

Dyrithiopsis lakefuxianensis gen. et sp. nov. from Fuxian Lake, Yunnan, China, and notes on the taxonomic confusion surrounding *Dyrithium*

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Abstract: A new taxon with *Dyrithium*-like characteristics was collected from Lake Fuxian in China. The taxon is typical of the *Amphisphaeriaceae* in that it has relatively large, ostiolate, immersed ascomata, unitunicate asci with a J+ subapical ring, and brown ascospores. It is similar to *Dyrithium* in that it has muriform ascospores, but considerable confusion surrounds this genus. In *Dyrithium* asci are bitunicate and lack a J+ subapical ring, while this was not true of our species. A new genus, *Dyrithiopsis*, therefore is established to accommodate this new taxon. Details of its anamorph also are provided, based on cultural studies. Parsimony analyses of part of the large-subunit rDNA provide further evidence to support the familial placement of this new genus in the *Amphisphaeriaceae*. The taxonomic position of *Dyrithium* also is discussed.

Key words: Amphisphaeriaceae, anamorph, *Pestalotiopsis*, phylogeny, rDNA

INTRODUCTION

Dyrithium M.E. Barr is a monotypic genus represented by *Sphaeria livida* Fr., which was included in the Amphisphaeriaceae by Barr (1994). However, Kang et al (1999a) re-examined genera in the Amphisphaeriaceae and excluded *Dyrithium* because the asci in the collection they examined were bitunicate. This collection had been listed as a collection of *Dyrithium lividum* (Fr.) M.E. Barr by Barr (1994). However, Kang et al (1999a) had not examined the holotype of *Sphaeria livida*.

During a biodiversity survey of fungi on submerged wood in Lake Fuxian, Yunnan, China (Cai et al 2002), we collected a taxon with characteristics that keyed out to *Dyrithium* in the key provided by Barr (1994). Ascospores were brown and muriform, while asci were unitunicate and the ostiolate ascomata were relatively large and immersed. The taxon differed from *Dyrithium*, however, in that it clearly has unitunicate asci with a J+ subapical ring. In this respect it was even more typical of the Amphisphaeriaceae.

The objectives of this study are: (i) to establish *Dyrithiopsis* as a new genus; (ii) to support its inclusion in the family Amphisphaeriaceae based on phylogenetic analyses of part of the rDNA sequences; and (iii) to discuss its morphological affinities with *Dyrithium*.

MATERIALS AND METHODS

Morphological and cultural studies.—A fresh specimen of the new species collected from Yunnan, China, and the herbarium specimen of *Dyrithium* obtained from UPS were examined morphologically. To establish anamorph-teleomorph connections of the new species, single ascospores from ascomata were isolated by micromanipulation, following the procedures as outlined by Goh (1999) and Choi et al (1999), and allowed to grow on PDA agar under light at 24–26 C. For examination of morphological features of the teleomorph, cotton blue/lactic acid and phase-contrast microscopy were used. Measurements of the conidia arising from the single ascospore culture were done in water.

DNA extraction, amplification and sequencing.—Single-spore cultures of the new species were grown on PDA medium for 3 wk. Sources, Genbank accession numbers, designation and geographical origin of species used in this study are listed in TABLE I. Mycelia were used as the starting material for DNA extraction, following a modified protocol of Doyle

TABLE I. Fungal strains used in the study, and their accession numbers, hosts and locality

Species	Source of cultures ^a	Host, geographic origin	GenBank No.
Ingroup			
<i>Amphisphaeria umbrina</i>	HKUCC 994	<i>Tilia</i> sp., Switzerland	AF452029
<i>Bartalinia robillardoides</i>	BRIP 14180	<i>Macrotyloma daltonii</i> , Australia	AF382366
<i>Discosia</i> sp.	HKUCC 6626	Unidentified dead leaf, Hong Kong	AF382381
<i>Discostroma tosta</i>	HKUCC 1004	Unidentified terrestrial wood, Hong Kong	AF382380
<i>Dyrithiopsis lakefuxianensis</i>	HKUCC 7303	Submerged wood, China	AF452047
<i>Lepteutypa cupressi</i>	IMI 052255	<i>Cupressus forbesii</i> , Kenya	AF382379
<i>Monochaetia monochaeta</i>	CBS 199.82	<i>Quercus pubescens</i> , Italy	AF382370
<i>Pestalotia palmarum</i>	ATCC 10085	Coconut Palm, India	AF382361
<i>Pestalotia vaccinii</i>	ICMP 5446	<i>Vaccinium</i> sp., New Zealand	AF382362
<i>Pestalotiopsis maculans</i>	CBS 322.76	<i>Camellia</i> sp., France	AF382354
<i>Pestalotiopsis versicolor</i>	BRIP 14534	<i>Psidium guajava</i> , Australia	AF382357
<i>Seimatosporium vaccinii</i>	ICMP 7003	<i>Vaccinium ashei</i> Reade, New Zealand	AF382374
<i>Seiridium cupressi</i>	FABI, CMW 5596	<i>Cupressus sempervirens</i> , S. Africa	AF382378
<i>Truncatella angustata</i>	ICMP 7062	<i>Malus domestica</i> , New Zealand	AF382383
Outgroups			
<i>Diaporthe phaseolorum</i>	NA ^b	NA ^b	U47830
<i>Dothidea sambuci</i>	CBS 198.58	<i>Acer pseudoplatanus</i> , Switzerland	AF382387
<i>Hypocrea schweinitzii</i>		NA ^b	U47833
<i>Ophiostoma africanum</i>	NA ^b	NA ^b	AF221015
<i>Nectria pityrodes</i>	ATCC 208843	NA ^b	AF193240
<i>Nectria sesquicili</i>	ATCC 66880	NA ^b	AF193241
<i>Xylaria curta</i>	NA ^b	NA ^b	U47940
<i>Xylaria hypoxylon</i> ^c	ATCC 42768	NA ^b	U47841

^a ATCC: American Type Culture Collection; BRIP: Queensland Department of Primary Industries Plant Pathology Herbarium; CBS: Centraalbureau voor Schimmelcultures; FABI: Forestry and Agricultural Biotechnology Institute; HKUCC: The University of Hong Kong Culture Collection; ICMP: International Collection of Microorganisms from Plants.

^b NA: Information not available.

and Doyle (1987). Part of the LSU of the rDNA was amplified by PCR with primers LROR and LR05. Amplified products then were purified using minicolumns, purification resin and buffer, according to the manufacturer's protocol (Wizard PCR Preps DNA Purification System). Purified products were sequenced directly, using primers LROR, LR3R, LR5, LR3 and other reagents, following the manufacturer's protocol (Pharmacia Biotech). Sequences were edited manually and assembled using the Alf software and SeqPup (Gilbert 1996).

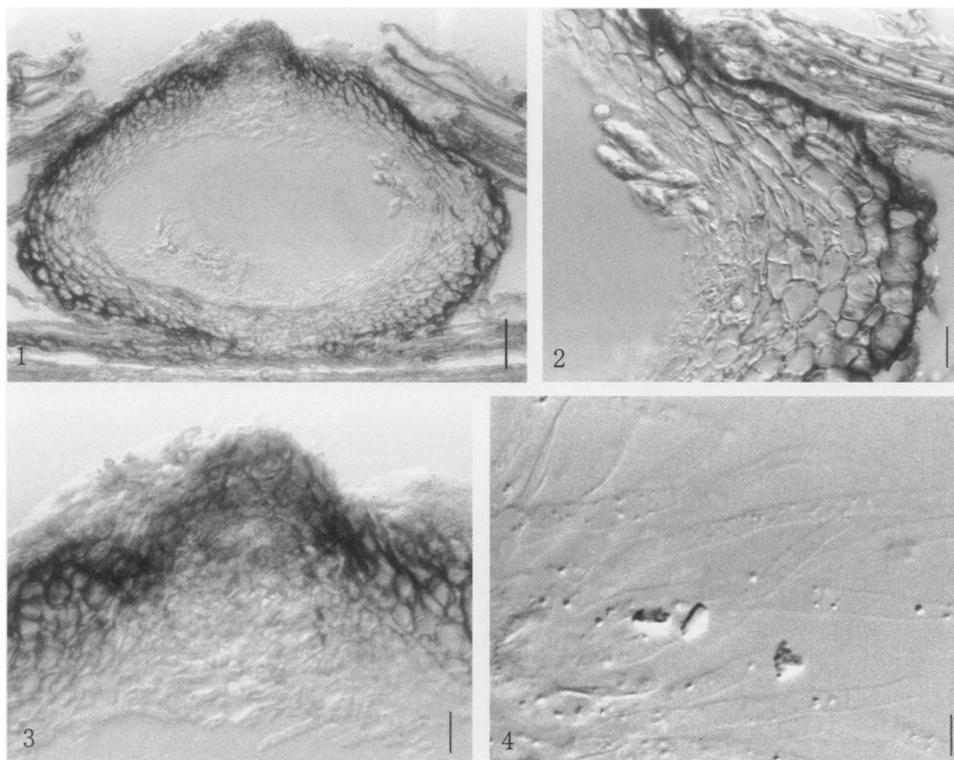
Phylogenetic analyses.—Phylogenetic analyses were performed in PAUP* 4.0b9 (Swofford 2002) on part of the LSU of the rDNA sequenced. Analyses included representatives of members from other orders (sequences available from GenBank) to resolve phylogenetic relationships and to root cladograms. Trees were inferred using the heuristic search option with 10, 100 and 1000 random-sequence additions. Gaps were treated as missing data, and characters were unordered and weighted equally and differentially. Clade stability was assessed in a bootstrap analysis with 1000 replicates, random-sequence additions with maxtrees set to 5000 and other default parameters as implemented in PAUP*. For maximum-likelihood (ML) analyses, a single tree generated under the maximum-parsimony criterion was used

as a starting tree and transition-transversion ratios, base frequencies and shape parameter were estimated. Using these initial estimates of substitution rates and kinds, a heuristic search with TBR branch swapping was used to find a maximum-likelihood tree. The gamma model of site-rate variation was used with no enforcement of a molecular clock. Initial branch lengths were obtained with Rogers-Swofford approximation methods. Neighbor-joining (NJ) analyses was conducted under different models of distance algorithms, including HKY85, JC, K2P and F81, and the support for individual clades within the tree was assessed by 1000 replicates of bootstrapping. *Dothidea sambuci* was used as outgroup.

RESULTS

Description of Dyrithiopsis lakefuxianensis (teleomorph)

Dyrithiopsis L. Cai, R. Jeewon et K.D. Hyde, gen. nov.
[Ascomata immersa vel semi-immersa, subglobosa, nigra, coriacea, papillata, ostiolata, periphysata, paraphysata. Asci unitunicati, 8-spore, cylindrici, pedicellati, apparatus apicale J+ praediti. Ascosporeae, fusiformes vel ellipsoid, pallid brunneae, muriformes, euseptatae.]



FIGS. 1–4. Interference contrast micrographs of *Dyrithiopsis lakefuxianensis* (from holotype HKU(M) 8280). 1. Section of the ascoma. 2–3. Section of the peridium. 4. Paraphyses. Scale bars: 1 = 50 μm , 2–4 = 15 μm .

Ascomata immersed or semi-immersed, subglobose, blackened, coriaceous, papillate, ostiole, periphysate. Peridium dark brown. Paraphyses hypha-like, sparse, septate, tapering towards the ends. Asci unitunicate, 8-spored, cylindrical, pedicellate, apically rounded, discoid, J+, subapical ring. Ascospores fusiform or ellipsoid, light brown, muriform, smooth-walled and euseptate.

Type species. *Dyrithiopsis lakefuxianensis* L. Cai, R. Jeewon and K.D. Hyde, sp. nov.

Dyrithiopsis lakefuxianensis L. Cai, R. Jeewon et K.D. Hyde, sp. nov. FIGS. 1–12

Ascomata 250–370 μm diam, immersa vel semi-immersa, subglobosa, nigra, coriacea, gregaria, papillata, periphysata, paraphysata. Peridium 32–72 μm crassum, *textura angulari* (FIGS. 2–3). Paraphyses ca 6 μm crass, hyphoideus, sparsus, septatae (FIG. 4). Asci 87.5–125 \times 11–14 μm , 8-sporei, cylindrici, unitunicati, pedicellati, apparatus apicale J+, 3–4.5 μm diametro, 1.75–3 μm alto praediti. Ascosporae 15–22.5 \times 7.5–10 μm , ellipsoid-fusiformes, pallide brunneae, muriformes.

Etymology. in reference to the collection site.

Ascomata 250–370 μm diam, immersed, becoming semi-immersed, subglobose, black, coriaceous, clustered in groups, papillate, ostiole periphysate (FIG. 1). Peridium 32–72 μm wide, comprising *textura angularis*, with light, brown walls inwardly and black-

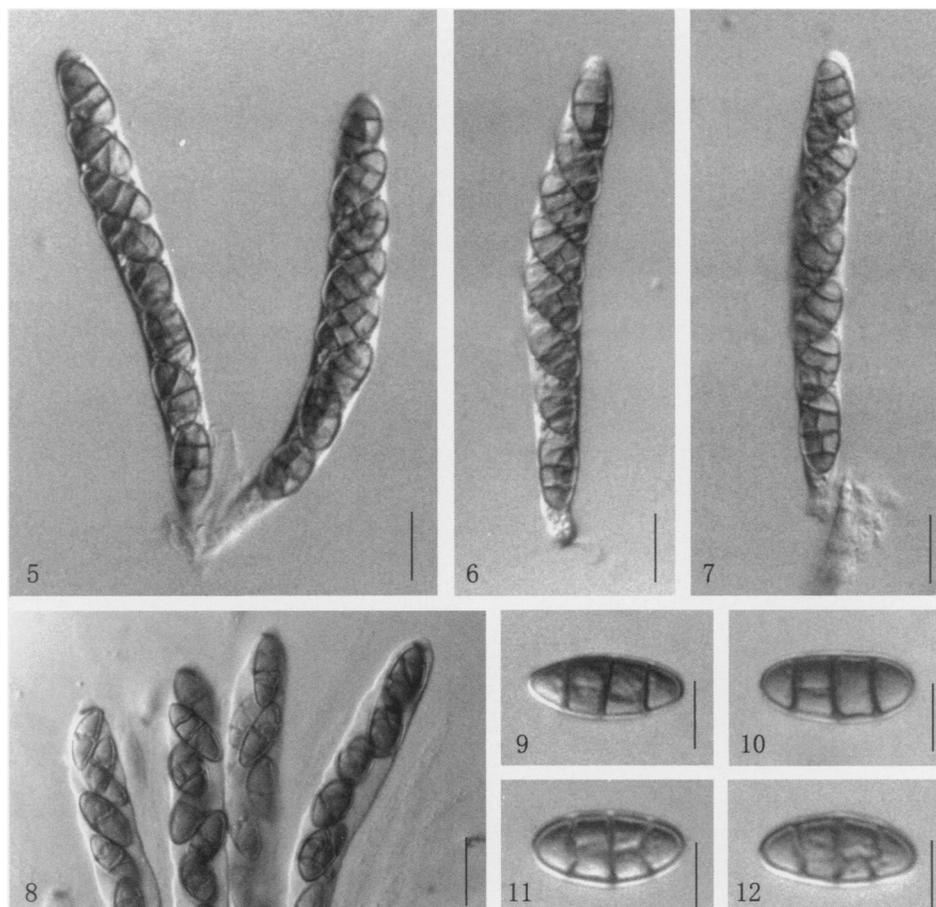
ened walls at the outside (FIGS. 2–3). Paraphyses up to 6 μm wide at the base, hypha-like, sparse, septate, tapering toward the ends, shorter than asci (FIG. 4). Asci 87.5–125 \times 11–14 μm (\bar{x} = 107 \times 12.5 μm , n = 10), 8-spored, cylindrical, unitunicate, pedicellate, apically rounded, with a discoid, J+ subapical ring, 3–4.5 μm diam 1.75–3 μm high (FIGS. 5–8). Ascospores 15–22.5 \times 7.5–10 μm (\bar{x} = 18.2 \times 8.6 μm , n = 25), overlapping uniseriate, ellipsoid-fusiform, light brown, with 3 transverse septa and (0–)1–2 longitudinal septa, smooth-walled (FIGS. 9–12).

Colonies on PDA growing quickly, up to 3 cm diam in 7 d at room temperature (\sim 25 C), compact, white from above, woolly, lacking aerial mycelium, pale orange-brown from below, hyphae up to 6.5 μm wide, septate, branched and smooth-walled, producing anamorph in culture (HKUCC 7303).

Description of Monochaetiopsis lakefuxianensis (anamorph)

Monochaetiopsis L. Cai, R. Jeewon et K.D. Hyde, gen. nov.

[Conidiomata nigra, coriacea, subglobosa, glabra, semimmersa vel superficialia, disseminata vel gregaria; stroma basalis et textura angularis, cellae crassitunica, incolorii, conidiophori ex cellulis in cavitas de conidioma, enatus de superior cellae de stroma. Cellulae conidiogenae incolorii,



FIGS. 5–12. Interference contrast micrographs of *Dyrithiopsis lakefuxianensis* (from holotype). 5–8. Asci. Note J+ amyloid subapical ring. 9–12. Ascospores (muriform). Scale bars: 5–8 = 20 μm , 9–12 = 10 μm .

laevis. Conidii fusiformie elliptica, directa vel arcuata, euseptatae, iferus appendicis; cella basalaris cum angustus truncatus basis, laevis, hyalina, 3–4 medius cellae pigmentum, pallida bruneus, breve cylindrica, concolor, septum parce colligo ad septa, appendicis tubularie, centralis, attenuare, directa, cellularie, non paniculata, solitaria, appendicis basalaris fere absens, cum praesens, solitaria, non paniculata, centralis, formata post deniceps de conidii.]

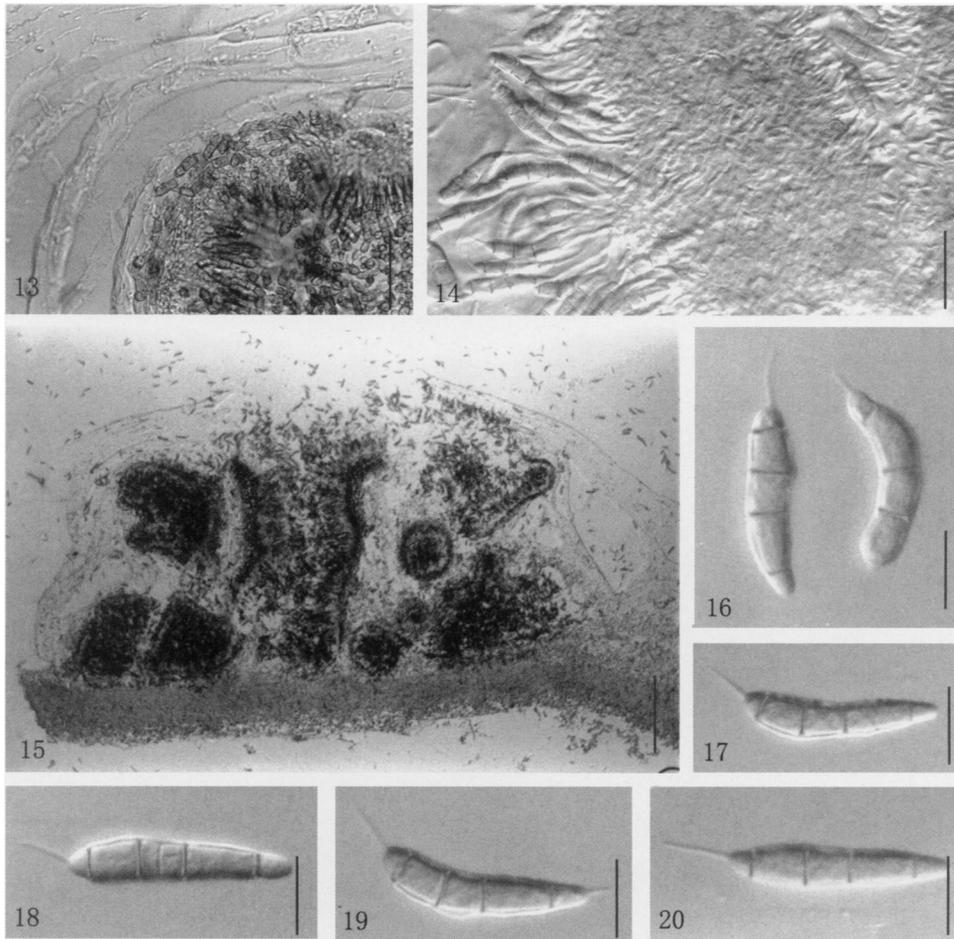
Conidiomata black, coriaceous, subglobose, glabrous, semi-immersed or superficial, scattered or gregarious; basal stroma *textura angularis*, cells thick-walled, colorless, conidiophores lining the cavity of the conidioma, arising from the upper cells of the basal stroma and reduced to conidiogenous cells. *Conidiogenous cells* integrated, colorless, smooth. *Conidia* fusiform elliptical, straight or curved, euseptate, bearing appendages; basal cell with a narrowly truncate base, smooth, hyaline, 3–4 median cells pale brown, short-cylindrical, concolorous, slightly constricted at the septa, with appendages tubular, centric, attenuated, straight, cellular, unbranched, single, basal appendages usually absent, when present,

single, unbranched, centric, formed after secession of the conidia.

Type species. *Monochaetiopsis lakefuxianensis* L. Cai, R. Jeewon et K.D. Hyde, sp. nov.

Monochaetiopsis lakefuxianensis L. Cai, R. Jeewon et K.D. Hyde, sp. nov. FIGS. 13–20.

[*Conidiomata* 190–290 μm diam, nigra, coriacea, subglobose, glabra, semiimmersa vel superficialia, disseminata vel gregaria; stroma basalis ad per 25 μm crassum et textura angularis, cellae crassitunica, incolorii (FIG. 13), conidiophori ex cellulis in cavitas de conidioma, enatus de superior cellae de stroma. Cellulae conidiogenae integratae, incolorii, laevae (FIGS. 14–15). Conidii 29–40 \times 5–7.5 μm), fusiformes vel ellipsoideae, recta vel curvatea, euseptatae, fere 4 euseptata, raro 5 euseptata, iferus appendicis; cella basalaris cum angustus truncatus basis, laevis, hyalina, 3.8–7.5 μm , longum, 3–4 medius cellae (pigmentum) pallida bruneus, breve cylindrica, concolor, septum leniter constricto ad septa, 21–29 μm longum; cellulae apicalis conicus hyalinae, laevae, 2.5–4.5 μm longum; apicalis appendices tubularie centralis, attenuare, recta, cellularie, non paniculata, singulis, 5–11 μm longum, appendicis basalaris fere



FIGS. 13–20. Interference contrast micrographs of *Monochaetiopsis lakefuxianensis* (from HKUCC holotype 7303). 13. Squash mount of conidioma and conidiophore. 14. Conidiogenous cells. 15. Section of the conidioma. 16–20. Conidia 4-septate bearing short apical and basal appendages). Scale bars: 13 = 60 μm , 14 = 30 μm , 15 = 180 μm 16–20 = 15 μm .

absens, cum praesens, singulis, non paniculata, centralis., 4–22 μm , formata post deniceps de conidii (FIGS. 16–20).]

Conidiomata 190–290 μm diam, black, coriaceous, subglobose, glabrous, semi-immersed or superficial, scattered or gregarious; basal stroma up to 25 μm thick, of *textura angularis*, cells thick-walled, colorless (FIG. 13), conidiophores lining the cavity of the conidioma, arising from the upper cells of the basal stroma and reduced to conidiogenous cells. *Conidiogenous cells* integrated, colorless, smooth (FIGS. 14–15). *Conidia* 29–40 \times 5–7.5 μm (\bar{x} = 34 \times 6.3 μm , n = 20), fusiform elliptical, straight or curved, mostly 4-septate, occasionally 5-septate, bearing appendages; basal cell with a narrowly truncate base, smooth, hyaline, 3.8–7.5 μm (\bar{x} = 5.1 μm , n = 20) long; 3–4 median cells (pigmented) pale brown, short-cylindrical, concolorous, slightly constricted at the septa, together with 21–29 μm (\bar{x} = 25.6 μm , n = 20) long, apical cell conical, colorless, smooth, 2.5–4.5 μm (\bar{x} = 3.5 μm , n = 20) long, apical appendages tubular, centric, attenuated, straight, cellular, unbranched,

single, 5–11 μm (\bar{x} = 8.8 μm , n = 20) long, basal appendage usually absent, when present, single, unbranched, centric, 4–22 μm (\bar{x} = 11 μm , n = 6) formed after secession of the conidia (FIGS. 16–20).

Etymology. From Lake Fuxian (relating to the lake where it was collected).

Known habitat. On submerged wood in a lake in China.

Material examined. CHINA. Yunnan Province: Cheng Jiang, Fuxian Lake, on submerged twig, 28 Aug 2000, L. Cai, R. Jeewon and K.D. Hyde (HKU(M) 8280, [holotype, isotype in living culture HKUCC 7303].

Dyrithium lividum (Fr.) M.E. Barr, Mycotaxon 51:204 (1994). FIGS. 21–31.

[= *Sphaeria livida* (Fr.) Syst. Mycol. 2:479 (1823).]

Ascomata 570–680 μm wide, 460–540 μm high, immersed under a clypeus, visible as raised darkened oval regions on the host surface, subglobose to ellipsoidal, papillate, ostiole periphysate 70 μm in diam



FIGS. 21–31. Interference contrast micrographs of *Dyrithium lividum* (from lectotype of *Sphaeria livida*). 21. Section of the ascoma. 22. Appearance of ascomata on host. 23. Section of ostiole (with paraphyses). 24. Section of the peridium. 25. Paraphyses. 26–28. Asci (bitunicate). 29–31. Ascospores. Scale bars: 21 = 80 μm , 22 = 600 μm , 23 = 40 μm , 24–25 = 20 μm , 26–28 = 10 μm , 29–31 = 7 μm .

(FIGS. 21–22). Peridium up to 30 μm thick, dark brown, comprising several layers of compressed cells (FIGS. 23–24). Paraphyses up to 3.5 μm diam, filamentous, flexuose, numerous, embedded in a gelatinous matrix (FIG. 25). Asci 95–120 \times 10–15 μm (\bar{x} = 107 \times 12.7 μm , n = 20), 8-spored, long cylindrical, bitunicate, pedicellate, apically rounded (FIGS. 26–28). Ascospores 13–20 \times 7–10 μm (\bar{x} = 15 \times 8.7 μm , n = 20), overlapping uniseriate, ellipsoidal, dull

brown, with 3–5 transverse septa and one to several longitudinal septa, granular (FIGS. 29–31).

Material examined. Sweden, Småland. No date. Herb. Musei. Botanici Upsaliensis, UPS (F-05092) 59653.

Note: There were three specimens in UPS in Herbarium Fries Botanici Upsaliensis. The best specimen has been designated as lectotype. O. E. Eriksson examined this material in 1985 and labelled it as *Thyr-*

idium lividum (Pers. Fr.) Sacc. The other two *Sphaeria livida* are isotypes.

Phylogenetic analyses. The alignment of the dataset consists of 900 bp, of which 189 were parsimony informative. Unweighted parsimony analyses and treating gaps as missing data resulted in three trees on one island. Tree length was 636 steps, CI = 0.654, RI = 0.695, RC = 0.455 and HI = 0.346. Unweighted parsimony analyses (transition-transversion ratio of 1.5:1) of the same dataset resulted in one most-parsimonious tree of 765 steps, CI = 0.654, RI = 0.700, RC = 0.457 and HI = 0.346. Weighted parsimony analyses yielded trees with better resolution that were more strongly supported by bootstrap values than trees generated from unweighted parsimony analyses. The single parsimonious tree obtained by treating gaps as missing data and with a transition-transversion ratio of 1.5:1 is shown in FIG. 32. Maximum-likelihood (ML) analyses under the HKY model, with an estimated shape parameter of 0.2 and an estimated transition-transversion ratio of 1.7, yielded a single tree of log-likelihood of 4345.69818. The topology of the ML tree is identical in that of FIG. 32 (results not shown). The phylogram generated under the neighbor-joining method was similar to FIG. 32 with a tree length of 644 steps, CI = 0.646, RI = 0.684, RC = 0.442 HI = 0.352 and -log likelihood of 4646.14791 (FIG. 33).

Clade A (FIG. 32) supports the monophyly of all amphisphaeriaceous genera producing *Pestalotiopsis*-like anamorphs and is supported by a high bootstrap confidence (99%). *Dyrithiopsis lakefuxianensis* appear to be closely related to the genus *Bartalinia* Tassi and forms a sister group to the genus *Truncatella* Stey. These relationships also are supported by high bootstrap values.

DISCUSSION

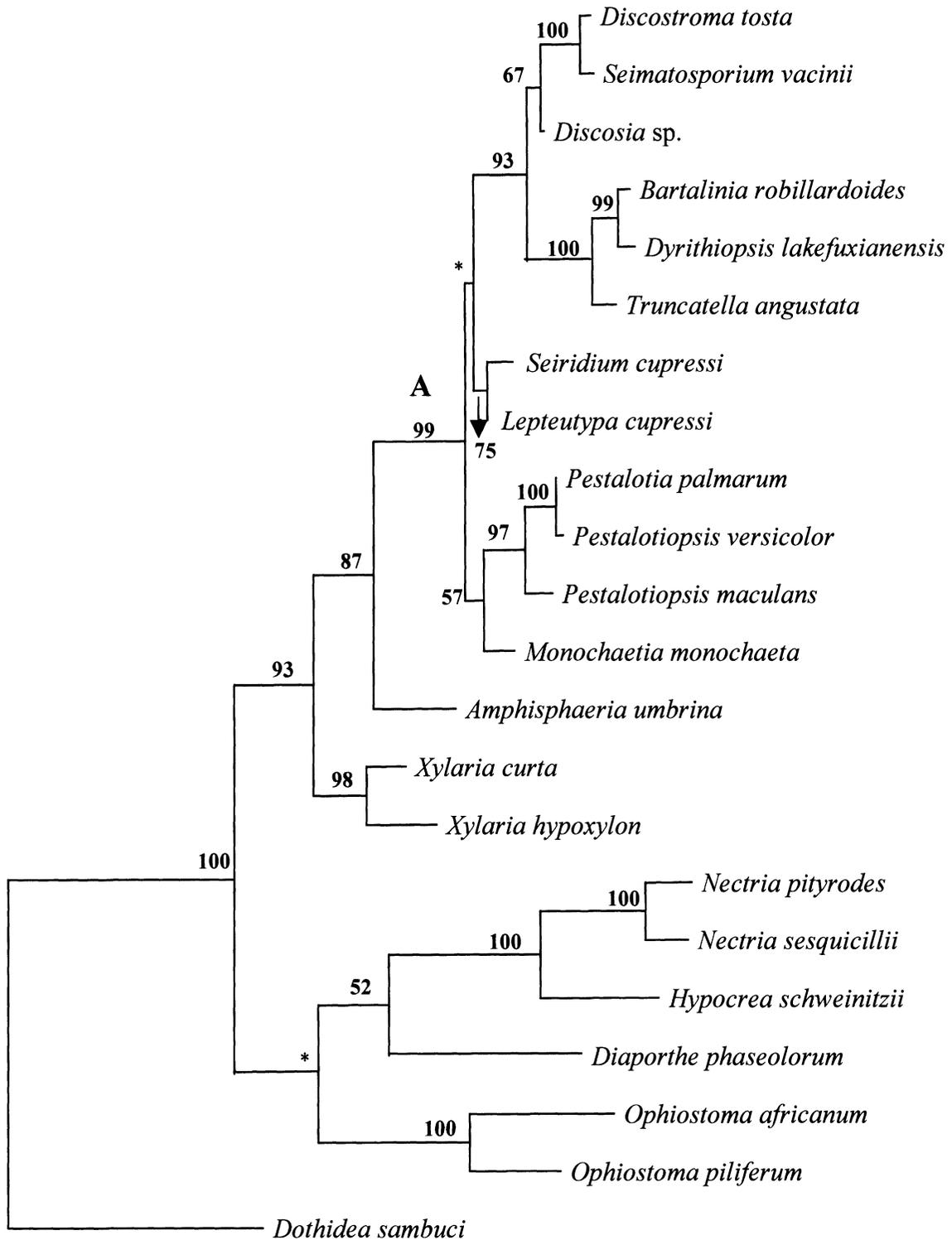
Morphological studies coupled with phylogenetic analyses of rDNA sequences reported here provide additional insights regarding the systematic placement of the new genus *Dyrithiopsis*. On morphological grounds, *Dyrithiopsis* has close affinities to the genus *Dyrithium*, which currently is accommodated in the family Amphisphaeriaceae (Barr 1994). However, considerable taxonomic confusion surrounds the genus *Dyrithium* (Kang et al 1999a). The generic name *Dyrithium*, based on *D. lividum*, was introduced for *Sphaeria livida* by Barr (1994). Kang et al (1999a) examined a collection of *Sphaeria livida*, which was cited as having unitunicate asci by Barr (1994), and found that the asci were distinctly bitunicate (FIGS. 21–31, Kang et al 1999a). We requested Fries type material of *Sphaeria livida* to resolve this confusion.

The material, despite its age, is in reasonable condition, and ascomata contain numerous asci and ascospores. Although we could find no evidence that the asci were fissitunicate, it was clear that they were bitunicate (FIGS. 26–28) and reminiscent of genera such as *Verruculina* (Kohlm.) Kohlm. & Volkm.-Kohlm. (Hyde et al 2000). There was no J+ subapical ascal ring. Because of the ascal characters that are more typical of the loculoascomycetes, we are convinced that *Dyrithium* is not amphisphaeriaceous. The loculoascomycetous nature of the taxon also was evident in the pseudoparaphyses, which were long and straight between the asci, anastomosed above the asci, did not taper and were embedded in a gelatinous matrix. This is typical of bitunicate genera, such as *Massarina* Sacc., as compared to the sparse tapering paraphyses in the Amphisphaeriaceae (Poonyth et al 2000).

Similar confusion surrounds genera such as *Roussella* Sacc. and *Saccardoella* Speg. (Hyde et al 1996a) because, although the asci in these genera are bitunicate, they do not show fissitunicate dehiscence. We therefore describe a new genus *Dyrithiopsis* to accommodate our new taxon, which clearly is amphisphaeriaceous, based on its ascal characters. Characters pertaining to the Amphisphaeriaceae and related families already have been elaborated (Hyde 1996, Hyde et al 1996b, Kang et al 1999b).

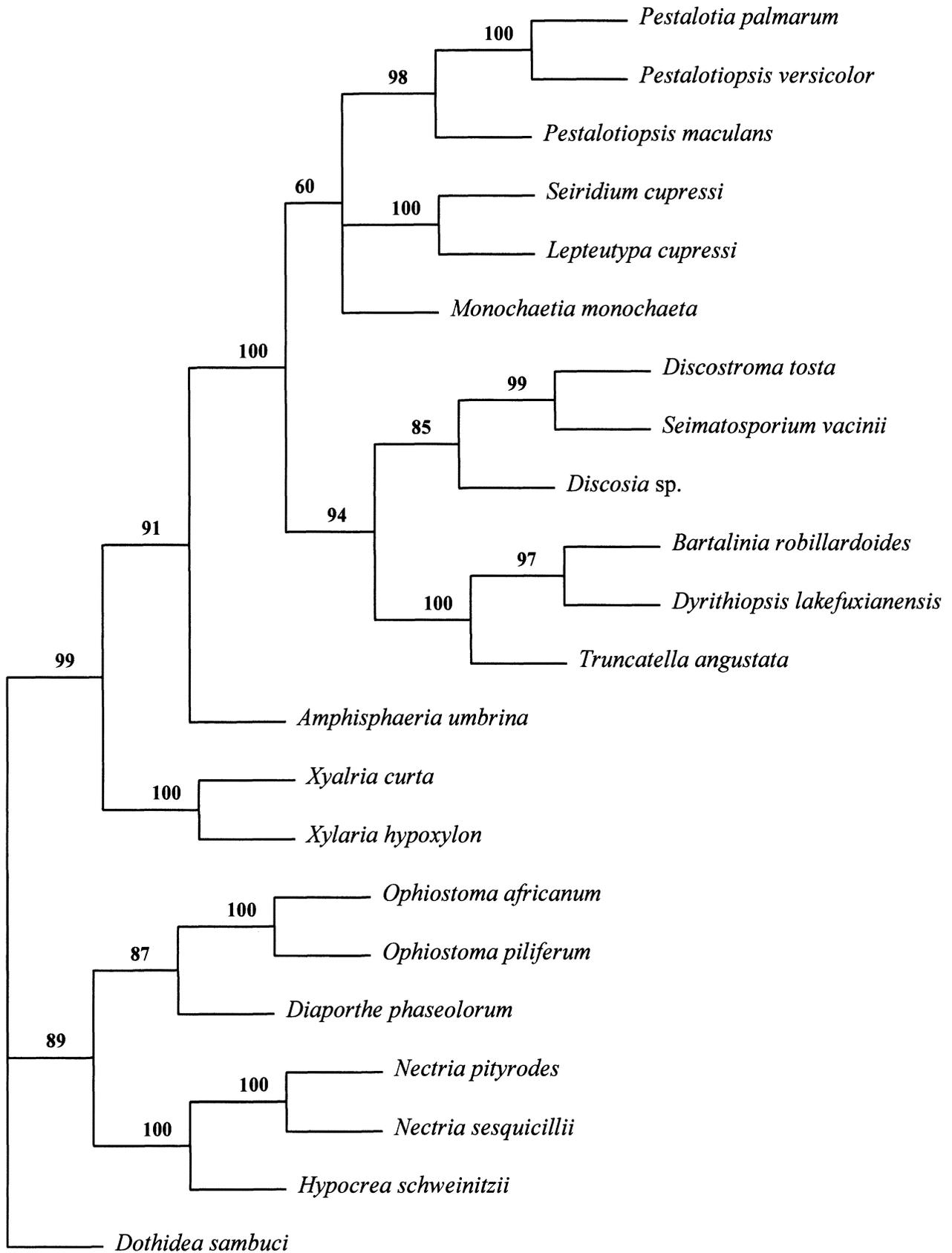
The outcome of molecular analyses based on the large subunit rDNA sequences provide further evidence that *Dyrithiopsis* is phylogenetically related to other members of the family Amphisphaeriaceae (FIG. 32). In recent studies, it has been shown that ascomycetous genera producing *Pestalotiopsis*-like anamorphs as well as coelomycetous genera, such as *Bartalinia*, *Discosia* Libert, *Pestalotiopsis* Stey., *Monochaetia* (Sacc.) Allesh., *Seimatosporium* Corda, *Seiridium* Nees: Fries and *Truncatella*, are members of the family Amphisphaeriaceae (Kang et al 1998; 1999b; Jeewon et al 2002, 2003a, b). Based on morphological and molecular data, the taxonomic concept of this family has been revised to accommodate genera that produce *Pestalotiopsis*-like anamorphs (Kang et al 1998, 1999a, b). Results from our molecular study indicate that *Dyrithiopsis* is strictly amphisphaeriaceous because it is nested between *Discostroma* Clements and *Lepteutypa* Petrak, which are members of the Amphisphaeriaceae *sensu stricto* (Barr 1994, Hawksworth et al 1995, Kang et al 1998, 1999b). In addition, it possesses unitunicate asci with a J+ subapical ring and a *Pestalotiopsis*-like anamorph, characteristic of other members of this family.

The new genus *Dyrithiopsis* produced a coelomycetous anamorph with morphological affinities to *Pestalotiopsis*, *Monochaetia* and *Seimatosporium*. It has



— 10 steps

FIG. 32. Phylogram depicting the relationships of *Dyrithiopsis lakefuxianensis* with respect to others members of the Amphisphaeriaceae. Tree was generated by a weighted parsimony analysis (transition transversion ratio of 1.5:1) from partial LSU sequences of the rDNA gene. *Dothidea sambuci* was the designated outgroup. Bootstrap values (1000 replicates) are indicated on nodes. * Represents those clades that collapsed in the bootstrap analysis.



- 10 steps

FIG. 33. Relationships among *Dyrithiopsis lakefuxianensis* and related taxa based on the neighbor-joining method. Phylogram is rooted with *Dothidea sambuci* and bootstrap frequencies are shown above the internodes.

four euseptate fusoid, brown conidia, which are constricted slightly at the septum, similar to those species in *Bartalinia*, *Pestalotiopsis*, *Monochaetia*, *Seimatosporium* and *Truncatella*. This anamorph, however, is morphologically distinguishable from *Monochaetia* and *Pestalotiopsis* and *Seiridium*, with respect to the appendages and conidial shape. Conidia are fusiform elliptical and characterized by three pigmented (honey brown) median cells that are slightly constricted. End cells are hyaline, bear a single and short apical and basal appendage that are unbranched and usually curved and separated by a septum from the end cells. This anamorph also differs morphologically from *Bartalinia* and *Truncatella* (its closest relatives in the tree). *Bartalinia* is characterized by median cells that are almost hyaline or pale brown with apical appendages arising from a particular locus above the apical cell (unlike *Monochaetiopsis*, which is separated by a septum). *Truncatella*, however, possesses mostly two median cells with highly branched apical appendages. Further details regarding the morphological characters and phylogenetic relationships pertaining to *Bartalinia*, *Discosia*, *Pestalotiopsis*, *Monochaetia*, *Seimatosporium*, *Seiridium* and *Truncatella* have been discussed by Jeewon et al (2002, 2003b). A new coelomycetous taxon, *Monochaetiopsis lakefuxianensis* therefore was erected to describe this fungus.

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