IFO Res. Commun. **16,**
24–62, 1993 (March)

INTERTIDAL MANGROVE FUNGI FROM IRIOMOTE ISLAND

AKIRA NAKAGIRI

Summary

Intertidal decomposing wood of Rhizophora stylosa and Bruguiera gymnorrhyza was collected from mangrove forests at the Shiira River and the Nakama River in Iriomote Is. and examined for higher fungi. Twenty-five species of ascomycetes and 6 species of deuteromycetes were found from 60 samples. Morphology and cultural properties of the 21 species identified are described and problems in their taxonomy are discussed. The frequency of occurrence of fungi on the two species of mangrove trees was compared. Species frequently found on R. stylosa were Caryosporella rhizophorae, Dactylospora haliotrepha, and Swampomyces triseptatus. Hypoxylon oceanicum occurred only on B. gymnorrhyza.

Keywords: mangrove fungi, Rhizophora stylosa, Bruguiera gymnorrhyza.

In the course of studies on the fungal flora of decomposing intertidal mangrove wood from Iriomote Is., 20 species of ascomycetes and 5 species of deuteromycetes were recorded from Rhizophora stylosa Griff. and 10 species of ascomycetes and 2 species of deuteromycetes from Bruguiera gymnorrhyza. The 21 species identified are described here in terms of their morphology and cultural characteristics. Ten species remain

unidentified. Newly found characteristics and findings contradictory to earlier reports are noted and the taxonomic problems of the fungi are discussed. The frequencies of occurrence of fungi on the two species of mangrove wood are compared.

Materials and Methods

Decomposing prop roots, branches and trunks of R. stylosa and B. gymnorrhyza were collected from intertidal mangroves of the Shiira River and the Nakama River, Iriomote Is. (25° 20'N, 123° 90'E), Okinawa Pref., on 26 Nov. 1991. The wood samples were incubated in plastic boxes at 20-25 C and were examined under a dissecting microscope for fungi occurring on and in the wood. Observation was continued for 5 months. In total, 45 samples of R. stylosa and 15 samples of B. gymnorrhyza were examined. Phase-contrast light microscopy and scanning electron microscopy [JSM 5400 (JEOL)] were used for observation. Isolation of cultures was carried out with a Skerman's micromanipulator. Single-spore isolates were incubated on sea water cornmeal agar [SWCMA: 2% cornmeal extract and 1.5% agar in 20‰ salinity (S) artificial sea water (Jamarin S; Jamarin Lab., Osaka)] at 25 C.

Results and Discussion

Description of occurring fungi

Ascomycetes and deuteromycetes found on mangrove wood, most of which are newly recorded Japanese fungal flora, are described here in alphabetical order.

Ascomycetes

Aigialus grandis Kohlm. & Schatz
Trans. Br. Mycol. Soc. 85: 699 (1985)

Figs. 1, A-D

Ascocarps subglobose in frontal view, obovate in vertical section, laterally compressed, mostly immersed in a black stroma, with carbona-

ceous, black, slightly convex stroma surrounding ostiole at the surface of substrates. Bitunicate asci arising from a basal ascogenous tissue. Because the specimens examined were old, asci and hamathecia were not observed in detail. Ascospores 72-102 X 20-28 μm ($\bar{x}$=81.8 X 23.8 μm), ellipsoid, muriform, with 11-15 trans-septa and 1-3 longisepta in all but the end cells, slightly constricted at the middle septum and the end septa, yellow-brown to dark brown except for the hyaline apical cell, with an easily deciduous, gelatinous cap around the apical cells.

Colonies on CMSWA pale brown, 11 mm in diam after incubation for 5 weeks at 25 C. Single-ascospore isolates [AN-1208 (IFO 32469), AN-1209 (IFO 32470) and AN-1210] from the specimen Shi-Ya-7 (IFO H-12137) produced ascocarp initials on CMSWA.

Substrates: Submerged wood of Rhizophora stylosa and Bruguiera gymnorrhyza.

Specimens examined: Submerged wood of R. stylosa, Shiira River, Shi-Ya-7, and B. gymnorrhyza, Nakama River, Na-O-6.

Aniptodera limnetica Shearer

Mycologia 81: 140 (1989)

Figs. 2, A-L

Ascocarps 180-220 μm high, 170-240 μm in diam, globose to subglobose, superficial or partly immersed, ostiolate, white to cream colored; long necks 200-440 X 38-48 μm, cylindrical, with 1-2 band-like hyphal structures, which may indicate the ceased and resumed elongation of the neck. Catenophyses present. Asci 90-130 X 16-24 μm, eight-spored, clavate, pedunculate, unitunicate, thin-walled, with thick apical plate and pore, with retracted cytoplasm below the apical plate. Ascospores 20-25 X 8-10 μm ($\bar{x}$=22.5 X 8.9 μm), one-septate, ellipsoid to oblong-ellipsoid, thin-walled [not thick-walled, as described by Shearer (1989)], hyaline. Ascospores are released from asci through a fissure in the apical plate, which splits at the pore.

Colonies on CMSWA dark olive to brown, 3-4 mm in diam after incubation for one month at 25 C. Single-ascospore isolates [AN-1270 (IFO 32471), AN-1271 (IFO 32472) and AN-1272] were obtained from the specimen Shi-O-3 (IFO H-12138).

Substrate: Submerged wood of B. gymnorrhyza.

Specimen examined: Submerged wood of B. gymnorrhyza, Shiira River, Shi-O-3.

The disagreement in ascospore wall thickness with the description by Shearer (1989) is probably due to the difference in appearance under the microscope in a different mount solutions. As indicated by Shearer (1989), appearance of ascospores of A. chesapeakensis Shearer & Miller differed when they were mounted in water or lactic acid. In lactic acid, ascospores appeared thick-walled, whereas in water they appeared thin-walled [compare Figs. 2, 5 and 9 in Shearer (1989)]. Ascospores of A. limnetica mounted in water or Shear's solution in this study appeared thin-walled, like those of A. chesapeakensis in water. Other characteristics of the present fungus fit well with Shearer's description. Therefore, I identified this fungus as A. limnetica.

Aniptodera longispora Hyde

Bot. Mar. 33: 335 (1990)

Figs. 3, A-J

Ascocarps 480-500 μm long, 200-280 μm thick, pyriform to subglobose in frontal view, elliptical in vertical section, lying horizontally immersed in the substrate, coriaceous to membranous, light brown to black at the upper exposed part, hyaline at the lower immersed part, ostiolate, papilate; necks rising eccentrically from one end. Catenophyses present. Asci 184-224 X 20-28 μm, eight-spored, clavate to cylindrical, pedunculate, unitunicate, persistent, thin-walled, with a refractive pore or plug-like structure at the apex, with swollen cytoplasm below the apical refractive structure, arising from the base of ascocarp venter, I-. Ascospores 40-53 X 10-14 μm ($\bar{x}$= 47.3 X 11.8 μm), cylindrical with rounded apices, one-septate, slightly constricted at the septum, hyaline. Ascospores were released from asci through a fissure made at the refractive pore or plug-like structure. The refractive structure was observed only in mature asci, not in young ones. Scanning electron microscopy did not show any corresponding structure.

Colonies on CMSWA olive brown to dark brown, 3-4 mm in diam after incubation for two months at 25 C. Single-ascospore isolates [AN-1267 (IFO 32473), AN-1268 (IFO 32474) and AN-1269] were obtained from the specimen Shi-Ya-19 (IFO H-12139).

Substrate: Submerged wood of R. stylosa.

Specimen examined: Submerged wood of R. stylosa, Shiira River, Shi-Ya-19.

Caryosporella rhizophorae Kohlm.

Proc. Ind. Acad. Sci. (Plant Sci.) 94: 356 (1985)

Figs. 4, A-J

Ascocarps up to 1 mm in diam and height, gregarious, globose to subglobose, superficially seated on a thin black stroma, ostiolate, short papillate, carbonaceous, thick-walled, black. Hamathecia (pseudoparaphyses?) 1.5-2 μm in diam, septate, simple between asci, branched and anastomosing above asci, arising with asci from the base of ascocarp venter. Asci 170-210 X 11-14 μm, eight-spored (abnormally six-spored), cylindrical, long pedunculate, bitunicate (or multitunicate?), I-. Ascospores 20-26 X 9-11 μm ($\bar{x}$= 22.8 X 10.6 μm) [ascospores in six-spored asci; 28-34 X 10-11 μm], uniseriate, ellipsoidal, one-septate, slightly constricted at the septum, brown to dark brown, light colored or hyaline at the apices, thick-walled except for the apices, verrucose. Under SEM, two kinds of ornamentations, ca. 1 μm long flexible conical spines and smaller, 0.1-0.3 μm in diam, granules, were revealed. Small black pycnidia (spermogonia?) with short or no papilla are formed on stroma close to ascocarps. Unicellular, globose conidia (spermatia?) (1.5-2 μm in diam) are abundantly produced from phialides in the pycnidia.

Colonies on CMSWA hyaline, grow fast at 25 C. Single-ascospore isolates [AN-1179 (IFO 32475), AN-1180 (IFO 32476) and AN-1181] from the specimen Shi-Ya-5 (IFO H-12140) produced globose black pycnidia (400-480 μm in diam) with a long neck (240-260 X 56-72 μm) but without stroma on CMSWA.

Substrate: Submerged wood of R. stylosa.

Specimens examined: Submerged wood of R. stylosa, Shiira River, Shi-Ya-5, 7, 13, 16, 17, 19, 22, 23, 24, 26, 30, 31, 32, 33, 34.

Cultural study confirmed that the pycnidia-like structures found in natural substrates were truely of C. rhizophorae, and also showed the variablity in morphology of pycnidia.

Cucullosporella mangrovei (Hyde & Jones) Hyde & Jones in Jones and Hyde

Mycotaxon 37: 200 (1990)

Basionym: Cucullospora mangrovei Hyde & Jones, Bot. Mar. 29: 491 (1986)

Figs. 5, A-F

Ascocarps 280-400 μm high, 240-400 μm in diam, subglobose, pale brown, immersed, ostiolate; necks 200-280 X 64-80 μm, dark brown to black. Asci 220-260 X 32-52 μm, eight-spored, clavate, pedunculate, unitunicate, thin-walled, with a thickened apex and a refractive plug-like structure at the center of the thickness, with swollen cytoplasm below the refractive structure. Ascospores 50-68 X 13-20 μm, fusiform to ellipsoid, one-septate, not constricted at the septum, hyaline, with fine longitudinal striation visible under SEM, with polar appendages arising from a tube-like extension of the spore wall. Appendages composed of a coiled string (0.3-0.5 μm in diam), which elongates freely to become long thread-like polar filaments.

Colonies on CMSWA dark brown to black, 15 mm in diam after incubation for two months at 25 C. single-ascospore isolates [AN-1152 (IFO 32477) and AN-1153 (IFO 32478)] from the specimen Shi-Ya-0 (IFO H-12141) produced ascocarp initials on CMSWA.

Substrate: Submerged wood of R. stylosa.

Specimen examined: Submerged wood of R. stylosa, Shiira River, Shi-Ya-0.

Scanning electron microscopy revealed the refractive structure at the ascus apex as a disc-like (2.5-3 μm in diam) structure.

Dactylospora haliotrepha (Kohlm. & Kohlm.) Hafellner

Beih. Nova Hedwigia 62: 111 (1979)

Basionym: Buellia haliotrepha Kohlm. & Kohlm., Nova Hedwigia 9: 90 (1965)

Figs. 6, A-G

Ascocarps 200-300 μm high, up to 1mm in diam, at first globose, developed into discoid, flat or convex, apothecia-like, superficial, sessile, fleshy-leathery, dark reddish-brown, solitary or gregarious. Paraphyses 85-110 X 1.5-2 μm, at the swollen apex 3-5 μm in diam, sep-

tate, branching at the upper part, hyaline. Asci 60-86 X 16-20 μm, eight-spored, clavate, short pedunculate, bitunicate, apically thick-walled, thinner toward the base; the ectoascus secrets a gelatinous sheath that reacts blue with iodine, and the endoascus elongate upto 58 μm long through a fissure at the apex of the ectoascus and the gelatinous sheath. Ascospores 16-22 X 8-11 μm, obovoid, one-septate in the lower third, constricted at the septum, light brown; spore surface with longitudinally or obliquely woven ribs.

Colonies on CMSWA white, floccose, 15 mm in diam after incubation for three months at 25 C. Hyphae characteristically branch perpendicularly and often anastomose with each other. A four-ascospore isolate [AN-1170 (IFO 32479)] and single-ascospore isolates [AN-1171 (IFO 32480) and AN-1172] were obtained from the specimen Shi-Ya-0 (IFO H-12142).

Substrate: Submerged wood of R. stylosa and B. gymnorrhyza.

Specimens examined: Submerged wood of R. stylosa, Shiira River, Shi-Ya-0, 1, 7, 11, 14, 17, 19, 20, 22, 28, 30, and B. gymnorrhyza, Nakama River, Na-0-5, 6.

Halosarpheia abonis Kohlm.

Mar. Ecol. (P. S. Z. N. I.) 5: 339 (1984)

Figs. 7, A-H

Ascocarps subglobose, immersed, ostiolate, with long neck, coriaceous, hyaline at the lower immersed part, light brown at the upper exposed neck. Catenophyses present. Asci 180-264 X 32-60 μm, eight-spored, clavate, pedunculate, unitunicate, thin-walled, thicker at the apex, with swollen cytoplasm below the apex only in immature asci, I- but ascus wall, ascospores and ascospore appendages are stained brown with iodine. Ascospores 38-48 X 16-20 μm, ellipsoid, one-septate, slightly constricted at the septum, hyaline, with apical appendages; a scoop-like appendage is attached to each apex and runs along the side of the ascospore; at maturity it becomes soft and the composing fibers uncoil into long sticky filaments.

Colonies on CMSWA light brown, 26 mm in diam after incubation for 5 weeks at 25 C. Single-ascospore isolates [AN-1205 (IFO 32481), AN-1206 (IFO 32482) and AN-1207] obtained from the specimen Shi-Ya-8 (IFO H-12143) produce ascocarp initials (?) on CMSWA.

Substrates: Submerged wood of R. stylosa.

Specimens examined: Submerged wood of R. stylosa, Shiira River, Shi-Ya-8, 27.

Halosarpheia fibrosa Kohlm. & Kohlm.

Trans. Br. Mycol. Soc. 68: 208 (1977)

Figs. 8, A-L

Ascocarps 480-560 μm high, 480-520 μm in diam, pyriform to subglobose, immersed to partly immersed or superficial, ostiolate, with a long neck (160-700 X 96-105 μm), coriaceous, dark brown, top of necks lighter colored. Catenophyses present. Asci 152-184 X 40-48 μm, eight-spored, clavate, pedunculate, unitunicate, thin-walled, persistent, without apical apparatus or thickness but with dome-shaped thin-walled apex, I- but ascospores were densely stained brown with iodine. Ascospores 32-39 X 20-22 μm, broad ellipsoid, one-septate, not or slightly constricted at the septum, hyaline, with apical appendages; cap-like appendage is attached to each apex, at maturity the composing strings uncoil into long sticky filaments.

Colonies on CMSWA olive green, cottony, 10-20 mm in diam after incubation for 3 weeks at 25 C. Single-ascospore isolates [AN-1258 (IFO 32483), AN-1259 (IFO 32484) and AN-1260] were obtained from the specimen Shi-Ya-18 (IFO H-12144).

Substrates: Submerged wood of R. stylosa.

Specimens examined: Submerged wood of R. stylosa, Shiira River, Shi-Ya-18.

Under SEM, the ascospore appendage was seen to be composed of a meandering, 0.3-0.6 μm thick string. The string is attached to each pole of the ascospore and at maturity it uncoils and breaks down into many thinner, ca. 0.1 μm in diam, filaments. A similar appendage was illustrated for H. trullifera (Kohlm.) Jones et al. by Farrant (2). Outer morphology of ascus tip under SEM did not show any evidence for an apical thickening or apparatus.

Hypoxylon oceanicum Schatz

Mycotaxon 33: 413 (1988)

Figs. 9, A-G

Ascocarps 1-2 mm in diam, subglobose, solitary or united, ostiolate, short papillate, carbonaceous, black. Paraphyses 200-250 X 2-3 μm, septate, branching. Asci 160-200 X 14-20 μm, eight-spored, cylindrical, pedunculate, unitunicate, thin-walled, with apical ring stained blue with iodine (I+), with a flexible apical cushion at the apex. Ascospores 18-24 X 9-13 μm ($\bar{x}$= 20.8 X 10.6 μm), one-celled, subglobose to broad ellipsoid, with a germ slit, brown to dark brown.

Colonies on CMSWA white, sparse, 3.0-3.4 mm in diam after incubation for 2 weeks at 25 C. Multi-ascospore isolate [AN-1252 (IFO 32485)] and single-ascospore isolates [AN-1253 (IFO 32486) and AN-1254] were obtained from the specimen Na-O-1 (IFO H-12145).

Substrates: Submerged wood of B. gymnorrhyza.

Supecimens examined: Submerged wood of B. gymnorrhyza, Nakama River, Na-O-1, 4, 6.

The apical cushion of asci was seen under SEM as an undulate disc with a pore-like depression at the center.

Lineolata rhizophorae (Kohlm. & Kohlm.) Kohlm. & Volkm.-Kohlm. Mycol. Res. 94: 688 (1990)

Basionym: Didymosphaeria rhizophorae Kohlm. & Kohlm., Icones Fungorum Maris, Fasc. 4 & 5, Tabs. 62 and 62a, Figs. 1-19, J. Cramer, Weinheim (1967)

Figs. 10, A-G

Ascocarps 440-600 μm high (including a neck), 280-420 μm in diam, pyriform, partly or completely immersed, ostiolate, papillate, subcarbonaceous, dark brown to black, solitary or gregarious; necks 80-90 μm in diam at the apex, conical. Hamathecia (pseudoparaphyses?) 1.5-2 μm in diam, septate, branched and anastomosing, arising with asci from the base of the ascocarp venter. Asci 110-170 X 10-16 μm, eight-spored (infrequently four- and six-spored), cylindrical, short pedunculate, bitunicate, fissitunicate (physoclastic), with refractive apical apparatus, I-. Ascospores 26-34(-38) X 10-13 μm (four- or six-spored asci have long spores), ellipsoid, one-septate, slightly constricted at the septum, brown, with longitudinal striation of 0.2-0.3 μm wide, forking ribs.

Colonies on CMSWA olive grey to brown, 9-10 mm in diam after incu-

bation for 1 month at 25 C. Single-ascospore isolates [AN-1246 (IFO 32487), AN-1247 (IFO 32488) and AN-1248] were obtained from the specimen Shi-Ya-22 (IFO H-12146).

Substrates: Submerged wood of R. stylosa.

Specimens examined: Submerged wood of R. stylosa, Shiira River, Shi-Ya-1, 11, 14, 22, 28.

Massarina ramunculicola Hyde

Mycologia 83: 839 (1991)

Figs. 11, A-J

Ascocarps up to 450 μm high and 600 μm in diam, immersed or partly erumpent, with darkened areas on the wood around ascocarps, ostiolate, papillate, coriaceous, dark brown to black, solitary or gregarious. Hamathecia (pseudoparaphyses?) 1-2 μm in diam, filamentous, septate, branching, anastomosing. Asci 120-190 X 20-30 μm, eight-spored, clavate, pedunculate, bitunicate, fissitunicate, with a ring-like apical apparatus, I- but exposed endotunica was stained brown with iodine. Ascospores 34-45 X 11-13 μm, ellipsoid to fusiform, one-septate but in some spores having one more septum at each end, constricted at the septum, hyaline, surrounded by a sheath. The sheath breaks at ascospore poles, from which mucilaginous pads are released. Later the sheath and pads swells into a large mucilage surrounding whole spore.

Colonies on CMSWA light brown to light grey, 4 cm in diam after incubation for 5 weeks at 25 C. Single-ascospore isolates [AN-1199 (IFO 32489), AN-1200 (IFO 32490) and AN-1201] obtained from the specimen Shi-Ya-8 (IFO H-12147) produced black pycnidia (spermogonia?) on CMSWA, in which pyriform phialides (8-10 X 2-3 μm) produced ellipsoid, one-celled, hyaline conidia (spermatia?) (2-3 X 1 μm).

Substrates: Submerged wood of R. stylosa.

Specimens examined: Submerged wood of R. stylosa, Shiira River, Shi-Ya-8, 9.

In identifying this fungus, I compared material with authentic specimens of M. ramunculicola identified by Dr. K. D. Hyde and also with the holotype of M. velatospora (IMI 29770).

Quintaria lignatilis (Kohlm.) Kohlm. & Volkm.-Kohlm.
Bot. Mar. 34: 35 (1991)
Basionym: Trematosphaeria lignatilis Kohlm., Mar. Ecol. (P. S. Z. N. I.) 5: 365 (1984)

Figs. 12, A-H

Ascocarps obpyriform, immersed, ostiolate, papillate, carbonaceous, black, solitary or gregarious; black stromatic tissue surrounding neck in wood. Hamathecia (pseudoparaphyses?) 1.5-2 μm in diam, septate, branching and anastomosing. Asci 210-260 X 28-40 μm, eight-spored, cylindrical, pedunculate, bitunicate, fissitunicate, with an eccentric apical plate. The apical plate, at which ectotunica and endotunica unite, is a lid of the apical isthmus of the endotunica. When the ectotunica with the apical plate is detached from the endotunica, ascospores are released through the opened isthmus. Ascospores 52-74 X 12-20 μm ($\bar{x}$= 60.7 X 16 μm), fusiform, five-septate, constricted at the septa, hyaline to pale yellow. A chain of ascospores, which had possibly been contained in an endotunica, was often seen as having been forced out of the ostiole.

Colonies on CMSWA olive brown to dark brown, 2 cm in diam after incubation for 5 weeks at 25 C. Single-ascus isolate [AN-1193 (IFO 32491)] and single-ascospore isolates [AN-1194 (IFO 32492) and AN-1195] obtained from the specimen Shi-Ya-4 (IFO H-12148) produced ascocarp initials (?) on CMSWA.

Substrates: Submerged wood of R. stylosa.

Specimens examined: Submerged wood of R. stylosa, Shiira River, Shi-Ya-4, 12, 30.

Savoryella paucispora (Cribb & Cribb) Koch
Nordic J. Bot. 2: 169 (1982)
Basionym: Leptosphaeria paucispora Cribb & Cribb, Univ. Queensl. Pap., Dep. Bot. 4: 41 (1960)

Figs. 13, A-M

Ascocarps 200-240 μm high, 170-320 μm in diam, flask-shaped, ostiolate, papillate, superficial to immersed, dark brown; necks 240-330 X 50-72 μm, light brown. Catenophyses present. Asci 88-130 X 16-22 μm, two-spored, cylindrical, short pedunculate, with subapical slight retraction of cytoplasm in youg asci, with slightly thickened apex, I-. SEM observa-

tion revealed a pore or a depression at the ascus apex. Following dehiscence of the apex, ascospores are forcibly ejected. Thick ascus wall sometimes breaks laterally at the middle and cytoplasm is pushed out, suggestive of physoclastic bitunicate asci. This characteristic of asci might have led Cribb and Cribb (1960) originally to assign this fungus to Loculoascomycetes. Ascospores 42-56 X 14-18 μm ($\bar{x}$= 50.8 X 15.5 μm), three-septate, with brown central cells and hyaline end cells, smooth but with small warts close to endsepta on the central brown cells. The end cells are thin-walled and germinate hyphae.

Colonies on CMSWA brown to dark brown, 16-17 mm in diam after incubation for 6 weeks at 25 C. Single-ascospore isolates [AN-1276 (IFO 32493), AN-1277 (IFO 32494) and AN-1278] obtained from the specimen Na-O-4 (IFO H-12149) produced ascocarps on CMSWA, from around which ascospores were discharged.

Substrates: Submerged wood of B. gymnorrhyza.

Specimens examined: Submerged wood of B. gymnorrhyza, Nakama River, Na-O-4.

Presence or abscence of paraphyses is one of the taxonomic problems in this species and the genus. When Cribb and Cribb (1960) described this fungus as Leptosphaeria paucispora, they mentioned "paraphyses are poorly developed, and in some perithecia were difficult to detect;" and in Latin, "paraphysibus raris, simplicibus vel ramosis, usque ad 1 μm diam." However, Koch (1982) did not observe paraphyses in his specimens. Recently, Jones and Hyde (7) mentioned having "observed paraphyses, ---[which] are difficult to detect and may deliquesce in mature specimens," but presented no illustration of paraphyses. In this study, I observed catenophyses rather than paraphyses in ascocarps, but these do not seem to be identical with the paraphyses described by Cribb and Cribb (1960). I tried to examine the type material, but it was not available in any institution. In conclusion, further studies are neccessary to clarify whether this fungus has paraphyses or catenophyses or neither. This problem is also present in definition of the genus. The type species, S. lignicola Jones & Eaton, was first described as aparaphysate, but later Jones and Hyde (7) amended this to "paraphyses present, but sparse," but did not illustrate the paraphyses clearly in their Figures 5 and 6 (7). I examined the type material, IMI 129784, but could not observe any paraphyses on it. Further studies using fresh materials are necessary to

elucidate the presence or abscence of parphyses in S. lignicola.

Another taxonomic problem is of the apical structure of asci. Jones and Hyde (7) stated that the asci of all Savaryella species including their two new species have apical thickening containing a pore. However, the apical pore was not clearly shown in their light micrographs except for that of S. longispora Jones & Hyde. Therefore, it is not possible to confirm whether "the pores" are identical or not in all species of the genus. SEM studies on the apical structure, as shown in this study, for all species are necessary to resolve this problem.

Swampomyces triseptatus Hyde & Nakagiri

Sydowia 44: 122 (1992)

Figs. 14, A-H

Ascocarps pyriform, immersed, with long axis horizontal to oblique to the host surface, coriaceous, ostiolate, papillate, dark brown to black, solitary, developing under a darkened superficial pseudostroma; contents apricot coloured in mass; neck white to dull orange at the upper part. Paraphyses 1-2 μm in diam, branching, filamentous , hyaline. Asci 140-160 X 8-12 μm, eight-spored, cylindrical, short pedunculate, thin-walled, with ring-like structure at apex, apically thickened with a small central indentation visible under SEM, I-. Ascospores are released by splitting of ascus apex. Ascospores (14-)17-25 X 7-11 μm, uniseriate, ellispoid, three-septate, constricted at the septa, hyaline, with granular ornamentation visible under SEM.

Colonies on CMSWA white to hyaline at first, becoming dark brown with age, 4 cm in diam after incubation for 5 weeks at 25 C. Single-ascospore isolates [AN-1184 (IFO 32495), AN-1185 (IFO 32496) and AN-1186] were obtained from the specimen Shi-Ya-2 (IFO H-12150).

Substrates: Submerged wood of R. stylosa.

Specimens examined: Submerged wood of R. stylosa, Shiira River, Shi-Ya-1, 2, 5, 7, 8, 11, 12, 13, 14, 20, 22, 25, 28.

Verruculina enalia (Kohlm.) Kohlm. & Volkm.-Kohlm.

Mycol. Res. 94: 689 (1990)

Basionym: Didymosphaeria enalia Kohlm., Ber. Deutsch. Bot. Ges.

79: 28 (1966)

Figs. 15, A-I

Ascocarps subglobose to pyriform, partly or completely immersed, ostiolate papillate, clypeate, carbonaceous, black. Necks up to 200 X 80 μm, surrounded by black clypeus. Hamathecia (pseudoparaphyses?) 1-2 μm in diam, septate, branched. Asci 150-220 X 10-13 μm, eight-spored, cylindrical, pedunculated, bitunicate, physoclastic, with subapical thickening of endotunica, I- but ascus cytoplasm is stained orange with iodine, developing at the base of the ascocarp venter. Ascospores 18-22 X 9-11 μm ($\bar{x}$= 20.6 X 10.3 μm), uniseriate, ellipsoid, one-septate, constricted at the septum, brown, seen as methalic reddish blue under phase contrast, verrucose with 0.3-0.7 μm in diam, rounded warts on the surface, surrounded by an evanescent spore sheath or ascus cytoplasm remnant which is stained orange with iodine.

Colonies on CMSWA light brown, cottony, 15-20 mm in diam after incubation for 4 weeks at 25 C. Single-ascospore isolates [AN-1243 (IFO 32497), AN-1244 (IFO 32498) and AN-1245] obtained from the specimen Shi-Ya-17 (IFO H-12151) produced ascocarps on CMSWA, from which ascospores were ejected around.

Substrates: Submerged wood of R. stylosa and B. gymnorrhyza.

Specimens examined: Submerged wood of R. stylosa, Shiira River, Shi-Ya-17, 20, 21, 26, and B. gymnorrhyza, Nakama River, Na-0-5.

Deuteromycetes

Cirrenalia tropicalis Kohlm.

Mycologia 60: 267 (1968)

Figs. 16, A-B

Conidiophores 16-76 μm long, 2.5-4 μm in diam, macronematous, mononematous, light brown. Conidiogenous cells integrated, determinate. Conidia solitary, produced holoblastically, helicoid, mostly 1 to 1.5 times contorted, 7-9 septate, not or slightly constricted at the septa, brown to dark brown; spirals 32-40 μm in diam; cells increasing in diameter from base to apex; terminal cell 8-16 μm high, 11-16 μm in diam.

Colonies on CMSWA dark brown to black. Single-conidium isolates [AN-1150 (IFO 32499) and AN-1151 (IFO 32500)] obtained from the specimen

Shi-Ya-0 (IFO H-12152) produced conidia abundantly on CMSWA.

Substrates: Submerged wood of R. stylosa and B. gymnorrhyza.

Specimens examined: Submerged wood of R. stylosa, Shiira River, Shi-Ya-0 and B. gymnorrhyza, Nakama River, Na-0-2.

Dictyosporium elegans Corda

Weitenweber's Beitrage ...: 87 (1836)

Figs. 17, A-C

Conidiophores micronematous, mononematous, hyaline to light brown. Conidiogenous cells integrated, determinate. Conidia 32-44 μm long, 18-32 μm wide, 8-11 μm thick, solitary, produced holoblastically, branched, cheiroid, composed of 5-7 rows of cells all approximately the same length.

Colonies on CMSWA white to hyaline. Single-conidium isolates [AN-1196 (IFO 32501), AN-1197 (IFO 32502) and AN-1198] obtained from the specimen Shi-Ya-4 (IFO H-12153) produced conidia abundantly on CMSWA.

Substrates: Submerged wood of R. stylosa.

Specimens examined: Submerged wood of R. stylosa, Shiira River, Shi-Ya-4.

Mycocentrolobium platysporum Goos

Mycologia 62: 172 (1970)

Figs. 18, A-K

Conidiophores micronematous, mononematous, short, hyaline. Conidiogenous cells integrated, determinate. Conidia up to 90 μm long, up to 120 μm wide, up to 25 μm thick, solitary, produced holoblastically, dictyosporous, flattened in one plane, variable in shape, fanwise or lobed, shiny dark brown, composed of two muriform fans united like a pair of scallop shells. From the upper edge of matured conidium, ampulliform phialids (?) are often formed.

Colonies on CMSWA white at first, then becoming olive green, 15-17 mm in diam after incubation for 25 days at 25 C. Single-conidium isolates [AN-1249 (IFO 32503), AN-1250 (IFO 32504) and AN-1251] obtained from the specimen Shi-Ya-29 (IFO H-12154) produced conidia abundantly on and in CMSWA.

Substrates: Submerged wood of R. stylosa.

Specimens examined: Submerged wood of R. stylosa, Shiira River, Shi-Ya-29.

Conidium development was first observed under SEM. Clavate conidium initials first develop into a stipitate cup, then opposing sides of the cup elongate upward and attach to each other at the apex of the two lobes. The lobes continue to elongate upward and laterally until they attach to each other along their edges. Septation in the lobes continues to become muriform. The young conidia resemble a pair of scallop shells. At maturity, the two lobes unite firmly and the middle line between them becomes obscure. Observation of broken conidia revealed that the two lobes are united along the facing sides and no space is left in the conidium. The phialide-like cells come from between the two lobes in mature conidia. But it is not clear whether these cells are phialides producing secondary conidia or germinating hypha.

Phragmospathula phoenicis Subram. & Nair

Antonie van Leeuwenhoek 32: 384 (1966)

Figs. 19, A-J

Conidiophores 8-14 μm long, 6-8 μm in diam, macronematous, mononematous, arising from creeping hyphae on wood, crowded, unbranched, short, clavate to cup-shaped, light brown. Conidiogenous cells integrated, percurrent. Conidia 35-42 X 9-11 μm, solitary, holoblastically produced on 2-3 times percurrent proliferating conidiophores, spathulate, three-septate; the apical cell hyaline, shortest (2-3 μm); two middle cells brown, broadest; the basal cell hyaline, longest (13-21 μm), vacating cytoplasm at maturity. Germination occurrs from the apical cell.

Colonies on CMSWA white to light brown. Single-conidium isolates [AN-1241 (IFO 32505) and AN-1242 (IFO 32506)] obtained from the specimen Shi-Ya-14 (IFO H-12155) produced conidia abundantly on CMSWA. Conidiophores arise mostly from hyphal tufts composed of 2-3 hyphae.

Substrates: Submerged wood of R. stylosa.

Specimens examined: Submerged wood of R. stylosa, Shiira River, Shi-Ya-0, 14, 28.

The above conidial measurements differed from the description (25-35 X 7-10 μm) by Ellis (1). In the original description, Subramanian and

Nair (1966) recorded only the length of the apical cell (3.3-6.0 μm) and the basal cell (9.9-26.4 μm), not the total length and width of conidia, and thus it is impossible to compare the sizes with those of the present fungus. However, conidial length was found to be variable, since the isolates produced remarkably shorter conidia, 25-33 X 8-11 μm (with 1.5-2 μm long apical cell and 9-14 μm long basal cell), on CMSWA than on natural substrates, the latter being similar to Ellis's measurements. Therefore, I tentatively identified this isolate as P. phoenicis. Further studies are necessary to clarify the variation of conidial size in this species.

Stachybotrys mangiferae Misra & Srivastava
Trans. Br. Mycol. Soc. 78: 556 (1982)

Figs. 20, A-C

Conidiophores 60-120 μm long, 3-4 μm in diam, macronematous, mononematous, branched, septate, hyaline to light brown, verrucose, covered with granules. Conidiogenous cells 10-14 X 3-4 μm, discrete, phialidic, borne in groups of 6-8 at the apex of conidiophore, clavate, light brown. Conidia 5-7 X 3-4 μm, ovoid to ellispoid, verrucose, greyish brown, aggregated in a globose drop.

Colonies on CMSWA white to hyaline with black conidial drops on conidiophores, grow fast. Multi-conidia isolates [AN-1177 (IFO 32507) and AN-1178 (IFO 32508)] obtained from the specimen Shi-Ya-5 (IFO H-12156) produced conidia abundantly on CMSWA.

Substrates: Submerged wood of R. stylosa.

Specimens examined: Submerged wood of R. stylosa, Shiira River, Shi-Ya-5.

Trichocladium achrasporum (Meyers & Moore) Dixon in Shearer and Crane
Mycologia 63: 244 (1971)
Basionym: Culcitalna achraspora Meyers & Moore, Amer. J. Bot. 47: 349 (1960)

Figs. 21, A-B

Conidiophores nearly absent or short, mononematous, hyaline, pro-

duced laterally on the mycelium. Conidiogenous cells integrated, determinate. Conidia 20-26 X 11-13 μm, ovate to obpyriform, two to three-septate, constricted and occasionally with black bands at the septa, brown to dark brown; basal cell subhyaline.

Colonies on CMSWA olive brown to dark brown, 4 cm in diam after incubation for 5 weeks at 25 C. Single-conidium isolates [AN-1182 (IFO 32509) and AN-1183 (IFO 32510)] obtained from the specimen Shi-Ya-4 (IFO H-12157) produced conidia abundantly on CMSWA.

Substrates: Submerged wood of R. stylosa and B. gymnorrhyza.

Specimens examined: Submerged wood of R. stylosa, Shiira River, Shi-Ya-4 and B. gymnorrhyza, Shiira River, Shi-O-3.

Frequency of occurrence of fungi

Of the 45 wood samples of R. stylosa and 15 samples of B. gymnorrhyza, 34 and 9 samples, respectively, were found to be colonized by mangrove fungi. The frequency of occurrence of fungal species is summarized in Table 1.

Caryosporella rhizophorae, Dactylospora haliotrepha and Swampomyces triseptatus were commonly found. The former two have frequently been reported from mangroves in various parts of the world (3, 4, 5, 6, 8, 10). The third species is a very recently described one, but (as Sphaerulina cf. oraemaris) it was reported to be one of the common fungi on mangroves in Thailand (6).

Apparent host specificity or preference was seen in some species; e.g., C. rhyzophorae, Lineolata rhizophorae and Swampomyces triseptatus was found only on Rhizophora stylosa, while Hypoxylon oceanicum was found only on Bruguiera gymnorrhyza. This relationship is not certain, however, because of the small sample size. Host-specific fungal distribution is known on various species of mangrove trees (4). This fungal distribution may be affected by differences of substrates, e.g., chemical composition of wood, or environments where the mangrove trees and the inhabiting fungi grow. The two host trees examined here occupy different habitats in the mangrove area. Rhizophora stylosa grows mainly at river mouth close to the sea with higher salinity, while Bruguiera gymnorrhyza inhabits the middle to upper reach with lower salinity. In addition to these differences, the stage of decomposition of wood (10), the presence

Table 1. Occurrence of fungi from intertidal decomposing mangrove wood of Rhizophora stylosa and Bruguiera gymnorrhyza.

Fungal species	Substrate	
	R. stylosa	B. gymnorrhyza
Aigialus grandis	1a)	1b)
Aigialus sp. 1*	1	0
Aniptodera limnetica	0	1
Aniptodera longispora	1	0
Caryosporella rhyzophorae	15	0
Cucullosporella mangrovei	1	0
Dactylospora haliotrepha	11	2
Halosarpheia abonis	2	0
Halosarpheia fibrosa	1	0
Halosarpheia sp. 1*	1	3
Hypoxylon oceanicum	0	3
Leptosphaeria perviana?*	1	0
Lignincola sp. 1*	2	1
Lignincola sp. 2*	1	0
Lignincola sp. 3*	0	1
Lulworthia sp. 1*	0	1
Lineolata rhizophorae	5	0
Massarina ramunculicola	2	0
Quintaria lignatilis	3	0
Remispora salina?*	1	0
Savoryella paucispora	0	1
Savoryella sp. 1*	4	0
Swampomyces triseptatus	13	0
Swampomyces sp. 1*	1	0
Verruculina enalia	4	1
Cirrenalia tropicalis	0	1
Dictyosporium elegans	1	0
Mycocentrolobium platysporum	1	0
Phragmospathula phoenicis	2	0
Stachybotrys mangiferae	1	0
Trichocladium achrasporum	1	1

* Unidentified species.

a) Numbers of samples on which the fungus was observed out of 45 samples of R. stylosa.

b) Numbers of samples on which the fungus was observed out of 15 samples of B. gymnorrhyza.

or absence of bark on wood (6), season, fungal species-species interaction, and various environmental factors should be examined to clarify the factors affecting fungal distribution. Further studies, especially combined with cultural studies, and accumulation of flora data on individual mangrove tree species are necessary.

I wish to express my thanks to Dr. K. D. Hyde (Qld. D. P. I., Australia) and the International Mycological Institute (UK) for lending me authentic specimens.

References

1) Ellis, M. B. 1971. Dematiaceous Hyphomycetes. C. M. I., Kew, England.
2) Farrant, C. A. 1986. An electron microscope study of ascus and ascospore structure in Aniptodera and Halosarpheia, Halosphaeriaceae. In S. T. Moss (ed.) The biology of marine fungi, p. 231-243. Cambridge Univ. Press, Cambridge.
3) Hyde, K. D. 1989. Intertidal mangrove fungi from north Sumatra. Can. J. Bot. 67: 3078-3082.
4) Hyde, K. D. 1990. A comparison of the intertidal mycota of five mangrove tree species. Asian Mar. Biol. 7: 93-107.
5) Hyde, K. D. and E. B. G. Jones. 1988. Marine mangrove fungi. Mar. Ecol. (P. S. Z. N. I.) 9: 15-33.
6) Hyde, K. D., A. Chalermongse, and T. Boonthavikoon. 1990. Ecology of intertidal fungi at Ranong mangrove, Thailand. Trans. Mycol. Soc. Japan 31: 17-27.
7) Jones, E. B. G. and K. D. Hyde. 1992. Taxonomic studies on Savoryella Jones et Eaton (Ascomycotina). Bot. Mar. 35: 83-91.
8) Kohlmeyer, J. 1984. Tropical marine fungi. Mar. Ecol. (P. S. Z. N. I.) 5: 329-378.
9) Shearer, C. A. 1989. Aniptodera (Halosphaeriaceae) from wood in fresh water habitats. Mycologia 81:139-146.
10) Tan, T. K., W. F. Leong, and E. B. G. Jones. 1989. Succession of fungi on wood of Avicennia alba and A. lanata in Singapore. Can. J. Bot. 67: 2686-2691.

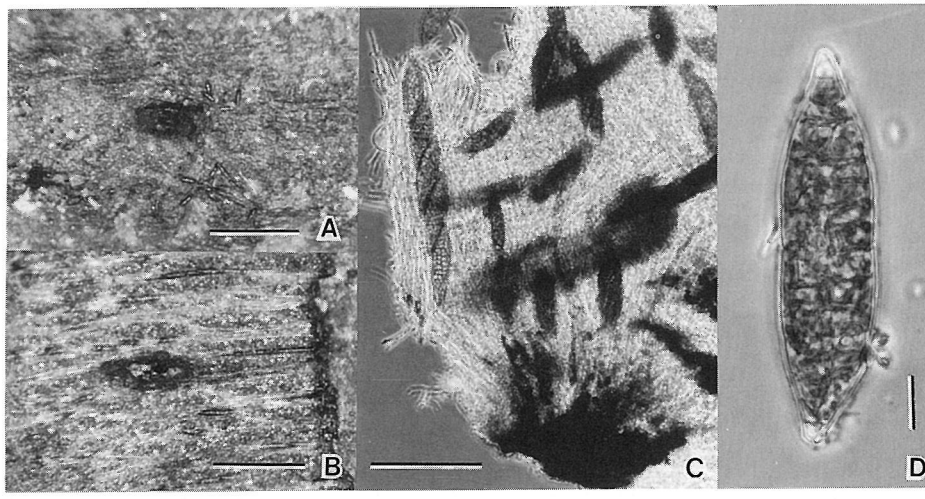

Fig. 1, A-D. Aigialus grandis. A. Front view of immersed ascocarp showing an ostiole opening. B. Surface-scraped wood showing ascocarp with thick peridium. C. Asci and pseudoparaphyses (?). D. Ascospore. (Bars: A, B = 500 μm; C = 100 μm; D = 10 μm)

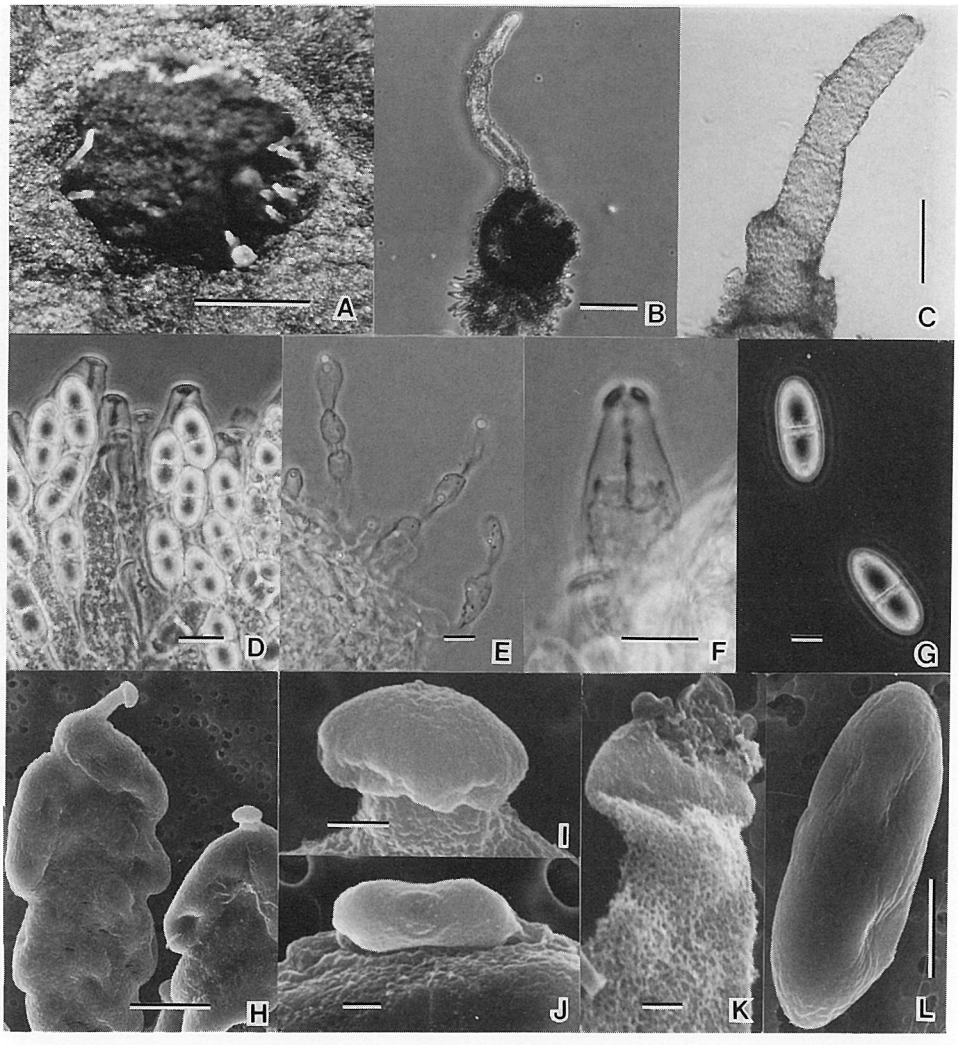

Fig. 2, A-L. Aniptodera limnetica. A. Ascocarp necks emerging from wood. B. Ascocarp. C. Ascocarp neck with band-like hyphal structures. D. Asci with a thick apical plate. E. Catenophyses. F. Fissured ascus apex. G. Ascospores. H. Asci. I-J. Apical plate with pore-like structure. K. Dehiscent ascus apex. L. Ascospore. (Bars: A = 500 μm; B = 100 μm; C = 50 μm; D-H = 10 μm; I-K = 1 μm; L = 5 μm)

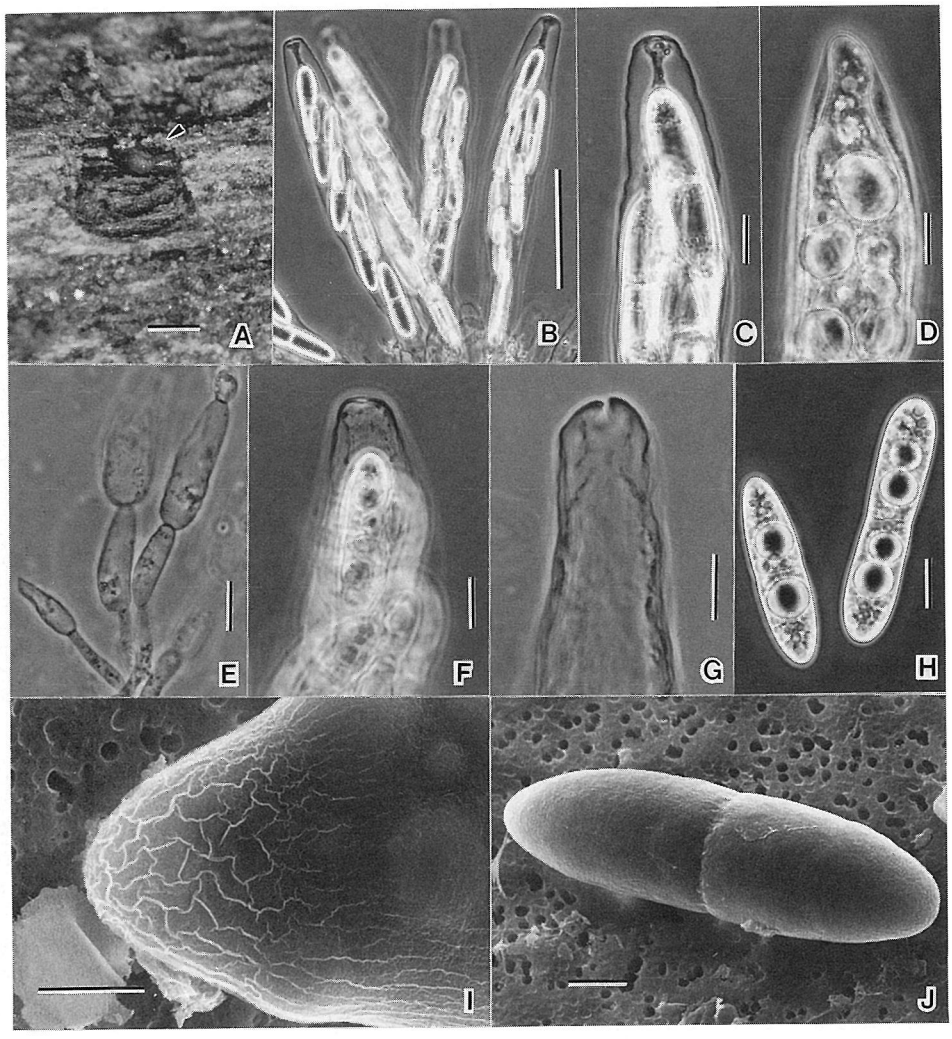

Fig. 3, A-J. Aniptodera longispora. A. Side view of immersed ascocarp lying horizontally (arrow). B. Asci. C. Apex of mature ascus with a refractive pore or plug-like structure. D. Subapex of young ascus with swollen cytoplasm. E. Catenophyses. F. A refractive structure at ascus apex. G. Dehiscent ascus apex. H. Ascospores. I. Ascus apex. J. Ascospore. (Bars: A = 500 μm; B = 50 μm; C-H = 10 μm; I, J = 5 μm)

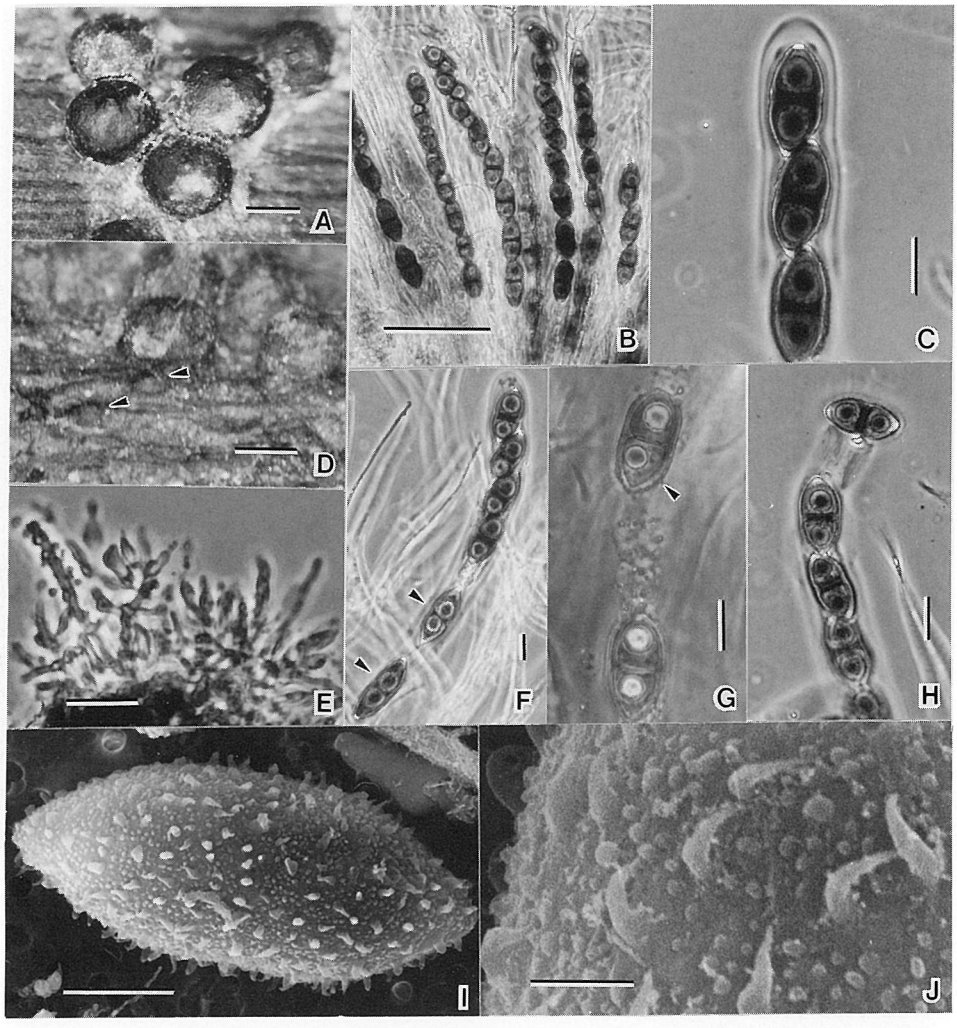

Fig. 4, A-J. Caryosporella rhizophorae. A. Front view of ascocarps on wood. B. Asci and pseudoparaphyses (?). C. Ascus apex with ectoascus. D. Pycnidia (or spermogonia?) (arrows) formed close to ascocarps. E. Phialides in pycnidia producing conidia (or spermatia?). F. Six-spored ascus with two larger spores (arrows) and four spores of ordinary size. G. Young ascospores with thick and verrucose outer wall (arrow) which is separated from inner wall. H. Ascus and released ascospore. I-J. Ascospore surface with flexible conical spines and small granules. (Bars: A, D = 500 μm; B = 50 μm; C, E-H = 10 μm; I = 5 μm; J = 1 μm)

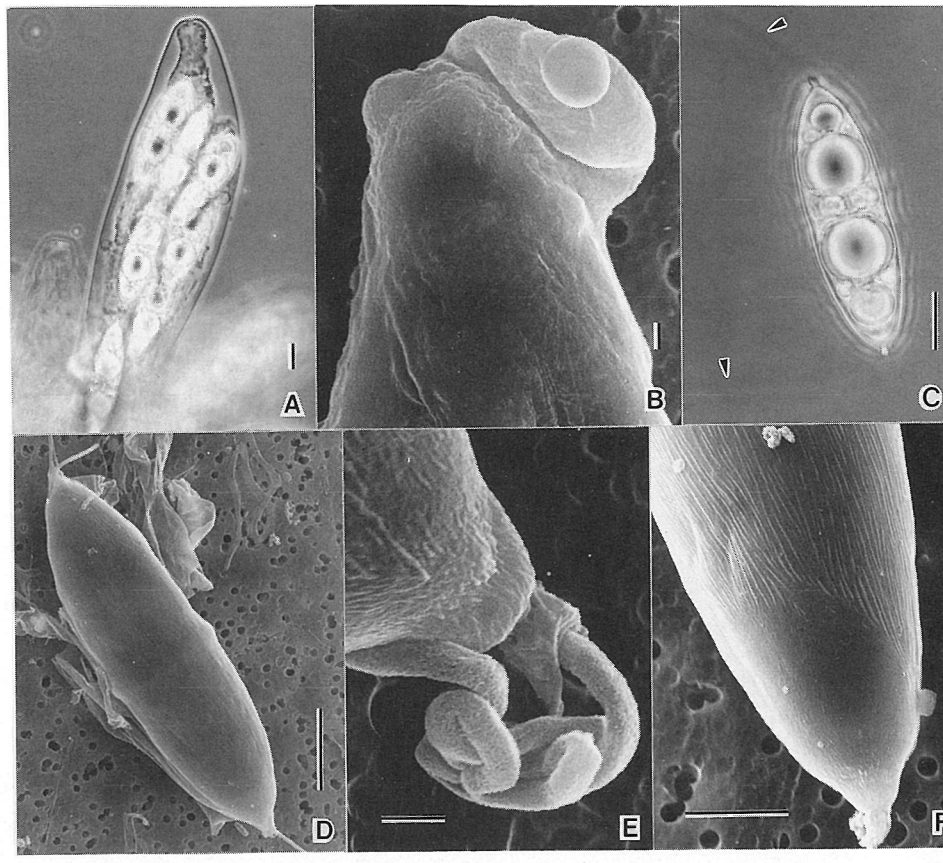

Fig. 5, A-F. Cucullosporella mangrovei. A. Ascus with thickened apex and a refractive structure and with subapical swelling of cytoplasm. B. Thickened ascus apex and a plug-like structure. C. Ascospore with thread-like appendages (arrows). D. Ascospore. E. Appendage arising from tube-like extension at the end of ascospore. F. Striation on ascospore surface. (Bars: A, C, D = 10 μm; B, E = 1 μm; F = 5 μm)

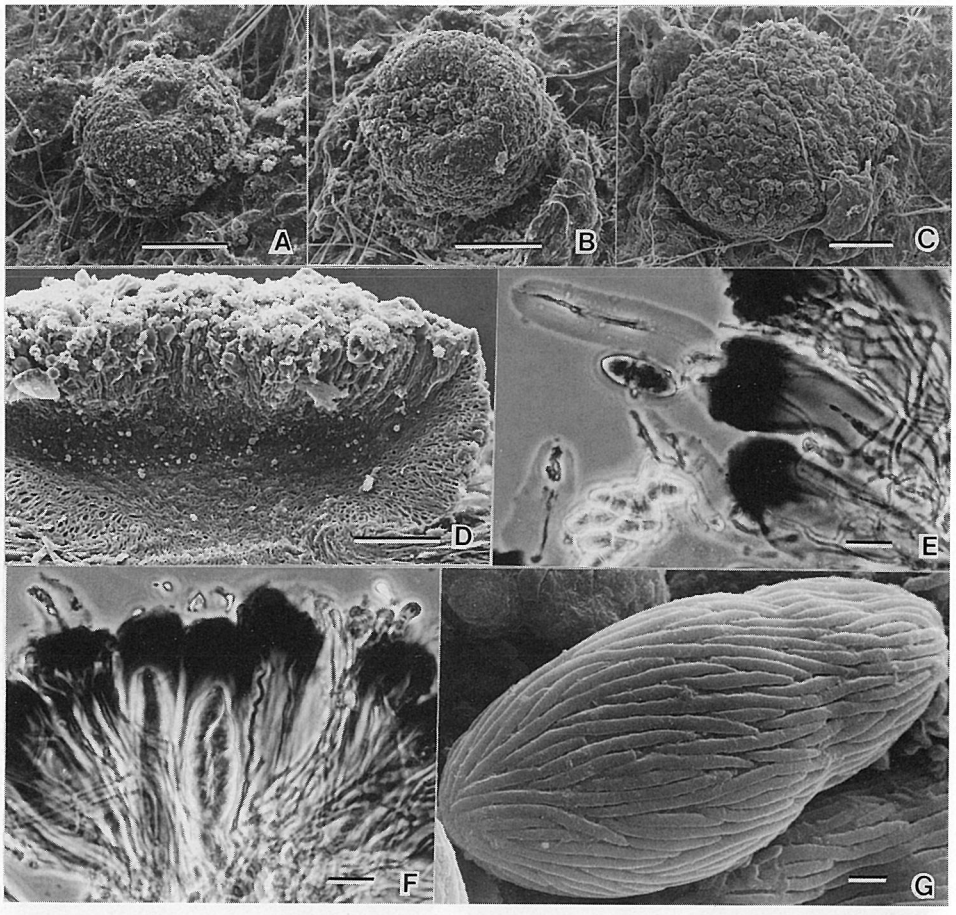

Fig. 6, A-G. Dactylospora haliotrepha. A-C. Development stages of ascocarp. D. Vertical section of ascocarp. E. Fissitunicate ascus showing elongated endotunica. F. Asci covered with gelatinous sheath which is stained blue by iodine. G. Ascospore with longitudinally woven ribs on the surface. (Bars: A-C = 100 μm; D = 50 μm; E, F = 10 μm; G = 1 μm)

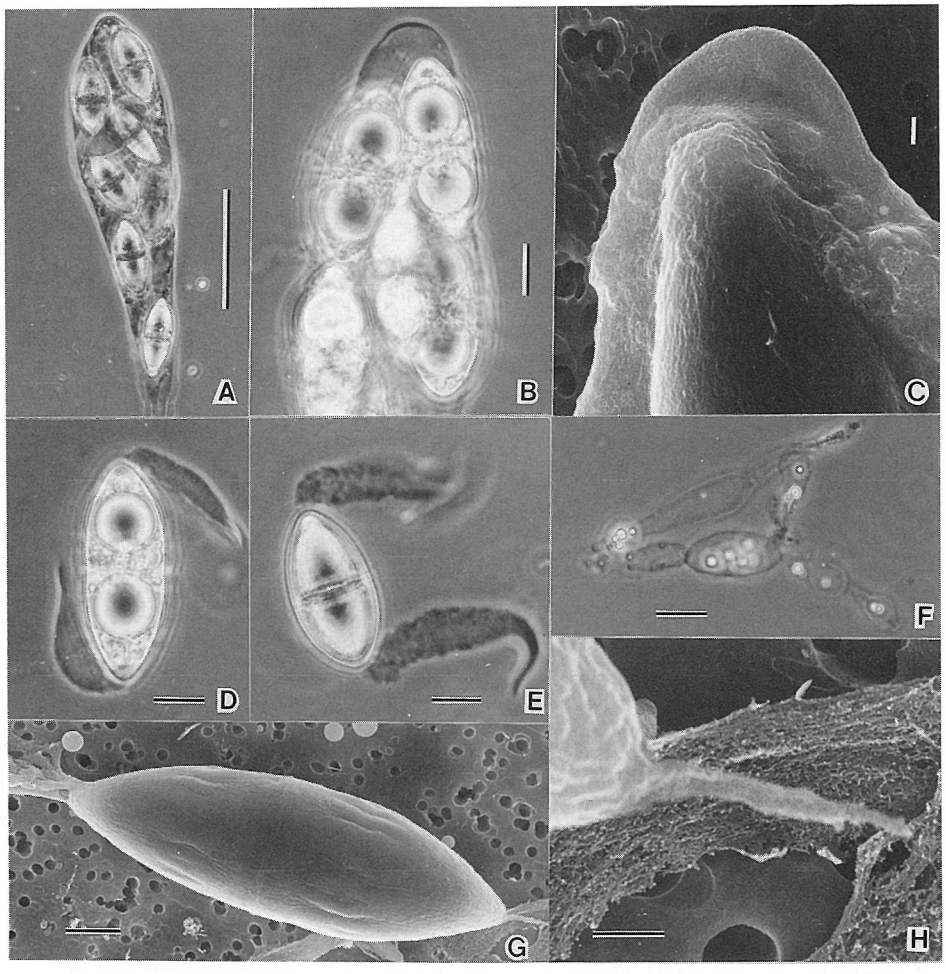

Fig. 7, A-H. Halosarpheia abonis. A. Ascus. B. Thickened ascus apex. C. Ascus apex under SEM. D. Ascospore with scoop-like appendages. E. Ascospore with uncoiled appendages. F. Catenophyses. G. Ascospore. H. Appendage composed of fine fibers. (Bars: A = 50 μm; B, D-F = 10 μm; C, H = 1 μm; G = 5 μm)

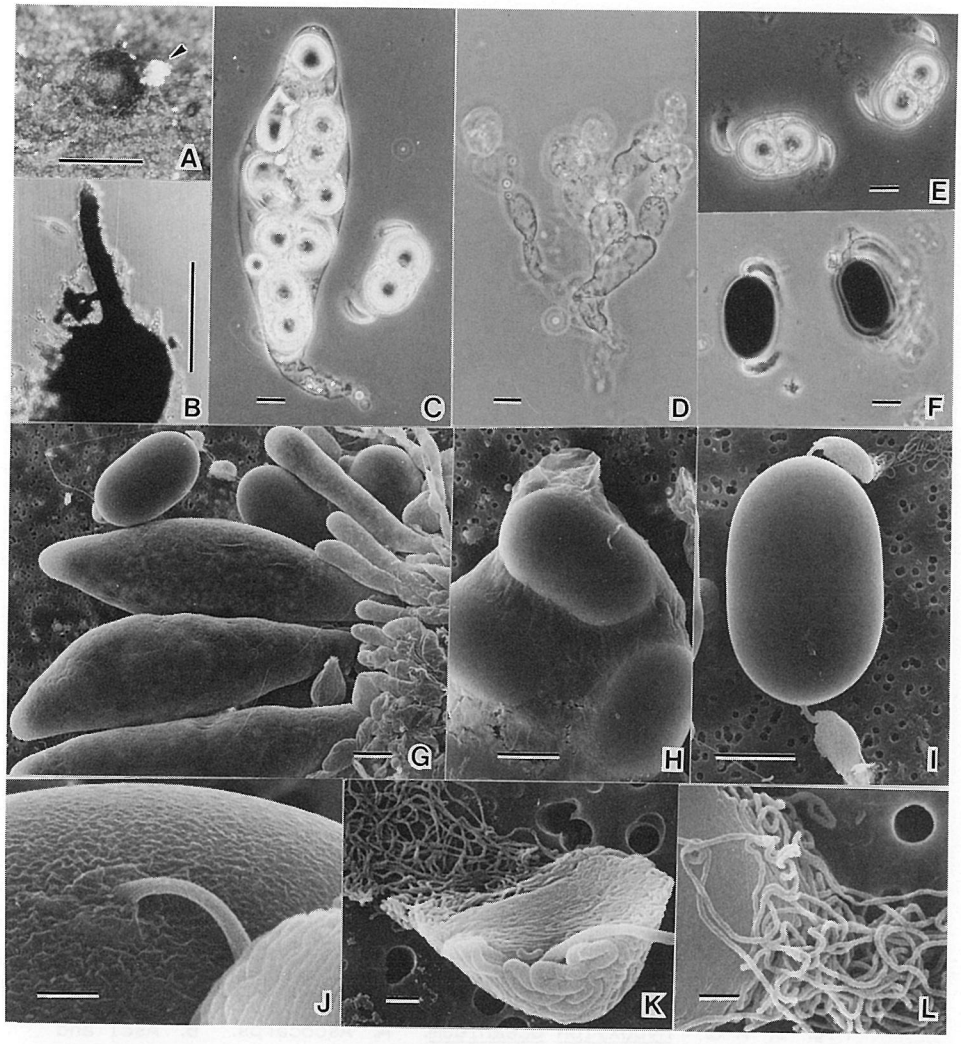

Fig. 8, A-L. Halosarpheia fibrosa. A. Ascocarp with a neck, from which asci and ascospores are ejected (arrow). B. Ascocarp with a long neck. C. Thin-walled ascus and an ascospore. D. Catenophyses. E. Ascospores with cap-like appendages. F. Ascospores densely stained brown with iodine. G. Asci. H. Thin-walled ascus apex. I. Ascospore with appendages. J. Appendage string attaching to the pole of ascospore. K. Appendage composed of filament. L. Uncoiling filament of appendage. (Bars: A, B = 500 μm; C-I = 10 μm; J-L = 1 μm)

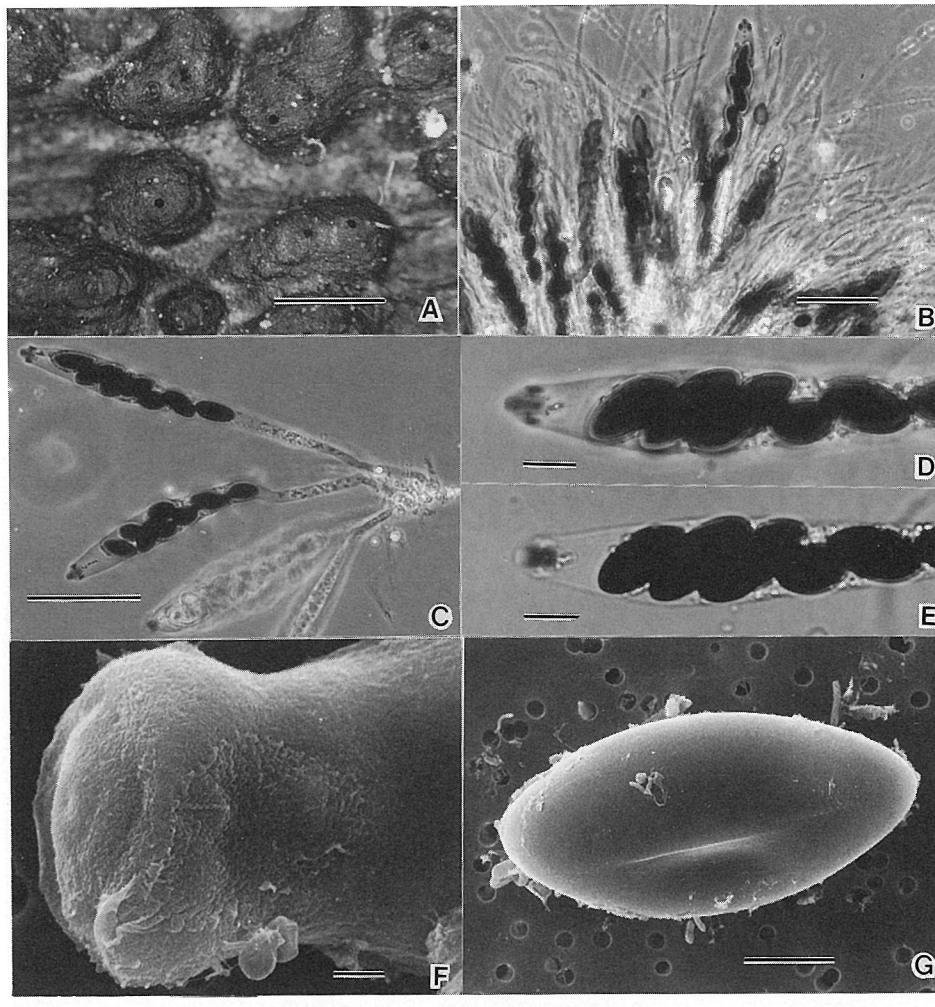

Fig. 9, A-G. Hypoxylon oceanicum. A. Ascocarps. B. Asci and paraphyses. C. Mature and immature asci. D. Ascus apex under phase-contrast light microscope. E. Apical ring of ascus stained with iodine under ordinary light microscope. F. Undulate disc with a pore-like depression at ascus apex. G. Ascospore with a germ slit. (Bars: A = 1mm; B, C = 50 μm; D, E = 10 μm; F = 1 μm; G = 5 μm)

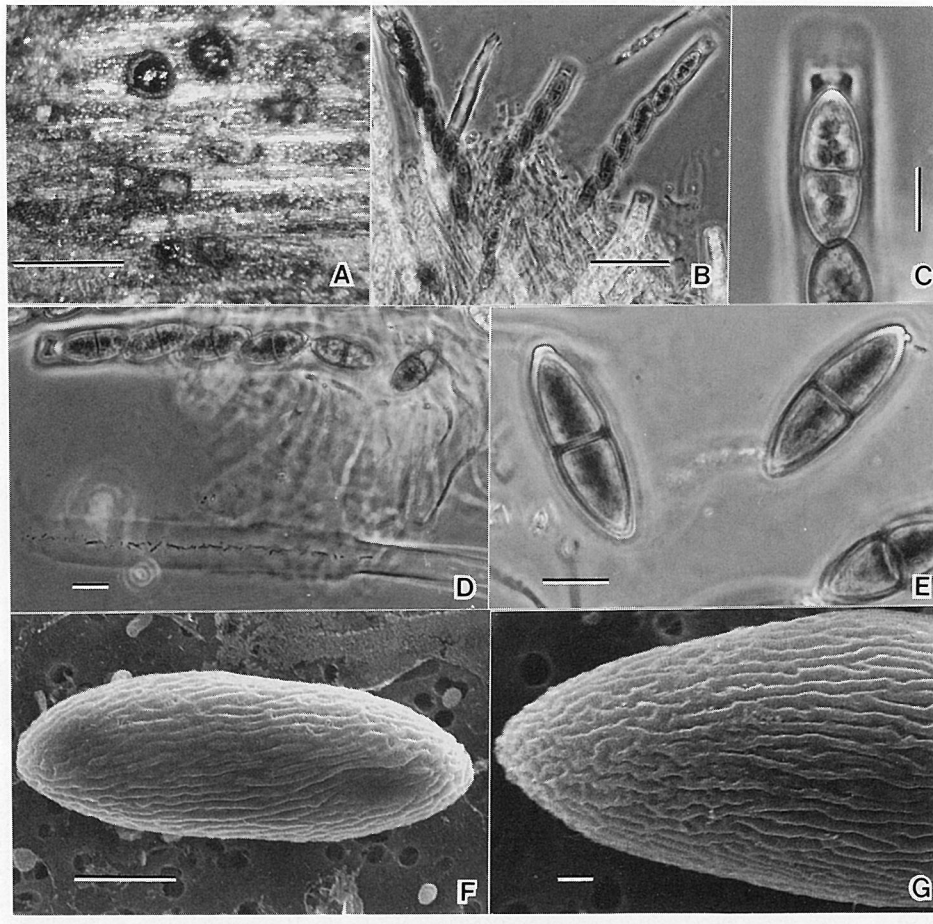

Fig. 10, A-G. Lineolata rhizophorae. A. Surface-scraped wood showing immersed ascocarps. B. Asci and pseudoparaphyses (?). C. Ascus apex with refractive apparatus. D. Physoclastic bitunicate asci. E. Ascospores. F-G. Ascospore with longitudinal striation of ribs. (Bars: A = 500 μm; B = 50 μm; C-E = 10 μm; F = 5 μm; G = 1 μm)

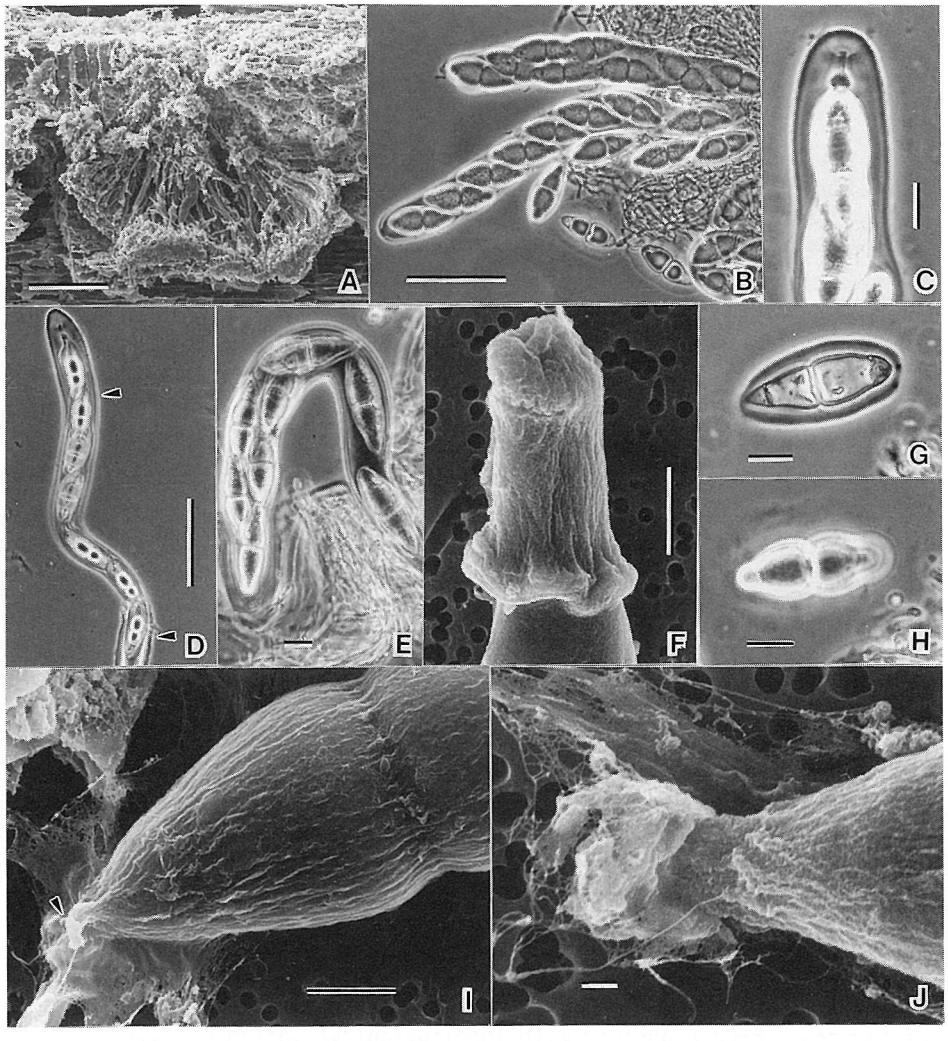

Fig. 11, A-J. Massarina ramunculicala. A. Vertical section of immersed ascocarp. B. Asci and pseudoparaphyses (?). C. Ring-like apical apparatus of ascus. D. Bitunicate ascus. Arrows shows ectotunica. E. Elongated and exposed endotunica stained brown with iodine. F. Ascus apex covered with ectotunica. G. Ascospore surrounded by sheath. H. Ascospore surrounded by mucilage. I-J. Ascospore pole releasing mucilage through tube-like structure (arrow). (Bars: A = 100 μm; B, D = 50 μm; C, E, G, H =10 μm; F, I = 5 μm; J = 1 μm)

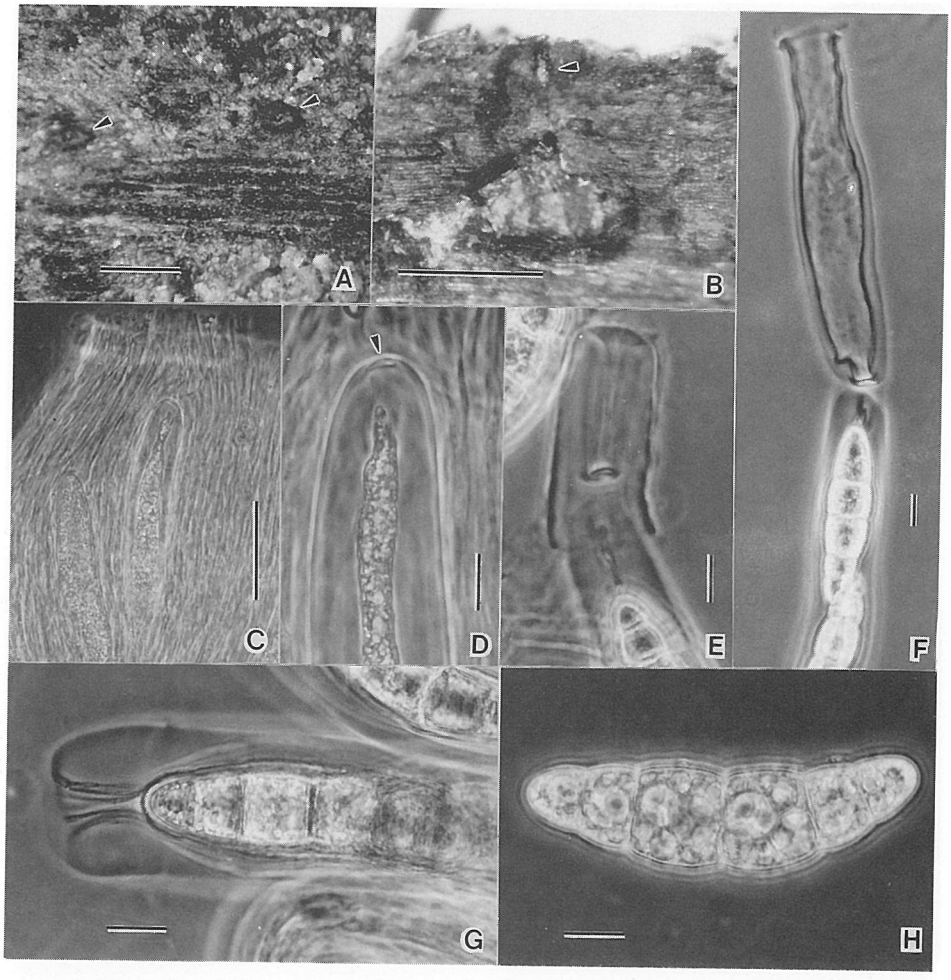

Fig. 12, A-H. Quintaria lignatilis. A. Surface view of immersed ascocarps. Arrows show ostiole openings. B. Vertical section of immersed ascocarp with an ostiole (arrow). C. Asci and pseudoparaphses (?). D. Ascus apex with apical plate (arrow). E-F. Inverting and completely inverted ectotunica attaching to endotunica at apical plate. G. Apex of endotunica releasing ascospores. H. Ascospore. (Bars: A, B = 500 μm; C = 50 μm; D-H = 10 μm)

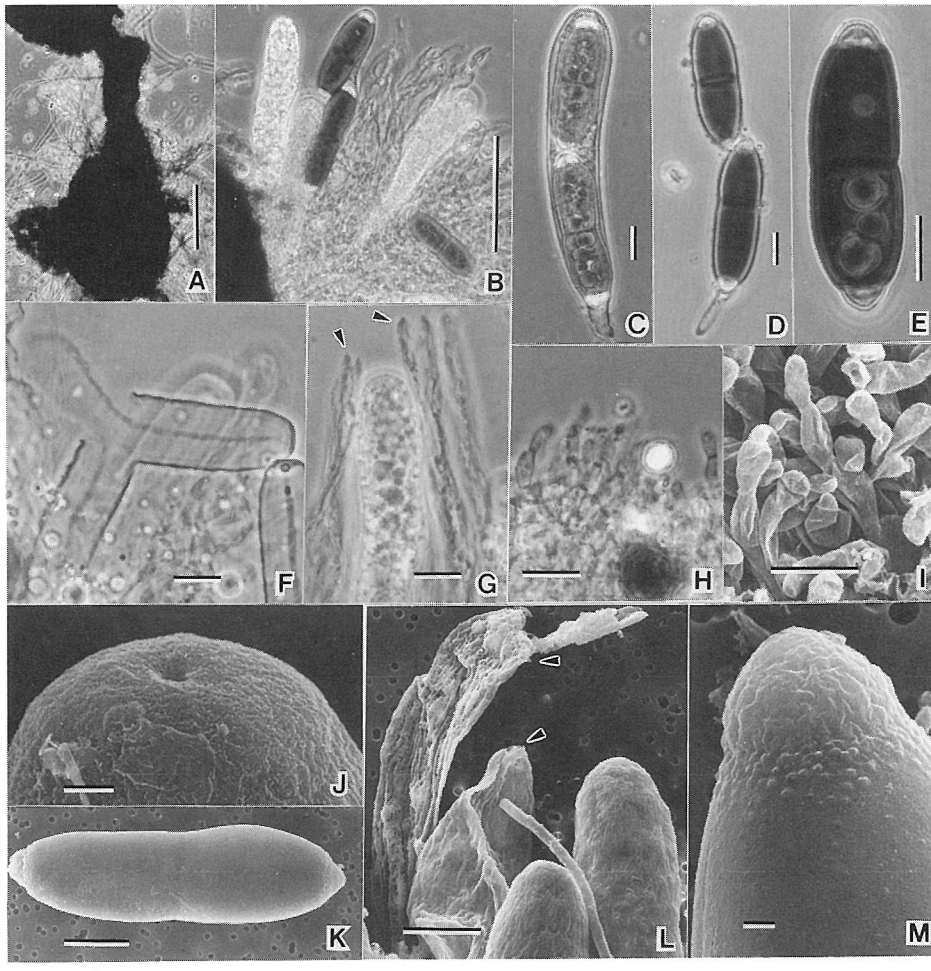

Fig. 13, A-M. Savoryella paucispora. A. Ascocarp. B. Mature and immature asci. C. Young ascus. D. Mature ascus. E. Ascospore. F. Thick-walled ascus releasing cytoplasm from the middle, resembling physoclastic bitunicate ascus. G. Spore-released asci with split apex (arrows). H-I. Catenophyses. J. Pore (or depression) of ascus apex. K. Ascospore. L. Dehiscent ascus apices (arrows). M. Spore end with small warts on the surface. (Bars: A = 100 μm; B, C = 50 μm; D-I, K, L = 10 μm; J, M = 1 μm)

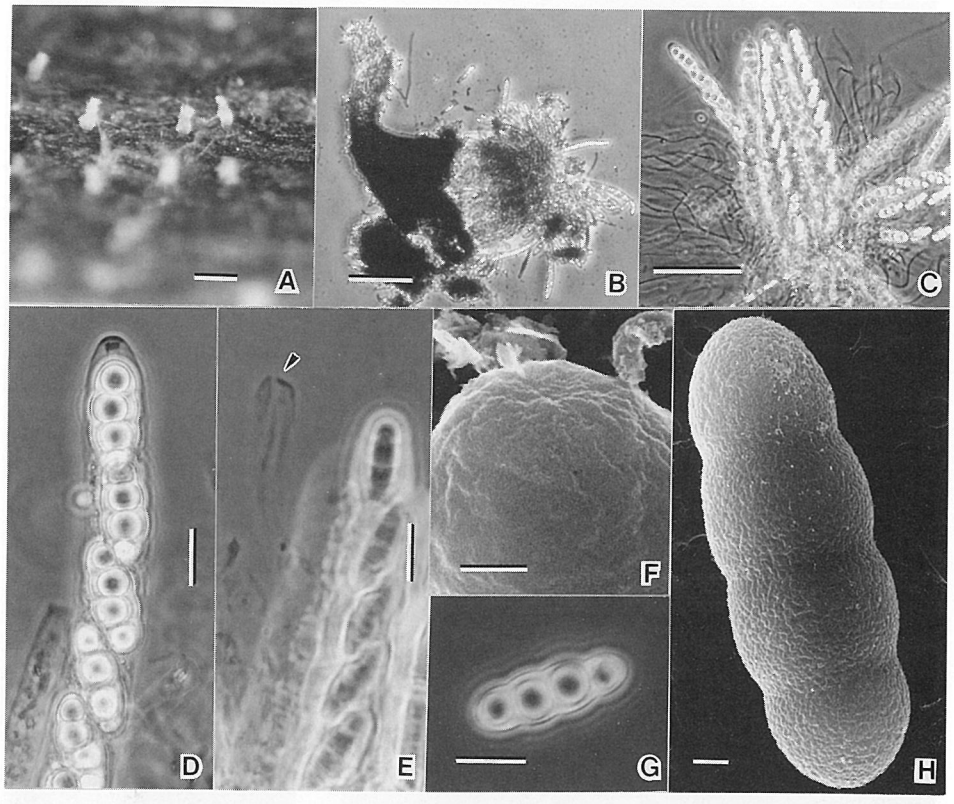

Fig. 14, A-H. Swampomyces triseptatus. A. Necks of immersed ascocarps. B. Horizontally lying ascocarp with a perpendicularly bending neck. C. Asci and paraphyses. D. Ascus apex with apical thickening and ring-like structure. E. Split apex of spore-released ascus. F. Ascus apex with central indentation. G. Ascospore. H. Ascospore with granular surface. (Bars: A, B = 100 μm; C = 50 μm; D, E, G = 10 μm; F, H = 1 μm)

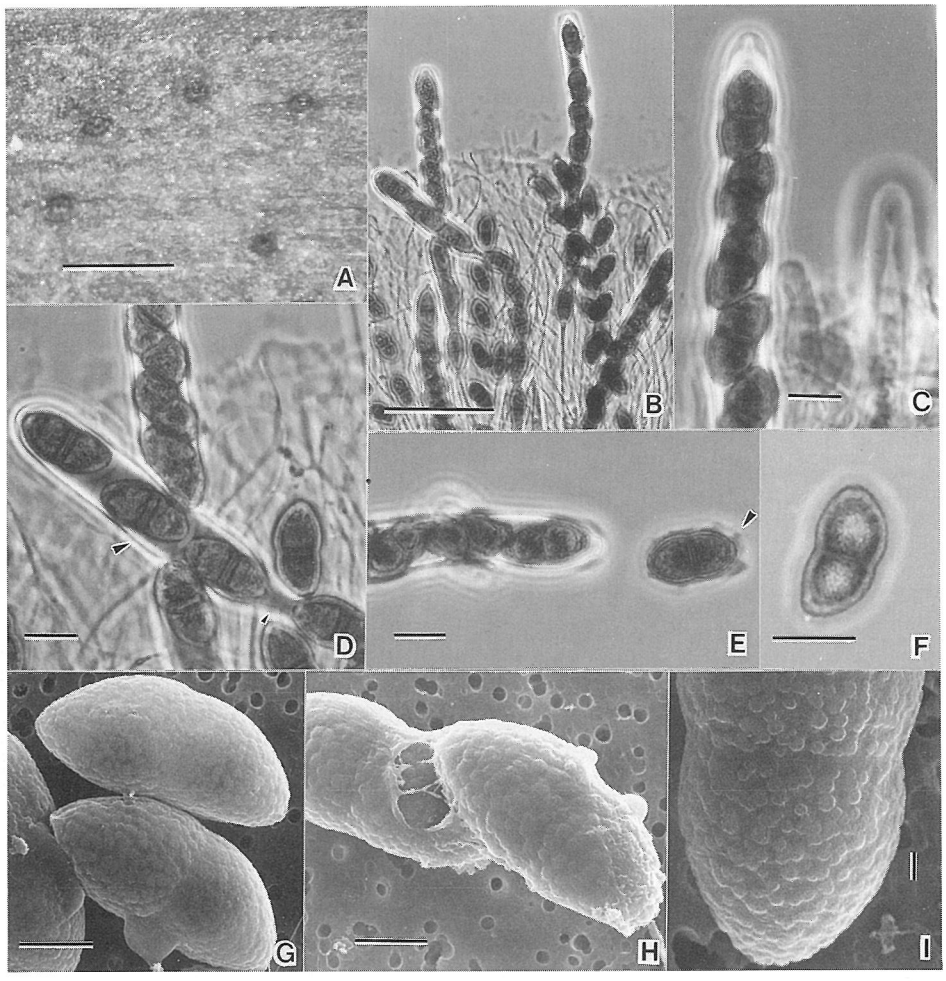

Fig. 15, A-I. Verruculina enalia. A. Surface view of immersed ascocarps showing ostiole openings. B. Asci and pseudoparaphyses (?). C. Ascus apex with subapical thickening of endotunica. D. Physoclastic bitunicate ascus showing ectotunica (large arrow) and endotunica (small arrow). E. Ascospore released from ascus apex, surrounded by mucilage (arrow). F. Ascospore. G-H. Ascospores surrounded by mucilage (or ascus cytoplasm remnant?). I. Verrucose spore surface with rounded warts. (Bars: A = 500 μm; B = 50 μm; C-F = 10 μm; G, H = 5 μm; I = 1 μm)

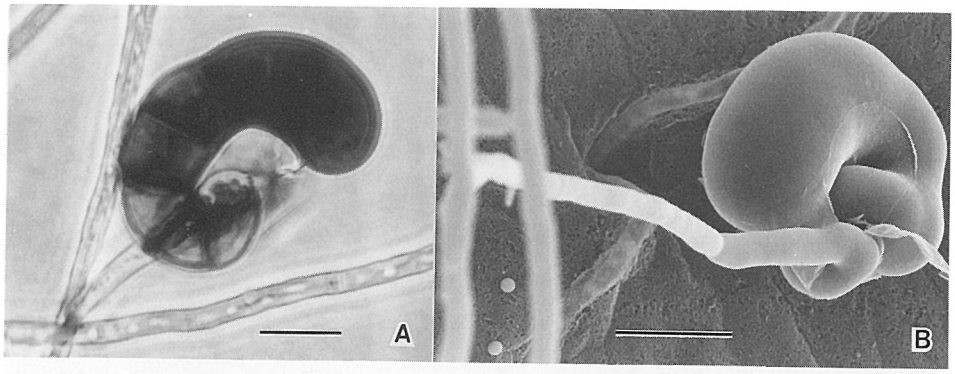

Fig. 16, A-B. Cirrenalia tropicalis. A-B. Conidium. (Bars: A, B = 10 μm)

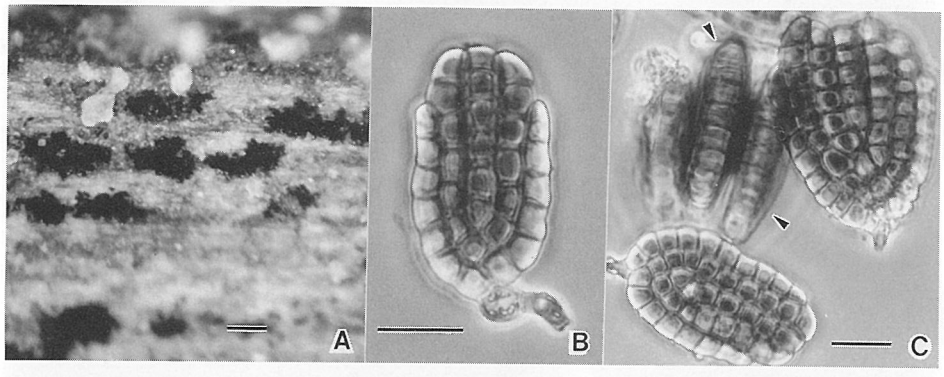

Fig. 17, A-C. Dictyosporium elegans. A. Conidial mass produced on wood. B. Conidium. C. Surface views and side views (arrows) of conidia. (Bars: A = 100 μm; B, C = 10 μm)

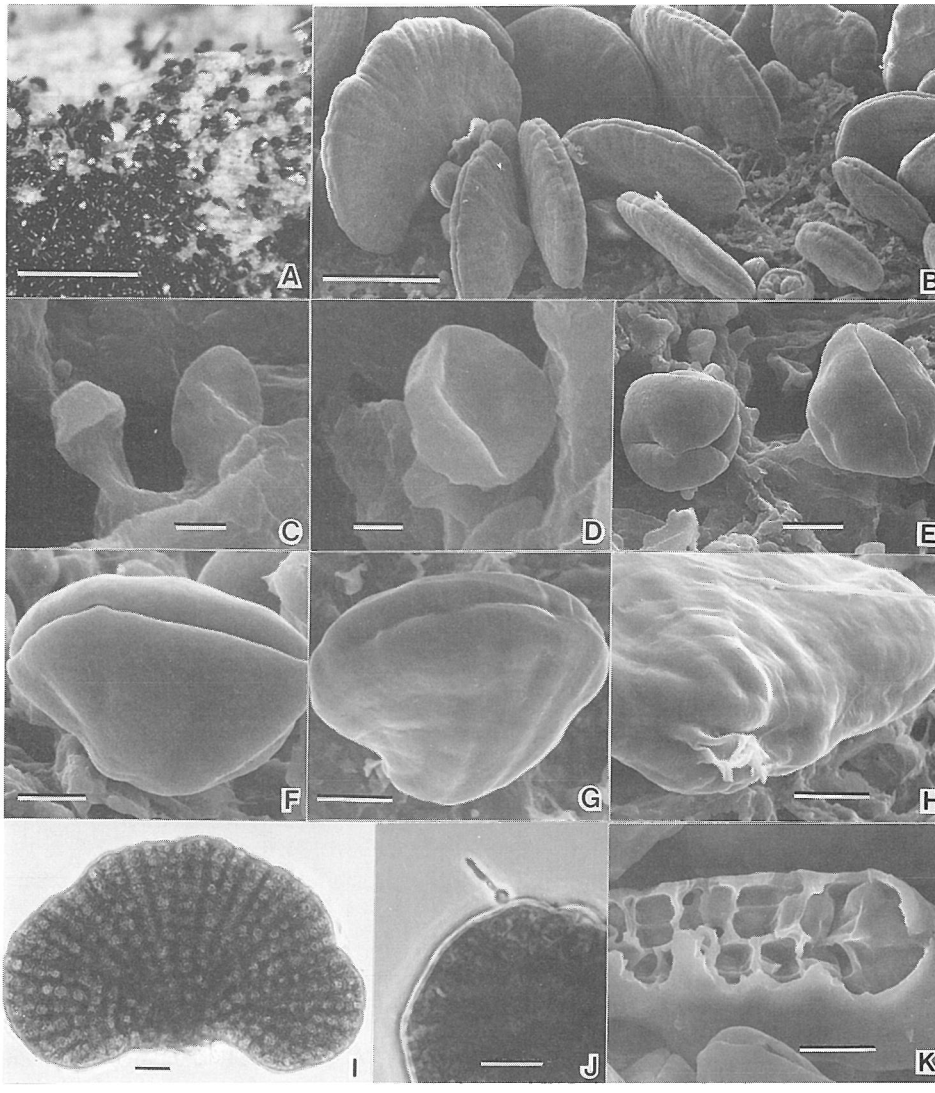

Fig. 18, A-K. Mycocentrolobium platysporum. A. Conidial mass produced on wood. B. Conidia. C-G. Development stages of conidium. H. Conidium base with a remains of conidiophore. I. Dictyosporous fan-shaped conidium. J. Phialide-like cell arising from conidium. K. Broken conidium showing the two composing lobes completely united with no space between. (Bars: A = 500 μm; B = 50 μm; C, D = 1 μm; E, F = 5 μm; G-K = 10 μm)

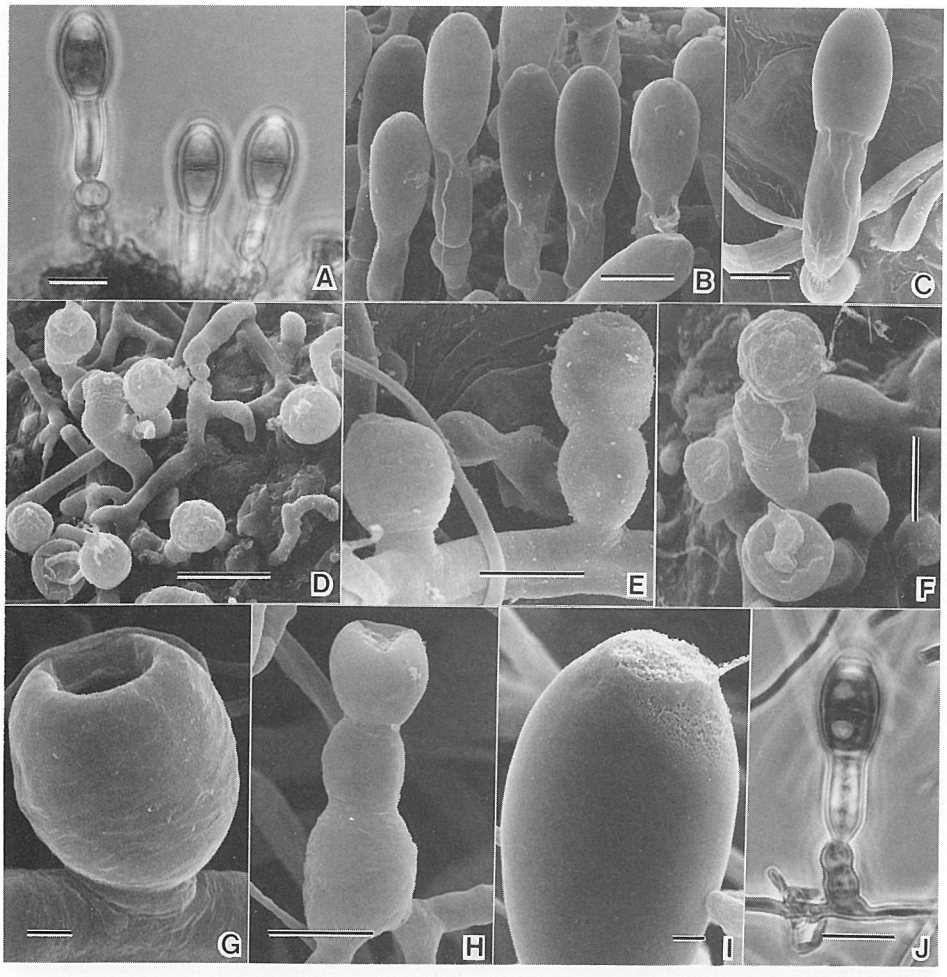

Fig. 19, A-J. Phragmospathula phoenicis. A-B. Conidia on wood. C. Conidium detaching from conidiophore. D. Conidiophores arising from creeping hyphae on wood. E-F. Percurrently proliferated conidiophores. G. Cup-shaped conidiophore. H. Three times proliferated conidiophore. I. Conidium apex with scar possibly left after detachment of a previously formed conidium. J. Conidium produced in culture. (Bars: A, B, D, J = 10 μm; C, E, F, H = 5 μm; G, I = 1 μm)

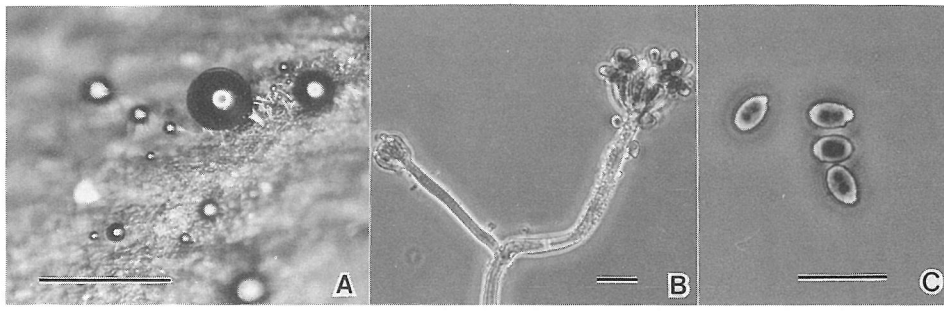

Fig. 20, A-C. Stachybotrys mangiferae. A. Habit on wood. Black drops are mass of conidia produced on conidiophores. B. Conidiophore. C. Conidia. (Bars: A = 500 μm; B, C = 10 μm)

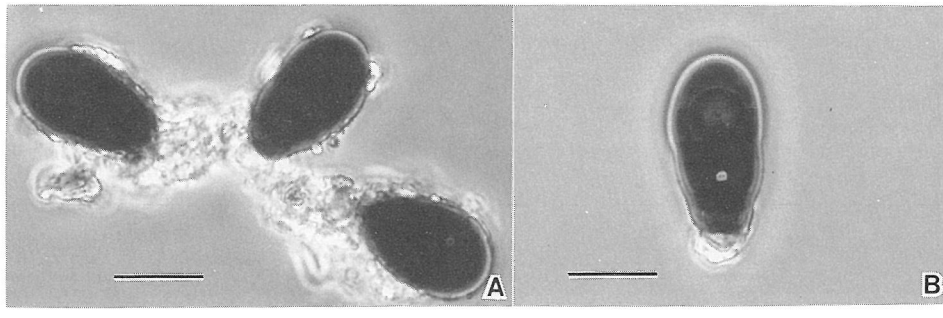

Fig. 21, A-B. Trichocladium achrasporum. A-B. Conidia. (Bars: A, B = 10 μm)