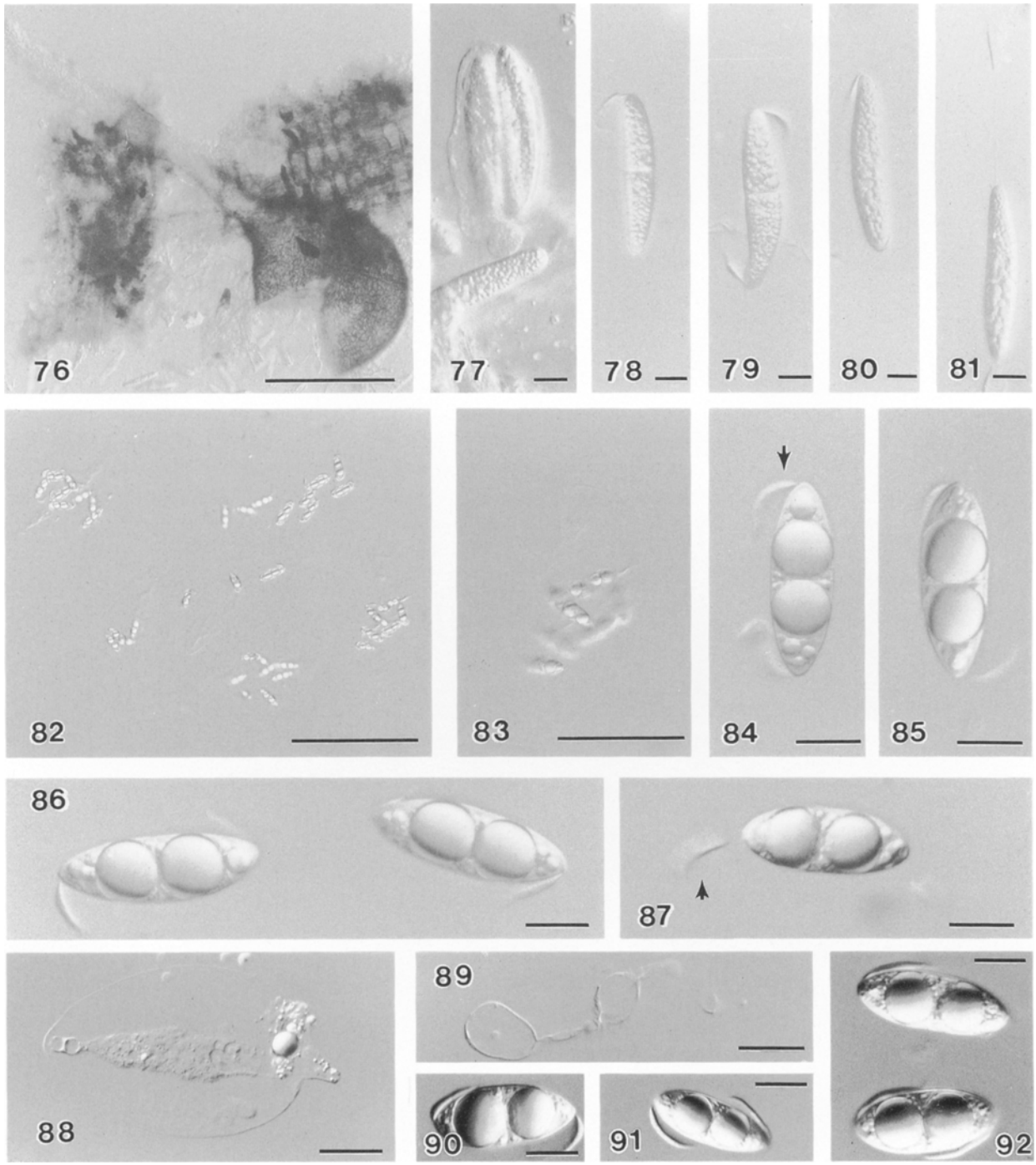
Distribution: Philippines, South Africa, USA.

Materials examined: Philippines: Luzon, Laguna, Los Baños, Mt. Maquiling, on wood submerged in a freshwater stream, Sept. 1995, K. D. Hyde and T. Umali PHIL33 (HKU(M) 2527); South Africa, Durban, Palmiet River, on submerged wood, Nov. 1994, K. D. Hyde and T. Steinke SAPR7 (HKU(M) 2219).

Nais aquatica K. D. Hyde, Aust. Syst. Bot. **5**: 117. 1992.

Illustrations: Hyde, 1992b.

Ascomata 115–390 μm in diam, globose to ampulliform, immersed, partly immersed or superficial, black, membraneous, ostiolate, papillate, periphysate. Cateno-

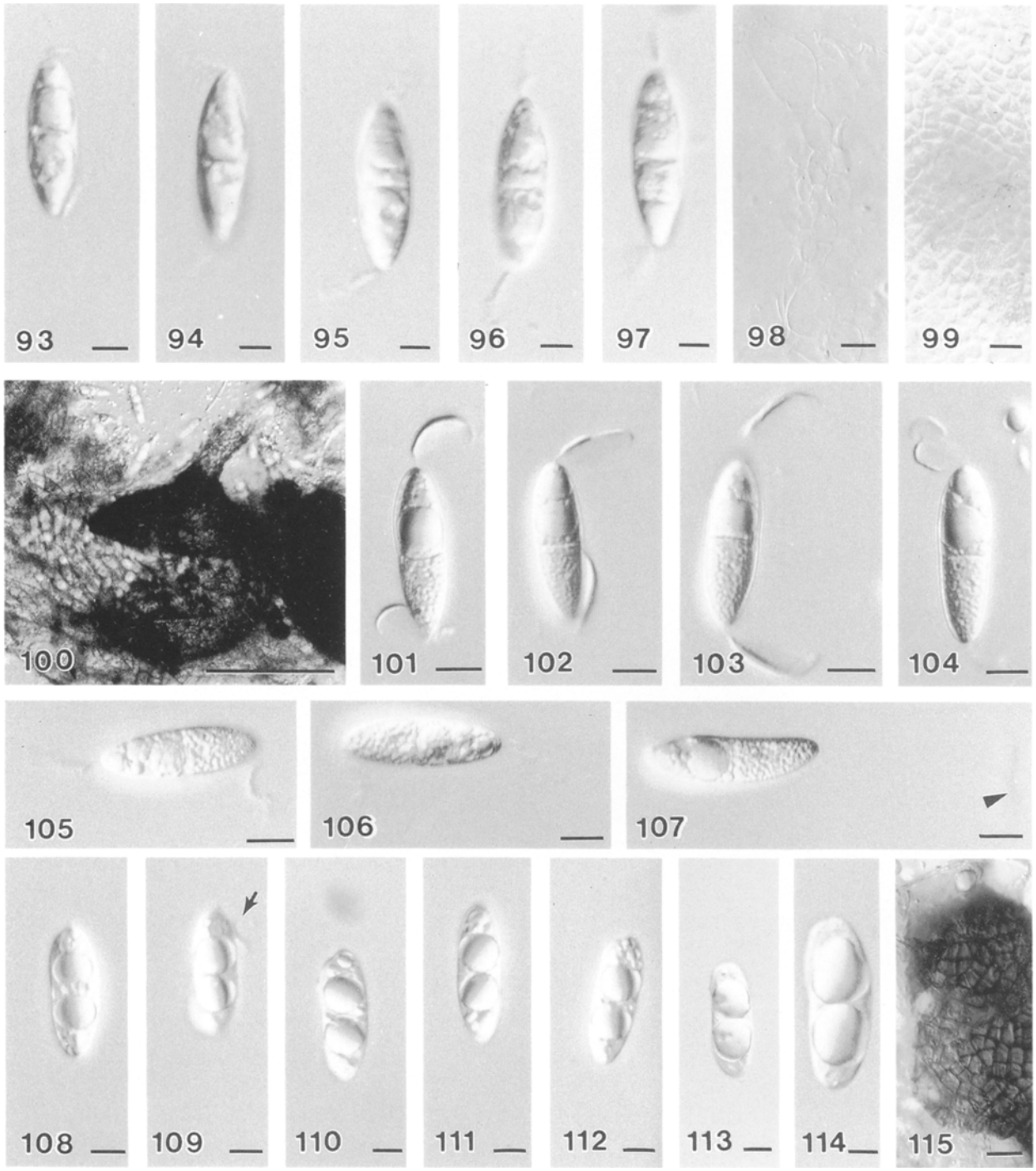


Figs. 76–81. *Halosarpheia aquatica* (from holotype).
76. Ascoma. 77. Mature ascus. 78–81. Ascospores with unfurling appendages.
Figs. 82–92. *Halosarpheia lotica* (82–87 from HKU(M) 2420; 88–92 from HKU(M) 887).
82, 83, 88. Swollen asci. Note the thickened apex. 89. Catenophyses. 84–87, 90–92. Ascospores. Note the polar appendages (arrowed in Figs. 84, 87).
Scale bars: 76, 82 = 200 μm; 77–81, 84–92 = 10 μm; 83 = 100 μm.

physes present. Asci 82 × 46 μm, 8-spored, saccate, thin-walled, lacking an apical pore or thickening, deliquescent. Ascospores 32–36 × 15–17 μm, hyaline, broadly ellipsoidal, bicelled, not constricted at the septum, relatively thin-walled, with oil droplets forming inner wall ornamentations at the septum.

Habitat: Saprobic on submerged woody material.

Distribution: Australia, Hong Kong, South Africa.

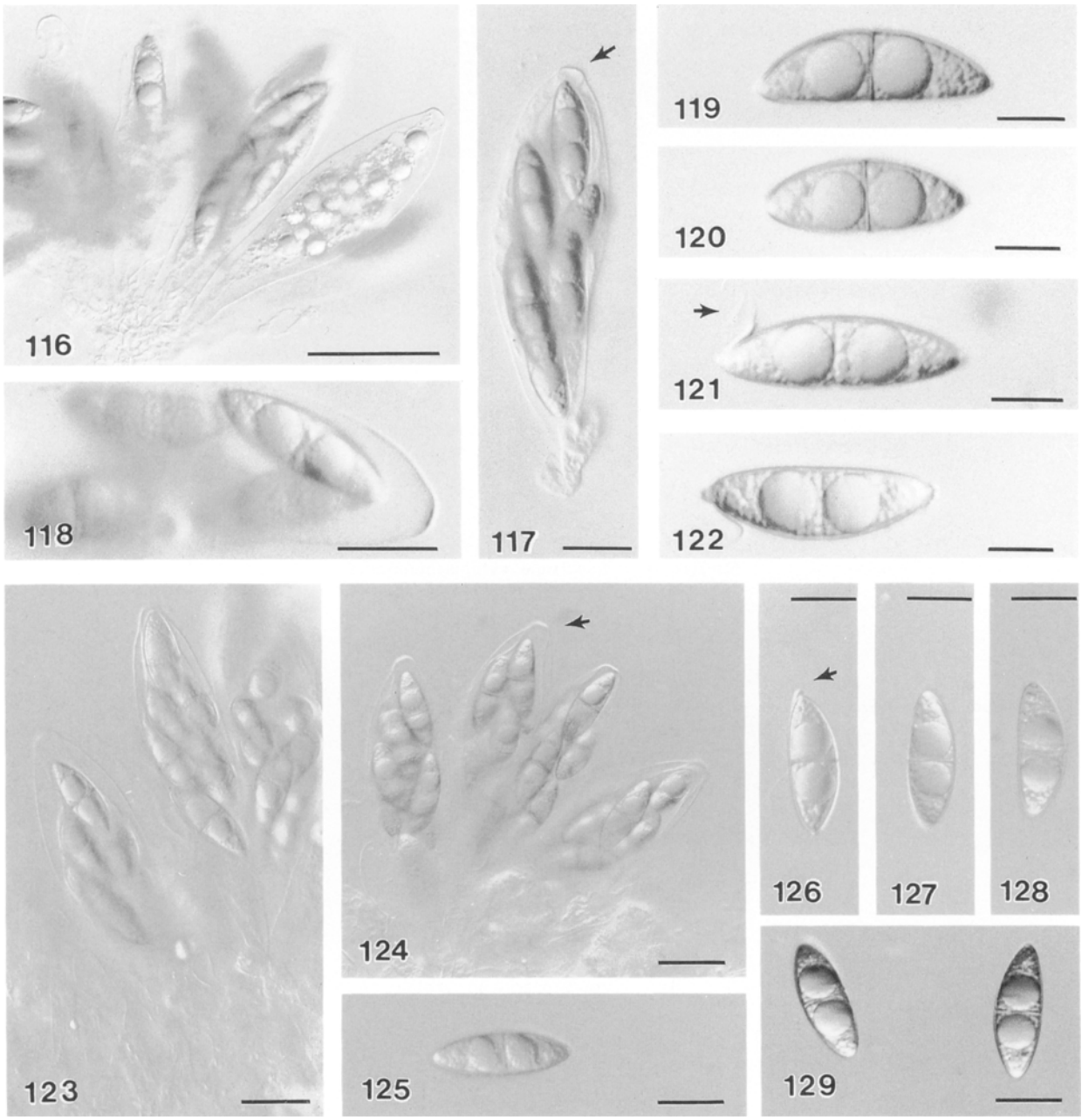


Figs. 93–99. *Halosarpheia retorquens* (from HKU(M) 2385).
93–97. Ascospores with unfurling appendages. 98. Catenophyses. 99. Peridium.
Figs. 100–107. *Halosarpheia heteroguttulata* (from holotype).
100. Ascoma. 101–107. Ascospores. Note the basal cell which always lack a large lipid globule and the polar appendages (arrowed in Fig. 107).
Figs. 108–115. *Halosarpheia viscosa* (from HKU(M) 2219).
108–114. Ascospores with polar appendages (arrowed in Fig. 109). 115. Peridium.
Scale bars: 93–97, 108–114 = 5 μm; 98, 99, 101–107 = 10 μm; 100 = 100 μm; 115 = 20 μm.

Materials examined: Australia, north Queensland, Millaa Millaa Falls, on submerged wood, July 1990, K. D. Hyde (BRIP 17373, holotype); Hong Kong, New Territories, Plover Cove Reservoir, on submerged wood, 18 Nov. 1996, K. D. Hyde and M. Wong PC59 (HKU(M) 4738); Tai Po, Lam Tsuen River, on submerged wood, 27 Nov. 1996, K. M. Tsui KM132 (HKU(M) 4675); South Africa, Durban; Palmiet River, on submerged wood, 15 Nov. 1994, K. D. Hyde and T. Steinke SAPR2 (HKU(M) 2158, and many more collections).

Hyde (1992b) reported appendages in some specimens, but these may belong to a different species.

Nais inornata Kohlm., Nova Hedwigia **4**: 409. 1962.



Figs. 116–122. *Phaeonectriella appendiculata* (from holotype).
116–118. Asci. Note the thickened truncate apex (arrowed in Fig. 117). 119–122. Ascospores, which are brown and have polar appendages (arrowed in Fig. 121).
Figs. 123–129. *Phaeonectriella lignicola* (from HKU(M) 2404).
123–125. Asci. Note the thickened truncate apex (arrowed in Fig. 124). 126–129. Ascospores, which are brown and have polar appendages (arrowed in Fig. 126).
Scale bars: 116=40 μm; 117, 118=20 μm; 119–122=10 μm; 123–125=20 μm; 126–129=15 μm.

Table 1. Synopsis of *Aniptodera*, *Halosarpheia*, *Nais* and *Phaeonectriella* species from freshwater habitats.

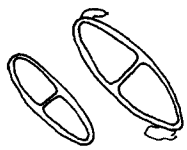
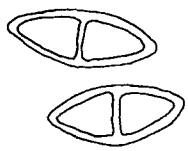
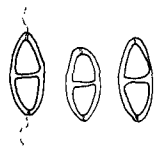
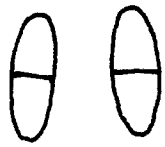
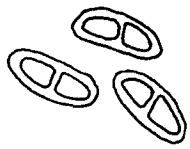
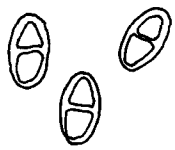
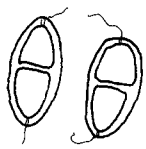
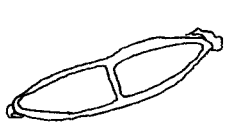
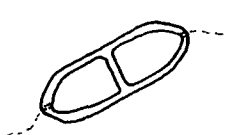
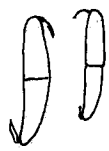
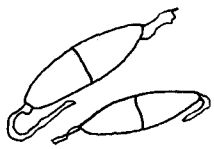
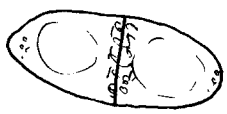
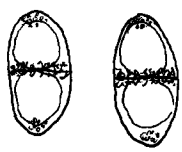
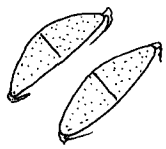
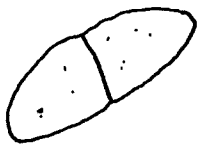
Species	Ascomata colour	Ascus size (μm)	Ascus apex	Ascospore size (μm)	Diagrammatic representation
Aniptodera chesapeakensis	hyaline to greyish brown	64–116 × 14–38	truncate, with apical pore, cytoplasm retracted below the ascus apex	21–37 × 7–15	
A. fusiformis	hyaline	35–60 × 19–35	apical pore, cytoplasm retracted below the ascus apex	19–28 × 8–12	
A. inflatiascigera	hyaline to greyish brown	135–200 × 50–87	rounded, cytoplasm retracted below the apex	32–46 × 15–22	
A. lignatilis	hyaline to cream	128–171 × 28–39.5	truncate, apical pore, cytoplasm retracted below the ascus apex	35–55 × 11.5–17	
A. lignicola	hyaline, then black at maturity	50–64 × 14–18.5	apical pore, cytoplasm retracted below the ascus apex	16–21.5 × 6.5–7.5	
A. limnetica	hyaline	50–70 × 12–17	apical pore, cytoplasm retracted below the ascus apex	18–24 × 8–11	
A. margarition	hyaline	48–70 × 19–35	thin-walled throughout	15–22(–24) × 9–13	
A. mauritaniensis	hyaline to greyish	80–95 × 22–28	truncate, apical pore, cytoplasm retracted below the apex	22–26 × 11–13	
A. megalospora	hyaline	120–150 × 37–50	truncate, with an indistinct apical thickening	55–82 × 10–12	
A. palmicola	hyaline to greyish brown	100–140 × 38–60	apical pore, cytoplasm retracted below the ascus apex	34–44 × 14–16	

Table 1. Continued.

Species	Ascomata colour	Ascus size (μm)	Ascus apex	Ascospore size (μm)	Diagrammatic representation
Halosarpheia aquadulcis	hyaline to light brown	75–130 × 18–32	truncate, with apical pore, cytoplasm retracted below the ascus apex	27–37 × 7.5–10	
H. aquatica	light brown to brown	56 × 30	thin-walled throughout	33.5–64 × 7–10	
H. lotica	hyaline to greyish brown	86–137 × 34–43	thin-walled throughout	26.5–38.5 × 9.5–14.5	
H. retorquens	hyaline to black	53–144 × 14.4–24	thin-walled throughout	20.5–33.5 × 7–10.8	
H. heteroguttulata	black	—	thin-walled throughout	27–37 × 12.5–17.5	
H. viscosa	black	62–75 × 17–20	thin-walled throughout	19–27 × 7.5–9.5	
Nais aquatica	black	82 × 46	thin-walled throughout	32–36 × 15–17	
N. inornata	black	80–150 × 20–35	thin-walled throughout	(19.2–)21.6–26.4(–29) × 9.6–14.4	
Phaeonectriella appendiculata	hyaline	100–140 × 24–30	truncate, apical pore, cytoplasm retracted below the apex	32–42 × 10–12	
P. lignicola	hyaline to pale brown	100–417 × 22–35	truncate, apical pore, cytoplasm retracted below the apex	26–30 × 9.5–11	

Illustrations: Shearer and Crane, 1978.

Ascomata 240–500 μm in diam, globose, immersed or superficial, black, membraneous, ostiolate, papillate, periphysate. Peridium of textura angularis. Catenophyses present. Asci 80–150 × 20–35 μm, 8-spored, clavate, thin-walled, lacking an apical pore or thickening, deliquescent. Ascospores (19.2–)21.6–26.4(–29) × 9.6–14.4 μm, hyaline, broadly ellipsoidal, bicelled, with or without constrictions at the septum, relatively thin-walled, with oil droplets forming inner wall ornamentations at the septum and at each end.

Habitat: Saprobic on submerged woody material.

Distribution: USA (Illinois).

Description modified from Shearer and Crane (1978). Ephemeral appendages were found in some specimens.

Phaeonectriella appendiculata K. D. Hyde, W. H. Ho et K. M. Tsui, sp. nov. Figs. 116–122

Ascomata 150–300 μm diam, globosa vel subglobosa, immersa vel subimmersa, hyalina, membranacea, ostiolata, papillata, periphysata. Asci 100–140 × 24–30 μm, 8-spori, clavati, pedicellati, tenuiparietales, truncati, apparatu apicali praediti. Ascosporae 32–42 × 10–12 μm, hyalinae vel pallide brunneae, fusiformes, bicellulares, tenieparietales, appendiculatae.

Etymology: In reference to the ascospore appendages.

Ascomata 150–300 μm in diam, globose to subglobose, immersed or partially immersed, hyaline, membraneous, ostiolate, papillata, periphysate. Peridium of textura angularis. Catenophyses not seen. Asci 100–140 × 24–30 μm, 8-spored, clavate, pedicellate, thin-walled, apically truncate and thickened, with apical pore and cytoplasm retracted below the ascus apex, persistent (Figs. 116–118). Ascospores 32–42 × 10–12 μm, hyaline or pale brown, fusiform, bicelled, not constricted at the septum, thin-walled, with appendages at each end (Figs. 119–122).

Habitat: Saprobic on submerged woody material.

Distribution: Australia, Philippines.

Materials examined: Australia, north Queensland, Crystal Cascades, on submerged wood, 28 Apr. 1996, K. D. and T. M. Hyde CC78 (HKU(M) 2864, holotype); Philippines, Luzon, Laguna, Los Baños, Mt. Maquiling, on wood submerged in a stream, Sep. 1995, K. D. Hyde and T. Umali PHIL41 (HKU(M) 2583).

Two very similar collections of this species have been made in Australia and Philippines and each have bipolar filamentous appendages. *Phaeonectriella lignicola* has smaller ascospores (26–30 × 9.5–11 μm vs. 32–42 × 10–12 μm).

Phaeonectriella lignicola R. A. Eaton et E. B. G. Jones, Nova Hedwigia **19**: 779. 1970. Figs. 123–129

Illustrations: Eaton and Jones, 1970.

Ascomata 100–575 μm in diam, globose to subglobose, immersed, hyaline to pale brown, membraneous, ostiolate, papillate, periphysate. Peridium of compressed cells. Catenophyses not seen. Asci 100–120 × 22–35 μm, 8-spored, clavate, pedicellate, thin-walled, apically truncate and thickened, with an apical pore and cytoplasm retracted below the ascus apex, persistent (Figs. 123–125). Ascospores 26–30 × 9.5–11 μm, hyaline or pale brown, becoming grey-brown at maturity, ellipsoidal-fusiform, bicelled and longitudinally asymmetrical, slightly constricted at the septum, thin-walled, with appendages at each end (Figs. 126–129).

Habitat: Saprobic on submerged woody material.

Distribution: Mauritius, UK.

Material examined: Mauritius, near Tamarin, Black River, on submerged wood, Aug. 1995, K. D. Hyde and A. Poonyth MAUR42 (HKU(M) 2404).

The collection from Mauritius had similar sized ascospores to the prologue, but had inconspicuous bipolar appendages (Figs. 126–129). Ascospore appendages were not mentioned in the original description of Eaton and Jones (1970), and Jones (1995) used the lack of appendages to distinguish this genus from *Aniptodera*. Further collections are required to establish if appendages are typical of *P. lignicola*.

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