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Modern taxonomic approaches to identifying
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Dayarathne & K.D.Hyde, gen. nov.

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Modern taxonomic approaches to identifying diatrypaceous fungi from marine habitats, with a novel genus *Halocryptovalsa* Dayarathne & K.D.Hyde, gen. nov.

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ABSTRACT

Marine diatrypaceous fungi are associated with many host species, including *Avicennia* spp., *Halosarceia halocnemoides* (Nees) Paul G. Wilson, *Kandelia candel* (L.) Druce, *Salicornia* sp., *Rhizophora apiculata* Blume and *Suaeda fruticosa* (L.) Forssk. Accurate morphological identification of individual taxa of this family is difficult, as previous classifications generally lack sequence data. We provide a detailed account of all known marine diatrypaceous taxa and determine their phylogenetic and morphological relationships. A novel genus *Halocryptovalsa* Dayarathne & K.D. Hyde, gen. nov. is established to accommodate *Halocryptovalsa salicorniae* Dayarathne & K.D. Hyde, sp. nov., and *Halocryptovalsa avicenniae*, comb. nov. (synonym of *Cryptovalsa avicenniae*). Three novel species *Cryptosphaeria avicenniae* Devadatha & V.V. Sarma, sp. nov., *Cryptosphaeria halophila* Dayarathne & K.D. Hyde, sp. nov., and *Diatrype mangrovei* Dayarathne & K.D. Hyde, sp. nov., are introduced from mangroves. *Halodiatrype* is amended with asexual morph characters.

RÉSUMÉ

Des approches taxinomiques modernes pour l'identification d'espèces fongiques diatrypoides d'habitats marin, avec un nouveau genre Halocryptovalsa Dayarathne & K.D. Hyde, gen. nov.

Les espèces fongiques diatrypoides marines sont associées à de nombreux hôtes, comprenant *Avicennia* spp., *Halosarceia halocnemoides* (Nees) Paul G. Wilson, *Kandelia candel* (L.) Druce, *Salicornia* sp., *Rhizophora apiculata* Blume et *Suaeda fruticosa* (L.) Forssk. L'identification morphologique des taxons de cette famille est difficile en l'absence de séquences permettant de confirmer leur placement dans les classifications antérieures. Nous fournissons un aperçu détaillé de tous les taxons diatrypoides marins connus et nous établissons leurs relations phylogénétiques et similarités morphologiques. Un nouveau genre *Halocryptovalsa* Dayarathne & K.D. Hyde, gen. nov. est introduit pour placer *Halocryptovalsa salicorniae* Dayarathne & K.D. Hyde, sp. nov., et *Halocryptovalsa avicenniae*, comb. nov. (basonym: *Cryptovalsa avicenniae*). Trois nouvelles espèces sont décrites des mangroves: *Cryptosphaeria avicenniae* Devadatha & V.V. Sarma, sp. nov., *Cryptosphaeria halophila* Dayarathne & K.D. Hyde, sp. nov., et *Diatrype mangrovei* Dayarathne & K.D. Hyde, sp. nov. La définition du genre *Halodiatrype* est amendée avec des caractères morphologiques de la forme asexuée.

INTRODUCTION

Marine fungi are those taxa that grow in saline habitats, such as on beaches, in mangroves, in salt marshes, in hypersaline lakes, in the sea and even in cooling towers running on seawater in coastal areas (Jones *et al.* 2015) and are involved in nutrient cycling of plant material (Hyde & Lee 1995; Jones 2000; Sarma & Hyde 2001; Wong *et al.* 1998). Species of *Diatrypaceae* are abundant on various woody plants around the world, while some are pathogens and/or endophytes (Carter 1957, 1991; Tiffany & Gilman 1965; Bolay & Moller 1977; Moller & Kasimatis 1978; Hyde & Rappaz 1993; Munkvold & Marois 1994; Acero *et al.* 2004; Trouillas *et al.* 2010a, b; Chalkley *et al.* 2010; Abdel-Wahab *et al.* 2014; Dayarathne *et al.* 2016). Several taxa have been reported from aquatic habitats (Glawe & Rogers 1984; Rappaz 1987; Vijaykrishna *et al.* 2006; Trouillas & Gubler 2010; Chalkley *et al.* 2010; Trouillas *et al.* 2011; Abdel-Wahab *et al.* 2014; Liu *et al.* 2015; Jones *et al.* 2015; Dayarathne *et al.* 2016; Shang *et al.* 2017; Senwanna *et al.* 2017). The introduction of *Cryptovalsa suaedicola* on *Suaeda fruticosa* from a salt marsh in United Kingdom was a starting point for studies on diatrypaceous marine fungi (Spooner 1981). Known diatrypaceous taxa that occur only in marine habitats are *Cryptovalsa suaedicola* (Spooner 1981), *C. halosarceicola* (Hyde 1993), *C. mangrovei* (Inderbitzin *et al.* 1999), *Pedumispora rhizophorae* (Hyde &

Jones 1992), *Eutypa bathurstensis* (Hyde & Rappaz 1993), *Eutypella naqsii* (Hyde 1995), *Diatrypasimilis australiensis* (Chalkley *et al.* 2010; Abdel-Wahab *et al.* 2014), *Halodiatrype avicenniae*, *H. mangrovei* (synonym of *Cryptosphaeria mangrovei*), *Halocryptovalsa salinicola* (Hyde 1993; Dayarathne *et al.* 2016) and *Cryptovalsa avicenniae* (Abdel-Wahab *et al.* 2017). They share common features of *Diatrypaceae*, especially in the formation of crustose stroma-like structures on the host surface, asci with a long pedicel and an apical ring, and allantoid ascospores. However, molecular studies to confirm their taxonomic placements have only been carried out for *Cryptovalsa avicenniae*, *Diatrypasimilis australiensis*, *Halodiatrype avicenniae*, *H. salinicola* and *Pedumispora rhizophorae*. Hence, further taxon sampling, and morphological and phylogenetic investigations are required to establish their exact phylogenetic placements within *Diatrypaceae*.

Taxa in *Diatrypaceae* can be distinguished by perithecial ascomata, usually embedded in a black stroma, cylindric-clavate to clavate, long pedicellate asci and allantoid ascospores (Glawe & Rogers 1984; Rappaz 1987; Mehrabi *et al.* 2015; de Almeida *et al.* 2016). Both coelomycetes (*Cytosporina*, *Libertella*) and hyphomycetes (*Phaeoisaria*) have been reported as asexual morphs of *Diatrypaceae* (Glawe & Rogers 1984; Wijayawardene *et al.* 2012; 2017; de Almeida *et al.* 2016; Mehrabi *et al.* 2016). Kirk *et al.* (2008) listed 13 genera and 229 species in *Diatrypaceae*, mostly from terrestrial habitats. Based on molecular and morphological

TABLE 1. — Diatrypaceous taxa introduced from marine habitats.

Taxa	Host/Substrate	Location	References
<i>Eutypa</i> sp.	Mangrove	Australia	Hyde (1990b)
<i>Diatrype</i> sp.	Mangrove	Malaysia	Jones & Kuthubutheen (1989)
<i>Cryptovalsa suaedicola</i>	<i>Suaeda fruticosa</i>	Salt marsh at Colne Point Nature Reserve, United Kingdom	Spooner (1981)
<i>Pedumispora rhizophorae</i>	Decayed intertidal prop roots and twigs of <i>Rhizophora apiculata</i>	Thailand	Hyde & Jones (1992)
<i>Eutypa bathurstensis</i>	<i>Avicennia</i> sp.	North Queensland	Hyde & Rappaz (1993)
<i>Cryptovalsa halosarceicola</i>	<i>Halosarceia halocnemoides</i>	Cairns, Queensland	Hyde (1993)
<i>Cryptosphaeria mangrovei</i>	intertidal roots of <i>Rhizophora apiculata</i>	Ranong mangrove, Thailand	Hyde (1993)
<i>Cryptovalsa mangrovei</i>	Wood test block submerged in the intertidal zone of Mai Po mangroves	Hong Kong	Inderbitzin <i>et al.</i> (1999)
<i>Cryptosphaeria eunomia</i>	Marine sponges	—	Thomas <i>et al.</i> (2010)
<i>Diatrypasimilis australiensis</i>	Roots of <i>Rhizophora</i> (mangrove)	Australia	Chalkley <i>et al.</i> (2010)
<i>Halodiatrype avicenniae</i>	Intertidal decayed wood of <i>Avicennia</i> sp.	Thailand	Dayarathne <i>et al.</i> (2016)
<i>Halodiatrype salinicola</i>	On submerged marine wood,	Thailand	Dayarathne <i>et al.</i> (2016)
<i>Cryptovalsa avicenniae</i>	Decayed wood of <i>Avicennia marina</i>	Saudi Arabia	Abdel-Wahab <i>et al.</i> (2017)

data, two saprotrophic genera, *Diatrypasimilis* and *Pedumispora*, which were reported from marine ecosystems, were added to the family by Klayuban *et al.* (2014) and Abdel-Wahab *et al.* (2014), respectively. Two additional genera, *Monosporascus* and *Phaeoisaria*, were referred to the family by Maharachchikumbura *et al.* (2015). According to Maharachchikumbura *et al.* (2016), the family contains 15 genera and studies by Dayarathne *et al.* (2016) and Senwana *et al.* (2017) broadened the family by introducing another two genera, *Halodiatrype* and *Alloccryptovalsa*. Wijayawardene *et al.* (2018) listed 17 genera in *Diatrypaceae*. However, recently *Phaeoisaria* has been linked to the family Pleurotheciaceae (Luo *et al.* 2018; Wijayawardene *et al.* 2018; Hyde *et al.* 2018). Diatrypaceous taxa introduced from various marine habitats are listed in Table 1.

This paper provides modern descriptions and illustrations of diatrypaceous taxa found in marine habitats and introduces a new genus, *Halocryptovalsa* Dayarathne & K.D.Hyde, gen. nov., and three new species. We also revise knowledge of the genus *Halodiatrype* by describing an asexual morph obtained from axenic culture. For each species, current scientific names including synonyms are provided along with hosts, distribution, and notes on their taxonomy and phylogeny. DNA sequence data, phylogenetic relationships and accurately defined names will be useful for scientists working on various aspects of fungi from marine habitats, such as conservation of mangroves and associate species as well as screening for bioactive metabolites.

KEY TO MARINE DIATRYPACEOUS SPECIES

1. Only asexual morph known *Cryptosphaeria halophila* Dayarathne & K.D.Hyde, sp. nov.
— Sexual morphs with or without asexual morphs 2
2. Asci 8-spored 3
— Asci more than 8 spored 12
3. Ascospores filiform or ellipsoidal 4
— Ascospores allantoid or subinequilateral 5
4. Ascospores 12-13-septate, without a longitudinal germ slit
..... *Pedumispora rhizophorae* K.D.Hyde & E.B.G.Jones
— Ascospores aseptate, without a longitudinal germ slit *Diatrypasimilis australiensis* J.J.Zhou & Kohlm
5. Ascospores septate 6
— Ascospores aseptate 7
6. Ascomata 125-140 × 105-115 µm *Halodiatrype salinicola* Dayarathne & K.D.Hyde
— Ascomata 520-990 × 740-880 µm *Halodiatrype mangrovei* (K.D.Hyde) Dayarathne & K.D.Hyde
7. Ascospores 45-52 × 10-14 µm, with several small guttules
..... *Halodiatrype avicenniae* Dayarathne & K.D.Hyde
— Ascospores 5-10.5 × 1.5-3 µm, with two small guttules or without guttules 8

8. Ascstromata erumpent, arising through cracks on bark, edges of cracks remaining as pointed, angular parts, carbonaceous *Diatrype mangrovei* Dayarathne & K.D.Hyde, sp. nov.
— Ascstromata immersed or semi immersed, blackening the wood surface or forming a blackened crust on host surface 9
9. Ascstromata blackening the wood surface with ectostromatal cushions occurring around each ascoma
..... *Eutypella naqsii* K.D.Hyde
— Ascstromata blackening the wood surface without ectostromatal cushions occurring around each ascoma. 10
10. With a thin white line under the black hymenium 11
— Without a thin white line under the black hymenium *Cryptosphaeria eunomia* (Fr.) Fuckel
11. Ascospores olive-brown
..... *Cryptosphaeria bathurstensis* (K.D.Hyde & Rappaz) Dayarathne & K.D.Hyde, comb. nov.
— Ascospores hyaline to slightly brownish *Cryptosphaeria avicenniae* Devadatha & V. V. Sarma, sp. nov.
12. Ascomatal neck with horizontal or vertical furrows 13
— Ascomatal neck lacking horizontal or vertical furrows 14
13. Ascomatal neck with 4 horizontal furrows *Cryptovalsa mangrovei* Abdel-Wahab & Inderb
— Ascomatal neck with 4 vertical furrows *Cryptovalsa suaedicola* Spooner
14. Ascospores yellow-brown to brown
..... *Halocryptovalsa avicenniae* (Abdel-Wahab, Bahkali & E.B.G.Jones) Dayarathne & K.D.Hyde, comb. nov.
— Ascospores hyaline 15
15. Ascomata 130-185 × 185-260 µm *Cryptovalsa halosarcicola* K.D.Hyde
— Ascomata 230-300 × 140-168 µm *Halocryptovalsa salicorniae* Dayarathne & K.D.Hyde, sp. nov.

MATERIAL AND METHODS

FUNGAL SAMPLING AND MORPHOLOGY

Fresh materials were collected from various marine habitats in Krabi, Phang-nga, Phetchaburi and Ranong Provinces, in Southern Thailand. Specimens were brought to the laboratory in Zip-lock plastic bags and incubated at room temperature in the laboratory and Fungal specimens were examined with a Motic SMZ 168 stereomicroscope. Rehydrated fruiting bodies were used to observe characteristics of ascomata, asci, ascospores and other tissues and characters were photographed using a Canon 550D digital camera fitted to a Nikon ECLIPSE 80i compound microscope. Photomicrographs were arranged with Adobe Photoshop v. CS6 and all measurements were made with Tarosoft v. 0.9.0.7. Specimens were preserved and deposited in the Mae Fah Luang University Herbarium (MFLU). Fungi from decaying wood samples of *Avicennia marina* collected from Muthupet mangroves, Tamil Nadu, India were examined and characterized as detailed in Devadatha *et al.* (2018). Herbarium material and culture deposited respectively at Ajrekar Mycological Herbarium (AMH), Agharkar Research Institute (ARI) and National Fungal Culture Collection of India (NFMCC), Pune, India.

Fruiting bodies were removed from the substrate using a sterilized needle, placed in a few drops of sterilized distilled water on a cavity slide, and spore suspensions prepared as described in Chomnunti *et al.* (2014). Germinating ascospores were aseptically transferred to potato dextrose agar (PDA) or malt extract agar (MEA) media prepared in 50% or 100% concentrations of sterilized natural seawater (Atlas 2009). Colonies were photographed and characters recorded after two weeks. Living cultures are deposited in Mae Fah Luang

University Culture Collection (MFLUCC) and in the International Collection of Microorganisms from Plants (ICMP), New Zealand. New species were established using modern criteria and standards (Taylor *et al.* 2000; Seifert & Rossman 2010; Jeewon & Hyde 2016). Faces of fungi, Index Fungorum numbers and MycoBank numbers were registered according to Jayasiri *et al.* (2015), Index Fungorum (2019) and MycoBank (2019).

All authorships of taxa are in Appendix 2.

HERBARIUM SPECIMEN EXAMINATION

Herbarium specimens, including type specimens and other relevant authentic specimens were borrowed from herbaria BRIP and IMI (see <http://sweetgum.nybg.org/ih/index.php> for full names). A small part of the specimen was cut and rehydrated in 5% KOH or water and stained with cotton blue (when necessary) prior to examination and sectioning. Micro-morphological characters were observed from rehydrated ascomata and photography was done as previously described.

DNA EXTRACTION, PCR AMPLIFICATION AND PHYLOGENY

DNA extraction, PCR and sequencing were conducted following the methods described in Dayarathne *et al.* (2016). When fungi failed to grow in culture, DNA was extracted directly from fruiting bodies by following the protocol as described in Wanasinghe *et al.* (2018). PCR amplification and sequencing of the SSU nrDNA region using the primer pair NS1/NS4 (White *et al.* 1990), LSU nrDNA region using the primer pair LROR/LR5 (Vilgalys & Hester 1990; Rehner & Samuels 1994), ITS nrDNA region using primer pair ITS5/ITS4 (White *et al.* 1990) and Btub gene region

using the primer pair Bt2a/Bt2b (Trouillas *et al.* 2011) were performed. Each amplification reaction contained 0.125 µL of 5 units/µL Ex-Taq DNA polymerase (TaKaRa), 2.5 µL of 10 × PCR buffer, 2 µL of 2 mM MgCl₂, 2.5 µL of 2 mM dNTPs, 1 µL of 0.2–1.0 µM primer, <500 ng DNA template and was adjusted with double-distilled water to a total volume of 25 µL. Amplification of SSU, LSU and ITS were accomplished by an initial step of 3 min at 94°C, followed by 35 cycles of 30 sec. at 94°C, 58 sec. at 30°C, and 1 min at 72°C, with a final extension of 10 min at 72°C. For the Btub amplification the 35 cycles consisted of initiation at 94°C for 3 min, denaturation at 94°C for 30 sec, annealing at 58°C for 30 sec, elongation at 72°C for 1 min with a final extension of 10 min at 72°C. All PCR products with a DNA ladder were determined by electrophoresis at 120 V/cm for 20 min in 1% agarose gel stained with ethidium bromide (0.5 mg/mL). The gel was visualized under a UV transilluminator to estimate the fragment size. PCR products were purified and sequenced with both primers at Sunbiotech Company, Beijing, China.

PHYLOGENETIC ANALYSES

Sequences generated from above primers of the different genes (LSU, SSU, ITS and Btub) were analyzed with other sequences retrieved from GenBank. Sequences with high similarity indices were determined from a BLAST search to find the closest matches with taxa in *Diatrypaceae* and relying on previous literature (Table 2) (Dayarathne *et al.* 2016; Shang *et al.* 2017; Senwanna *et al.* 2017; Shang *et al.* 2018). Three separate data sets (ITS+Btub, ITS and LSU+SSU) were prepared for the phylogenetic analyses. According to previous literature, the number of taxa with BTUB sequence data are less than those with ITS data. Therefore, we decided to conduct two distinct phylogenetic analyses: a single ITS dataset and combined ITS+BTUB dataset. Only LSU and SSU data are available for the recently introduced marine species *Cryptovalsa avicenniae* and we could obtain only LSU and SSU data for a newly collected species. Therefore, we conducted a separate analysis with combined LSU and SSU data to infer their phylogenetic relationships with the available data. Several ambiguous sequences were excluded by the primary phylogenetic analyses and a representative sample of 95 *Diatrypaceae* species, including new strains were selected for the first and the second analyses. *Kretzschmaria deusta* (CBS 826.72) and *Xylaria hypoxylon* (CBS 121680) were selected as out-group taxa for the first and the second data sets. The third analysis was carried out with 17 selected taxa from selected genera using combined SSU and LSU sequence data following Abdel-Wahab *et al.* (2017). Three datasets were initially aligned using MAFFT version 7 (Katoh & Standley 2013; <http://mafft.cbrc.jp/alignment/server/>) and manually corrected where necessary using BioEdit sequence alignment editor (Hall 1999) to minimize the uninformative gaps. Gaps were treated as missing data. Nucleotide substitution models were determined with MrModeltest v. 2.2 (Nylander 2004). The GTR+I+G model was used in each analysis for phylogenetic studies.

Phylogenetic trees were generated using maximum likelihood (ML), maximum parsimony (MP) and Bayesian inference analyses (BI). The ML trees were generated using the RAxML-HP2 on XSEDE (v. 8.2.8) (Stamatakis *et al.* 2008; Stamatakis 2014) in the CIPRES Science Gateway platform (Miller *et al.* 2010) using the GTR+I+G model of evolution. Bayesian analyses were performed for both individual and combined data sets using MrBayes v. 3.0b4 (Ronquist & Huelsenbeck 2003). Nucleotide substitution models were determined with MrModeltest v. 2.2 (Nylander 2004). A dirichlet state frequency was predicted for all four data partitions and GTR+I+G was the best model. The heating parameter (was set to 0.2 and trees were saved every 1000 generations (Ronquist *et al.* 2012). Posterior probabilities (PP) (Rannala *et al.* 1998; Zhaxybayeva & Gogarten 2002) were defined by Bayesian Markov Chain Monte Carlo (BMCMC) sampling method in MrBayes v. 3.0b4 (Huelsenbeck & Ronquist 2001). The MP was performed with PAUP v. 4.0b10 (Swofford 2003). Ambiguously aligned regions were excluded and all characters were unordered and given equal weight. Gaps were treated as missing data. Trees were inferred using the heuristic search option with TBR branch swapping and 100 random sequence additions. MaxTrees set to 1000 branches of zero length were collapsed and all multiple parsimonious trees were saved. Tree length (TL), consistency index (CI), retention index (RI), rescaled consistency index (RC), homoplasy index (HI), and log likelihood (–ln L) were calculated for trees generated under different optimality criteria. The robustness of the most parsimonious trees was evaluated by 1000 bootstrap replications resulting from the MP analysis, each with ten replicates of random step-wise addition of taxa (Felsenstein 1985). The Kishino-Hasegawa tests (Kishino & Hasegawa 1989) were performed to determine whether the trees inferred under different optimality criteria were significantly different. The resulting trees were viewed with FigTree v.1.4.0 (Rambaut 2012) and the final layout was done with Adobe illustrator SC6 version. The final alignments and the trees obtained were deposited in TreeBASE (Reviewer access URL: <http://purl.org/phylo/treebase/phylo/study/TB2:S22795?x-access-code=cc46077c5ae6d89e3fb9f6b733b10061&format=html>).

RESULTS

PHYLOGENETIC ANALYSIS

The ML analysis of concatenated sequence alignment with ITS and Btub, ITS dataset and combined SSU and LSU data set yielded best scoring RAxML trees (Figs 1–3) with a final ML optimisation likelihood values of –14416.427031, –8752.220584 and –4758.668375, respectively. Different parameters for ML and MP analyses of three distinct data sets are summarized in Table 3.

For concatenated ITS and Btub data set, six simultaneous Markovchains were run for 1.5M generations and trees were sampled every 100th generation resulting in 15 001 total trees. 13 501 trees were used for calculating posterior probabilities (PP)

TABLE 2. — Isolates used in this study and their GenBank accession numbers. Strain no column: ex-type strains are in bold; ^(†), denotes the type species of the genus; newly generated sequences are shaded. Abbreviations: **ATCC**, American Type Culture Collection, Manassas, America; **BAFC**, Herbarium, Department of Biological Sciences, Faculty of Natural Sciences, Buenos Aires' University, Argentina; **CBS**, Centraalbureau voor Schimmelcultures, Utrecht, Netherlands; **CMM**, Culture Collection of Phytopathogenic Fungi "Prof. Maria Menezes"; **HUEFS**, Herbarium of the State University of Feira de Santana; **HVFIG**, Hoosic Valley Family Interest Group; **IPV**, Instituto di Patologia Vegetale, Milan, Italy, and E. and J. Gallo, Modesto, CA; **MFLUCC**, Mae Fah Luang University Culture Collection, Chiang Rai, Thailand; **NFCCI**, National Fungal Culture Collection of India; **UCD**, University of California, Davis; **UFMGCB**, Culture Collection of Microorganisms and Cells of the Universidade Federal of Minas Gerais; in "GenBank accession" column, **ITS**: Internal transcribed spacers; **Btub**, beta-tubulin gene, partial cds. Notes: 1, Ex-type strains are in bold; newly generated sequences are in blue bold; 2, Internal transcribed spacers.

Taxon	Strain no. ¹	Locality	GenBank accession ²				Reference
			SSU	LSU	ITS	Btub	
<i>Alloccryptovalsa cryptovalsoidea</i>	HVFIG02	Australia	—	—	HQ692573	HQ692524	Trouillas <i>et al.</i> (2011)
<i>Alloccryptovalsa cryptovalsoidea</i>	HVFIG05	New South Wales	—	—	HQ692574	HQ692525	Trouillas <i>et al.</i> (2011)
<i>Alloccryptovalsa polyspora</i> ^(†)	MFLUCC 17-0364	Thailand	—	—	MF959500	—	Senwanna <i>et al.</i> (2017)
<i>Alloccryptovalsa rabenhorstii</i>	WA07CO	Western Australia	—	—	HQ692620	HQ692522	Trouillas <i>et al.</i> (2011)
<i>Alloccryptovalsa rabenhorstii</i>	Crel	Unknown	—	—	KC774567	—	Jaklitsch <i>et al.</i> (2014)
<i>Anthostoma decipiens</i> ^(†)	IPV-FW349	Italy	—	—	AM399021	AM920693	Unpublished
<i>Anthostoma decipiens</i> ^(†)	JL567	Spain	—	—	JN975370	JN975407	Luque <i>et al.</i> (2012)
<i>Cryptosphaeria avicenniae</i> , sp. nov.	NFCCI-4248	India	—	MH305300	MH304406	MH370273	This study
<i>Cryptosphaeria eunomia</i> var. <i>eunomia</i>	CBS 216.87	Switzerland	—	—	AJ302417	—	Acero <i>et al.</i> (2004)
<i>Cryptosphaeria eunomia</i> var. <i>fraxini</i>	CBS223.87	Switzerland	—	—	AJ302421	—	Acero <i>et al.</i> (2004)
<i>Cryptosphaeria halophila</i> , sp. nov.	MFLU 16-1199	Thailand	MH305318	MH305309	—	—	This study
<i>Cryptosphaeria ligniota</i>	CBS273.87	Switzerland	—	KT425298	KT425233	KT425168	Acero <i>et al.</i> (2004)
<i>Cryptosphaeria moravica</i>	CBS244.87	Switzerland	—	—	HM164735	HM164769	Trouillas & Gubler (2010)
<i>Cryptosphaeria pullmanensis</i>	HBPF24	United States	—	KT425267	KT425202	GQ294014	Trouillas <i>et al.</i> (2010a)
<i>Cryptosphaeria pullmanensis</i>	ATCC 52655	Washington, United States	—	—	KT425235	KT425170	Trouillas <i>et al.</i> (2015)
<i>Cryptosphaeria subcutanea</i>	DSUB100A	Norway	—	—	KT425189	KT425124	Trouillas <i>et al.</i> (2015)
<i>Cryptosphaeria subcutanea</i>	CBS240.87	Norway	—	—	KT425232	KT425167	Trouillas <i>et al.</i> (2015)
<i>Cryptovalsa ampelina</i>	A001	Australia	—	—	GQ293901	GQ293972	Trouillas <i>et al.</i> (2010a)
<i>Cryptovalsa ampelina</i>	DRO101	California, United States	—	—	GQ293902	GQ293982	Trouillas <i>et al.</i> (2010a)
<i>Cryptovalsa ampelina</i>	MFLUCC15-0139	Italy	KU550095	KU550096	—	—	Unpublished
<i>Cryptovalsa ampelina</i>	ATCC MYA 4399	Unknown	—	—	—	—	Unpublished
<i>Diatrypasimilis australiensis</i> ^(†)	ATCC MYA 3540	Australia	—	—	FJ430590	—	Chalkley <i>et al.</i> (2010)
<i>Diatrype bullata</i>	UCDDCh400	United States	—	—	DQ006946	DQ007002	Rolshausen <i>et al.</i> (2006)
<i>Diatrype disciformis</i>	AFTOL ID 927	Unknown	DQ471012	DQ470964	—	—	Spatafora <i>et al.</i> (2006)
<i>Diatrype disciformis</i> ^(†)	D21C (CBS 205.87)	Switzerland	—	—	AJ302437	—	Acero <i>et al.</i> (2004)
<i>Diatrype disciformis</i> ^(†)	MFLUCC 15-0538	Italy	—	—	KR092795	—	Senanayake <i>et al.</i> (2015)
<i>Diatrype enteroxantha</i>	HUEFS155114	Brazil	—	—	KM396617	KT003700	de Almeida <i>et al.</i> (2016)
<i>Diatrype enteroxantha</i>	HUEFS155116	Brazil	—	—	KM396618	KT022236	de Almeida <i>et al.</i> (2016)
<i>Diatrype macowaniana</i>	CBS214.87	Australia	—	—	AJ302413	—	Acero <i>et al.</i> (2004)
<i>Diatrype mangrovei</i> , sp. nov.	MFLUCC 17-0412	Thailand	MH305310	MH305301	MH304407	—	This study
<i>Diatrype mangrovei</i> , sp. nov.	MFLUCC 17-0391	Thailand	MH305311	MH305302	MH304408	—	This study
<i>Diatrype mangrovei</i> , sp. nov.	MFLUCC 17-0394	Thailand	MH305312	MH305303	MH304409	—	This study
<i>Diatrype oregonensis</i>	DPL200	United States	—	—	GQ293940	GQ293999	Trouillas <i>et al.</i> (2010a)
<i>Diatrype palmicola</i>	MFLUCC 11 0020	Thailand	KP753950	KP744482	—	—	Liu <i>et al.</i> (2015)
<i>Diatrype stigma</i>	DCASH200	United States	—	—	GQ293947	GQ294003	Trouillas <i>et al.</i> (2010a)
<i>Diatrype stigma</i>	ATCC MYA-4418	Unknown	FJ430579	FJ430588	—	—	Unpublished
<i>Diatrype undulate</i>	D20C (CBS 271.87)	Switzerland	—	—	AJ302436	—	Acero <i>et al.</i> (2004)
<i>Diatrypella atlantica</i>	HUEFS 194228	Brazil	—	—	KM396615	KR363998	de Almeida <i>et al.</i> (2016)
<i>Diatrypella atlantica</i>	HUEFS 136873	Brazil	—	—	KM396614	KR259647	de Almeida <i>et al.</i> (2016)
<i>Diatrypella favaceae</i>	Isolate 380	United States	—	—	KU320616	—	de Almeida <i>et al.</i> (2016)
<i>Diatrypella frostii</i>	UFMGCB 1917	Brazil	—	—	HQ377280	—	Vieira <i>et al.</i> (2011)
<i>Diatrypella heveae</i>	MFLUCC 17-0368	Thailand	—	—	MF959501	—	Senwanna <i>et al.</i> (2017)
<i>Diatrypella major</i>	Isolate 1058	United States	—	—	KU320613	—	de Almeida <i>et al.</i> (2016)

TABLE 2. — Continuation.

Taxon	Strain no. ¹	Locality	GenBank accession ²				Reference
			SSU	LSU	ITS	Btub	
<i>Diatrypella pulvinata</i>	H048	Czech Republic	–	–	FR715523	FR715495	de Almeida <i>et al.</i> (2016)
<i>Diatrypella tectonae</i>	MFLUCC 12-0172a	Thailand	–	–	KY283084	–	Shang <i>et al.</i> (2017)
<i>Diatrypella tectonae</i>	MFLUCC 12-0172b	Thailand	–	–	KY283085	KY421043	Shang <i>et al.</i> (2017)
<i>Diatrypella verruciformis</i> ^(†)	UCROK1467	United States	–	–	JX144793	JX174093	Lynch <i>et al.</i> (2013)
<i>Diatrypella verruciformis</i> ^(†)	UCROK754	United States	–	–	JX144783	JX174083	Lynch <i>et al.</i> (2013)
<i>Diatrypella vulgaris</i>	HVFRA02	New South Wales	–	–	HQ692591	HQ692503	Trouillas <i>et al.</i> (2011)
<i>Diatrypella vulgaris</i>	HVGRF03	New South Wales	–	–	HQ692590	HQ692502	Trouillas <i>et al.</i> (2011)
<i>Eutypa armeniacae</i>	ATCC 28120	Australia	–	–	DQ006948	DQ006975	Rolshausen <i>et al.</i> (2006)
<i>Eutypa astroidea</i>	CBS 292.87	Switzerland	–	–	AJ302458	DQ006966	Rolshausen <i>et al.</i> (2006)
<i>Eutypa consobrina</i>	EXF 5905	Slovenia	–	KJ468772	–	–	Kavkler <i>et al.</i> (2015)
<i>Eutypa flavovirens</i>	CBS 272.87	France	–	–	AJ302457	DQ006959	Rolshausen <i>et al.</i> (2006)
<i>Eutypa laevata</i>	CBS 291.87	Switzerland	–	–	AJ302449	–	Acero <i>et al.</i> (2004)
<i>Eutypa lata</i>	AFTOL ID 929	Unknown	DQ836896	DQ836903	–	–	Zhang <i>et al.</i> (2006)
<i>Eutypa lata</i> var <i>acerei</i>	CBS290.87	Switzerland	–	–	HM164736	HM164770	Trouillas & Gubler (2010)
<i>Eutypa lata</i> ^(†)	EP18	New South Wales	–	–	HQ692611	HQ692501	Trouillas <i>et al.</i> (2011)
<i>Eutypa lata</i> ^(†)	RGA01	South Australia	–	–	HQ692614	HQ692497	Trouillas <i>et al.</i> (2011)
<i>Eutypa lejioplaca</i>	CBS 248.87	Switzerland	–	–	DQ006922	DQ006974	Rolshausen <i>et al.</i> (2006)
<i>Eutypa leptoplaca</i>	CBS 287.87	Switzerland	–	–	DQ006924	DQ006961	Rolshausen <i>et al.</i> (2006)
<i>Eutypa maura</i>	CBS 219.87	Switzerland	–	–	DQ006926	DQ006967	Rolshausen <i>et al.</i> (2006)
<i>Eutypa microasca</i>	BAFC 51550	Argentina	–	–	KF964566	KF964572	Grassi <i>et al.</i> (2014)
<i>Eutypa sparsa</i>	3802 3b	Switzerland	–	–	AY684220	AY684201	Trouillas & Gubler (2004)
<i>Eutypella caricae</i>	EL51C	France	–	–	AJ302460	–	Acero <i>et al.</i> (2004)
<i>Eutypella cerviculata</i> ^(†)	M68	Latvia	–	–	JF340269	–	Arhipova <i>et al.</i> (2012)
<i>Eutypella cerviculata</i> ^(†)	EL59C	Switzerland	–	–	AJ302468	–	Acero <i>et al.</i> (2004)
<i>Eutypella citricolca</i>	HVVIT07	New South Wales	–	–	HQ692579	HQ692512	Trouillas <i>et al.</i> (2011)
<i>Eutypella citricolca</i>	HVGRF01	New South Wales	–	–	HQ692589	HQ692521	Trouillas <i>et al.</i> (2011)
<i>Eutypella leprosa</i>	EL54C	–	–	–	AJ302463	–	Acero <i>et al.</i> (2004)
<i>Eutypella leprosa</i>	Isolate 60	United States	–	–	KU320622	–	de Almeida <i>et al.</i> (2016)
<i>Eutypella microtheca</i>	BCM01	Mexico	–	–	KC405563	KC405560	Paolinelli-Alfonso <i>et al.</i> (2015)
<i>Eutypella microtheca</i>	ADEL200	South Australia	–	–	HQ692559	HQ692527	Trouillas <i>et al.</i> (2011)
<i>Eutypella semicircularis</i>	MP4669	Panama	–	–	JQ517314	–	Mehrabi <i>et al.</i> (2016)
<i>Eutypella vitis</i>	UCD2291AR	Arkansas, United States	–	–	HQ288224	HQ288303	Úrbez-Torres <i>et al.</i> (2012)
<i>Eutypella vitis</i>	UCD2428TX	Texas, United States	–	–	FJ790851	GU294726	Úrbez-Torres <i>et al.</i> (2009)
<i>Halocryptovalsa avicenniae</i>, comb. nov.^(†)	CBS H-22563	Saudi Arabia	KY020437	KY020436	–	–	Abdel-Wahab <i>et al.</i> (2017)
<i>Halocryptovalsa avicenniae</i>, comb. nov.^(†)	CBS H-22563	Saudi Arabia	–	KY020435	–	–	Abdel-Wahab <i>et al.</i> (2017)
<i>Halocryptovalsa salicorniae</i> , sp. nov. ^(†)	MFLUCC 15-0185	Thailand	MH305313	MH305304	MH304410	MH370274	This study
<i>Halodiatrype avicenniae</i>	MFLUCC 16-0532	Thailand	MH305314	MH305305	MH304411	MH370275	This study
<i>Halodiatrype avicenniae</i>	MFLUCC 16-0533	Thailand	MH305315	MH305306	MH304412	MH370276	This study
<i>Halodiatrype avicenniae</i>	MFLUCC 17-0396	Thailand	MH305316	MH305307	MH304413	MH370277	This study
<i>Halodiatrype avicenniae</i>	MFLUCC 15-0948	Thailand	MH305317	MH305308	MH304414	MH370278	This study
<i>Halodiatrype avicenniae</i>	MFLUCC 15-0953	Thailand	–	–	KX573916	KX573931	Dayarathne <i>et al.</i> (2016)
<i>Halodiatrype salinicola</i> ^(†)	MFLUCC 15-1277	Thailand	–	–	KX573915	KX573932	Dayarathne <i>et al.</i> (2016)
<i>Kretzschmaria deusta</i>	CBS 826.72	Mechelen, Belgium	–	–	KU683767	KU684190	U'Ren <i>et al.</i> (2016)
<i>Monosporascus cannonballus</i> ^(†)	CMM3646	Brazil	–	–	JX971617	–	unpublished
<i>Monosporascus cannonballus</i>^(†)	ATCC 26931	Unknown	–	–	FJ430598	–	unpublished
<i>Pedumispora rhizophorae</i>	BCC44878	Thailand	–	–	KJ888853	–	Klaysuban <i>et al.</i> (2014)
<i>Pedumispora rhizophorae</i>	BCC44877	Micronesia	–	–	KJ888854	–	Klaysuban <i>et al.</i> (2014)

TABLE 2. — Continuation.

Taxon	Strain no. ¹	Locality	GenBank accession ²				Reference
			SSU	LSU	ITS	Btub	
<i>Peroneutypa alsophila</i>	EL58C	France	–	–	AJ302467	–	Acero <i>et al.</i> (2004)
<i>Peroneutypa comosa</i>	BAFC 393	Argentina	–	–	KF964568	–	Grassi <i>et al.</i> (2014)
<i>Peroneutypa curvispora</i>	HUEFS 136877	Brazil	–	–	KM396641	–	de Almeida <i>et al.</i> (2016)
<i>Peroneutypa diminutiasca</i>	MFLUCC 17-2144	Thailand	–	–	MG873479	–	Shang <i>et al.</i> (2018)
<i>Peroneutypa diminutispora</i>	HUEFS 192196	Brazil	–	–	KM396647	–	de Almeida <i>et al.</i> (2016)
<i>Peroneutypa kochiana</i>	EL53M	Spain	–	–	AJ302462	–	Acero <i>et al.</i> (2004)
<i>Peroneutypa longiasca</i>	MFLUCC 17-0371	Thailand	–	–	MF959502	–	Senwanna <i>et al.</i> (2017)
<i>Peroneutypa rubiformis</i>	MFLUCC 17-2142	Thailand	–	–	MG873477	–	Shang <i>et al.</i> (2018)
<i>Peroneutypa scoparia</i>	MFLUCC 17-2143	Thailand	–	–	MG873478	–	Shang <i>et al.</i> (2018)
<i>Peroneutypa scoparia</i> ^(†)	MFLUCC 11-0478	Thailand	–	KU863139	KU940151	–	Dai <i>et al.</i> (2017)
<i>Quaternaria quaternata</i>	EL60C (CBS 278.87)	Switzerland	–	–	AJ302469	–	Acero <i>et al.</i> (2004)
<i>Quaternaria quaternata</i>	GNF13	Iran	–	–	KR605645	–	Mehrabi <i>et al.</i> (2016)
<i>Xylaria acuta</i>	5089	Unknown	–	JQ862609	–	–	Chen <i>et al.</i> (2013)
<i>Xylaria hypoxylon</i>	OSC 100004	Unknown	NG013136	NG027599	–	–	Unpublished
<i>Xylaria hypoxylon</i> ^(†)	CBS 122620	Sweden	–	–	AM993141	–	Peršoh <i>et al.</i> (2009)

TABLE 3. — Different parameters for ML and MP analyses of three distinct data sets.

Analyses	Parameters	ITS	Concatenated ITS and Btub	Concatenated SSU and LSU
ML	No of characters	579	952	1980
	Alignment patterns	375	698	249
	Proportion of undetermined characters or gaps	8.80 %	23.73 %	28.48 %
	Substitution model	GTR+I+G	GTR+I+G	GTR+I+G
	Tree-length	5.106498	6.665296	0.351401
	Estimated base frequencies	A = 0.232301 C = 0.250457 G = 0.237036 T = 0.280207	A = 0.225869 C = 0.264816 G = 0.235954 T = 0.273361	A = 0.261578 C = 0.208961 G = 0.280804 T = 0.248657
	Substitution rates	AC = 1.068182 AG = 3.127857 AT = 1.498128 CG = 0.948740 CT = 4.050618 GT = 1.000000	AC = 1.030114 AG = 3.262030 AT = 1.271164 CG = 0.872229 CT = 3.616471 GT = 1.000000	AC = 0.936159 AG = 2.455723 AT = 1.379166 CG = 0.334815 CT = 9.536768 GT = 1.000000
	Gamma distribution shape parameter	$\alpha = 0.427568$	$\alpha = 0.492984$	$\alpha = 0.020000$
	No. of characters	579	952	1980
	No. of constant characters	201	288	1758
MP	No. of parsimony-informative characters	288	555	97
	No. of parsimony-uninformative characters	90	109	125
	Tree length (TL)	1792	2955	369
	Consistency index (CI)	0.377	0.406	0.691
	Retention index (RI)	0.734	0.746	0.582
	Rescaled consistency index (RC)	0.276	0.303	0.402
	Homoplasy index (HI)	0.623	0.594	0.309

in the majority rule consensus tree, after discarding the first 1500 trees representing the burn-in phase (10%) of the analysis. For the ITS and concatenated SSU and LSU data sets, six simultaneous Markovchains were run for 1M generations and trees were sampled every 100th generation resulting in 10 001

total trees. 9001 trees were used for calculating posterior probabilities (PP) in the majority rule consensus tree, after discarding the first 1000 trees representing the burn-in phase (10%) of the analysis. Other details pertaining to ML and MP analyses of different datasets are summarized in Table 3. Overall, the

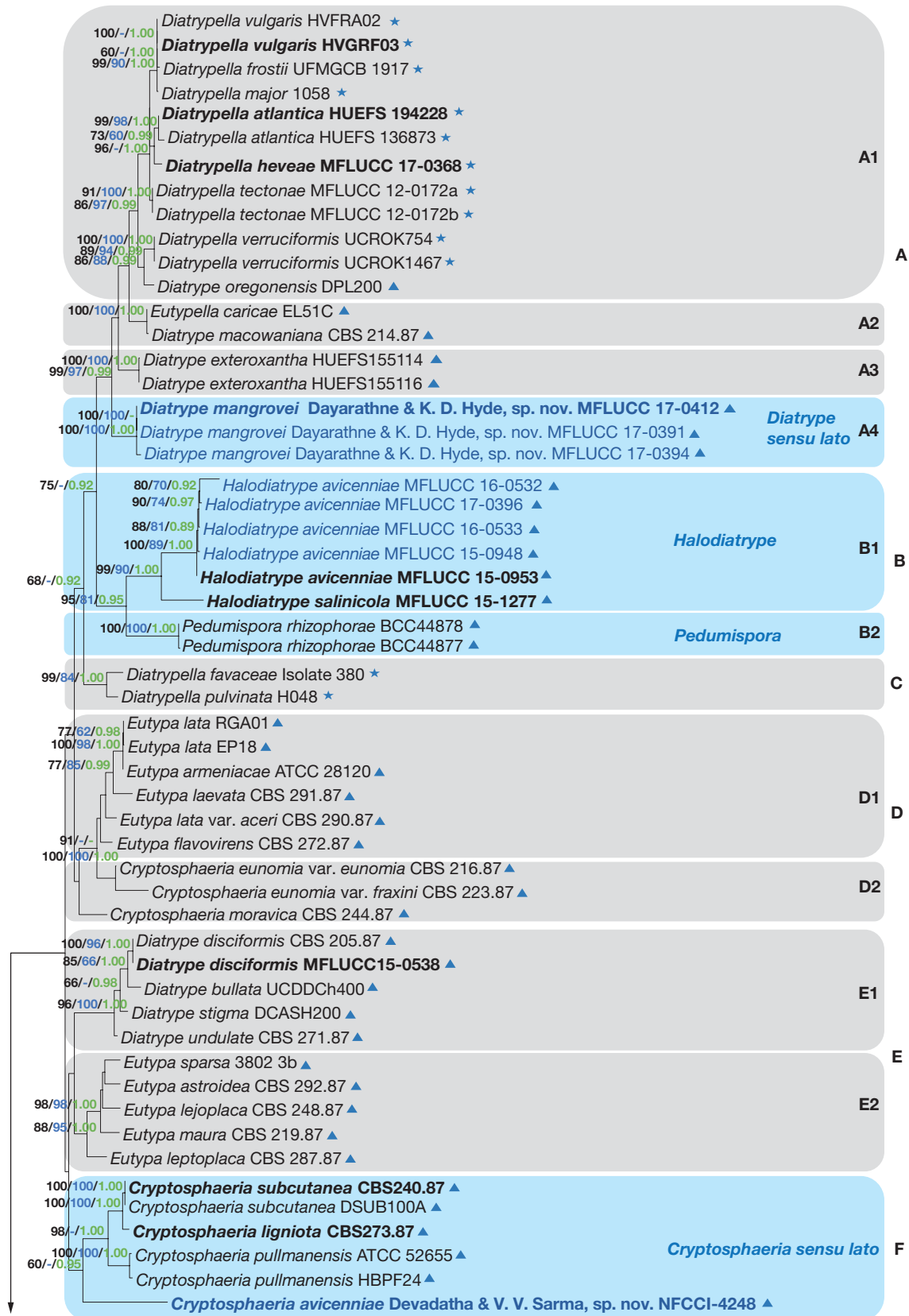


FIG. 1. — Phylogram generated from the best scoring RAxML tree based on combined ITS and Btub sequence data. Bootstrap support values for maximum likelihood (ML, black) and maximum parsimony (MP, blue) equal or greater than 60 % are given above the nodes. Bayesian posterior probabilities (PP, green) equal or greater than 0.90 are shown above the branch. The tree is rooted to *Xylaria hypoxylon* (CBS 122620) and *Kretzschmaria deusta* (CBS 826.72). All sequences from ex-type strains are in bold. Symbols: ★, polyporous species; ▲, octosporous species; ●, species with less than eight spores. Scale bar: 0.2 (expected number of nucleotide substitutions per site per branch).

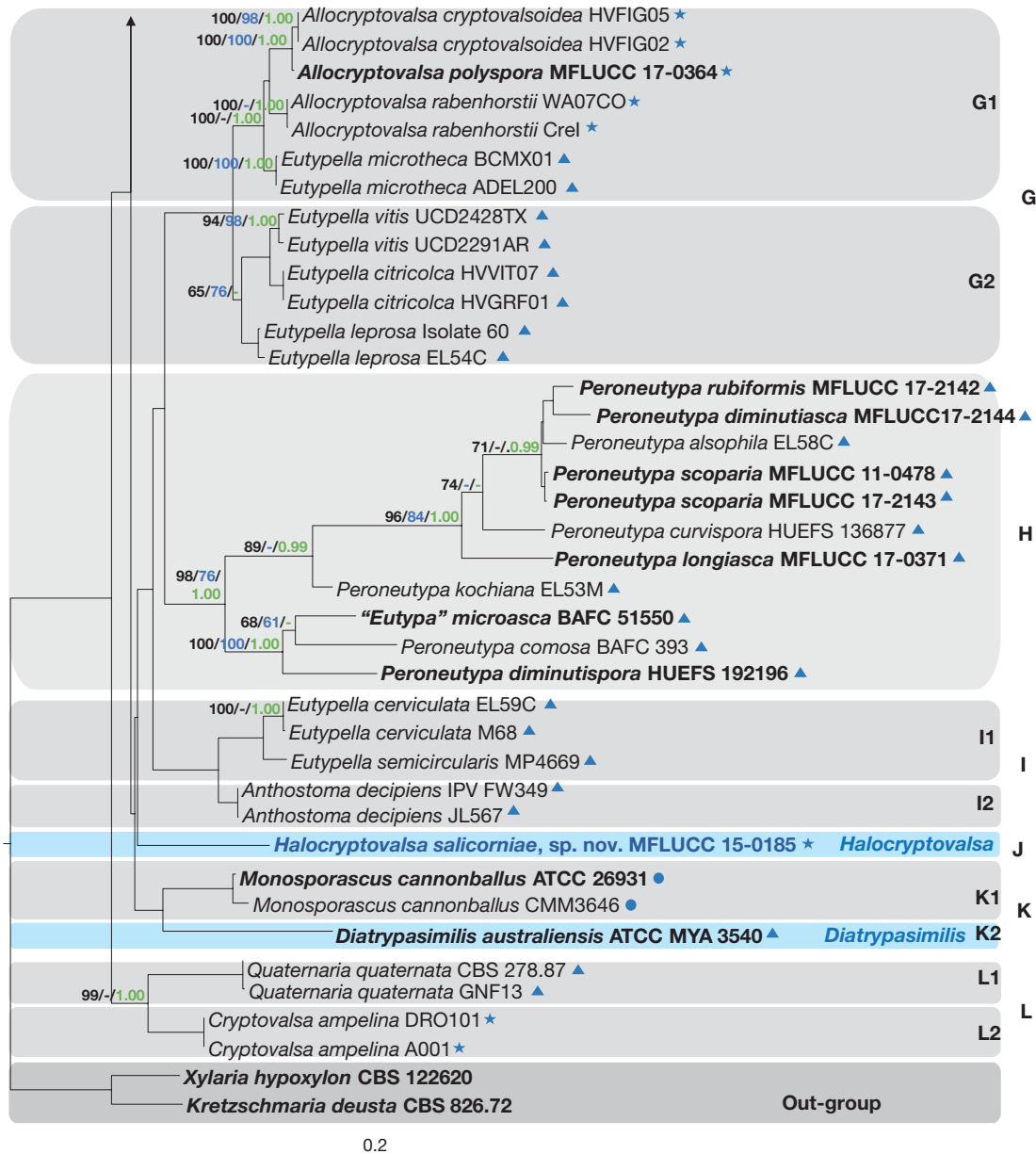


FIG. 1. — Continuation.

topologies obtained from the different phylogenetic analyses were mostly similar in ITS+Btub and ITS analyses and the best scoring ML trees are illustrated as Figures 1 and 2.

ITS & Btub phylogeny

To discuss tree output of combined ITS+Btub analysis (Fig. 1), we divided the taxa in the phylogram into 12 clades (A-L), and ingroup taxa in Clade A into four subclades (A1-A4), Clade B into two subclades (B1-B2), Clade D into two subclades (D1-D2), Clade E into two subclades (E1-E2), Clade G into two subclades (G1-G2), Clade K into two subclades (K1-K2), Clade L into two subclades (L1-L2). Three newly generated sequences of *Diatrypa mangrovei* Dayarathne & K.D.Hyde, sp. nov. (MFLUCC 17-0412, MFLUCC17-0391 and MFLUCC17-0394) grouped with *Diatrypa enteroxantha*,

D. macowaniana, *D. oregonensis*, *Diatrypella atlantica*, *Di. frostii*, *Di. heveae*, *Di. major*, *Di. tectonae*, *Di. verruciformis*, *Di. vulgaris* and *Eutypella caricae*. These taxa form a clade (clade A, Fig. 1) in *Diatrypaceae* with significant statistical support (99% ML, 97% MP and 0.99 PP, Fig. 1). *Diatrypa enteroxantha* is closely related to *D. mangrovei* Dayarathne & K.D.Hyde, sp. nov., in this clade A (Fig. 1). Clade B comprised only marine species viz. *Halodiatrypa avicenniae* (including four newly generated sequences), *H. salinicola* and *Pedumispora rhizophorae*. This clade received 95% ML, 85% MP and 0.95 PP (Fig. 1) statistical support.

The polysporous taxa *Diatrypella favaceae* and *Di. pulvinata* formed a distinct clade (clade C), basal to clade B in *Diatrypaceae* with strong bootstrap support (99% ML, 84% MP, 1.00 PP, Fig. 1). The fourth clade (clade D, Fig. 1)

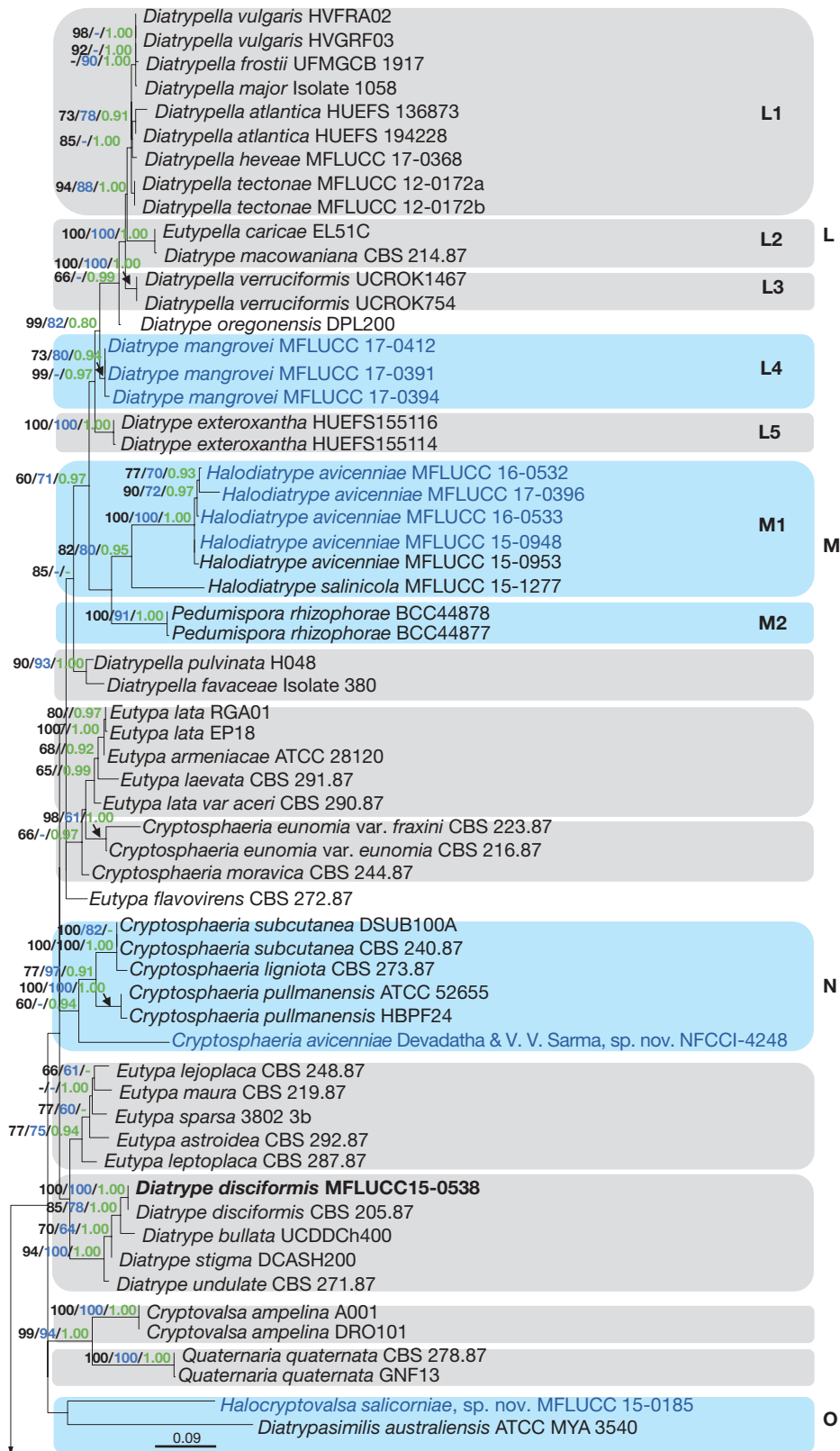


FIG. 2. — Phylogram generated from the best scoring RAXML tree based on ITS sequence data. Bootstrap support values for maximum likelihood (ML, black) and maximum parsimony (MP, blue) equal or greater than 60% are given above the nodes. Bayesian posterior probabilities (PP, green) equal or greater than 0.90 are shown above the branch. The tree is rooted to *Xylaria hypoxylon* (CBS 122620) and *Kretzschmaria deusta* (CBS 826.72). Scale bar: 0.09 (expected number of nucleotide substitutions per site per branch).

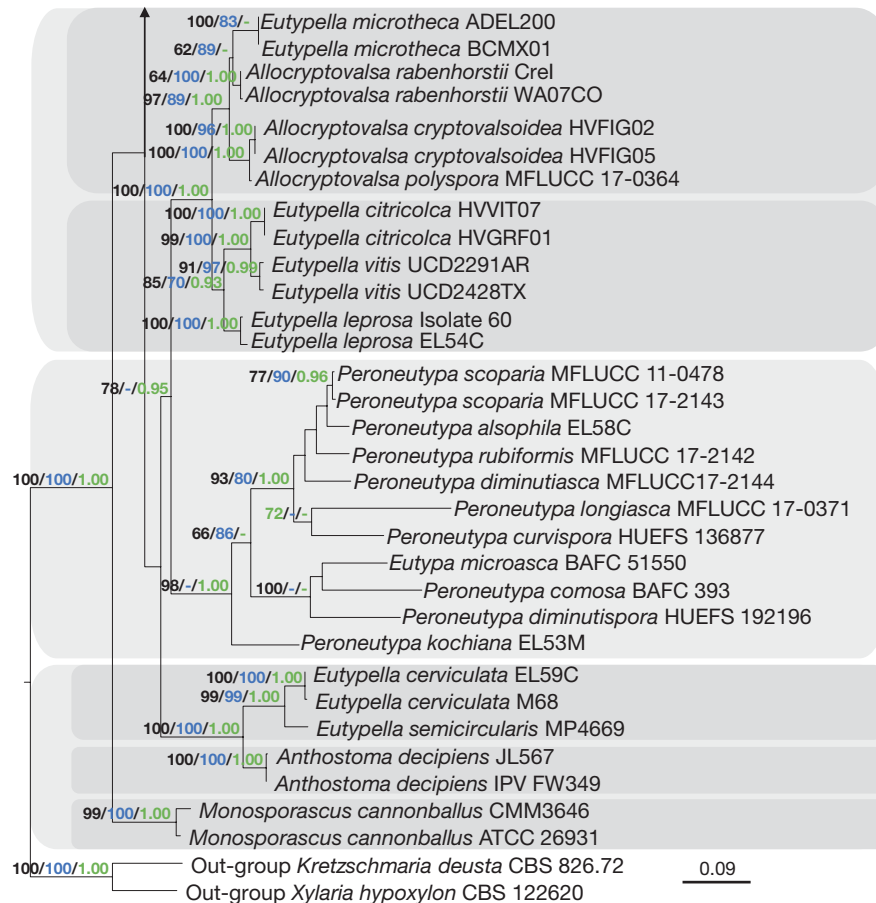


FIG. 2. — Continuation.

comprises octosporous *Eutypa* species (subclade D1); *Eutypa armeniacae*, *E. flavovirens*, *E. lata*, *E. lata* var. *aceri*, *E. laevata*, and *Cryptosphaeria sensu stricto* (subclade D2); *Cr. eunomia* var. *eunomia*, *Cr. eunomia* var. *fraxini* and *Cr. moravica*. This clade is not strongly supported in all three analyses.

Diatrype disciformis, which is the type of *Diatrype*, grouped in subclade E1 with *D. bullata*, *D. stigma* and *D. undulata* with strong bootstrap support (96% ML, 100% MP, 1.00 PP, Fig. 1). Several other octosporous *Eutypa* species (sub clade E2); *E. astroidea*, *E. lejioplaca*, *E. leptoplaca*, *E. maura* and *E. sparsa* were grouped with 88% ML, 95% MP, 1.00 PP, statistical support sister to subclade E1 in *Diatrypaceae* (Fig. 1). The novel marine *Cryptosphaeria* species, *Cryptosphaeria avicenniae* Devadatha & V.V.Sarma, sp. nov. (NFCCI 4248) grouped with *Cr. ligniota*, *Cr. pullmanensis*, and *Cr. subcutanea* in *Diatrypaceae* (clade F, Fig. 1). However, this relationship is not well supported in ITS+Btub analyses.

Allocryptovalsa cryptovalsoidea, *A. polyspora*, *A. rabenhorstii*, and octosporous *Eutypella* species, *Eutypella citricolca*, *Eu. leprosa*, *Eu. microtheca* and *Eu. vitis* represented clade G in *Diatrypaceae* (Fig. 1). *Eutypa microasca*, *Peroneutypa alsophila*, *P. comosa*, *P. curvispora*, *P. diminutiasca*, *P. diminutispora*, *P. kochiana*, *P. longiasca*, *P. rubiformis*, *P. scoparia* and

P. scoparia from a distinct clade (clade H) with high bootstrap values (98% and 76% in ML and MP analyses, respectively) and high PP value (1.00). Clade I comprised *Eutypella cerviculata*, *Eu. semicircularis* and *Anthostoma decipiens*. The novel marine genus and species *Halocryptovalsa salicorniae* Dayarathne & K.D.Hyde, sp. nov. (MFLUCC 15-0185) grouped basal to clade I (clade J). *Quaternaria quaternata* and *Cryptovalsa ampelina* are the most basal members in *Diatrypaceae* (clade L, Fig. 1).

ITS phylogeny

The alignment of ITS loci was used to build a phylogeny that resolved species diversity within the family *Diatrypaceae*. The ITS phylogram showed eleven distinct clades (Fig. 2) with few topological differences from the ITS+Btub phylogram. However, a significant difference was observed in the phylogenetic placement of the novel species *Halocryptovalsa salicorniae* Dayarathne & K.D.Hyde, sp. nov., which grouped with the monotypic marine genus *Diatrypasimilis* in the ITS phylogram (clade O in Fig. 2), and as a separate lineage in ITS+Btub tree. Overall topology of the ITS phylogram revealed that single ITS loci is inappropriate for generic delineation in the family *Diatrypaceae*.

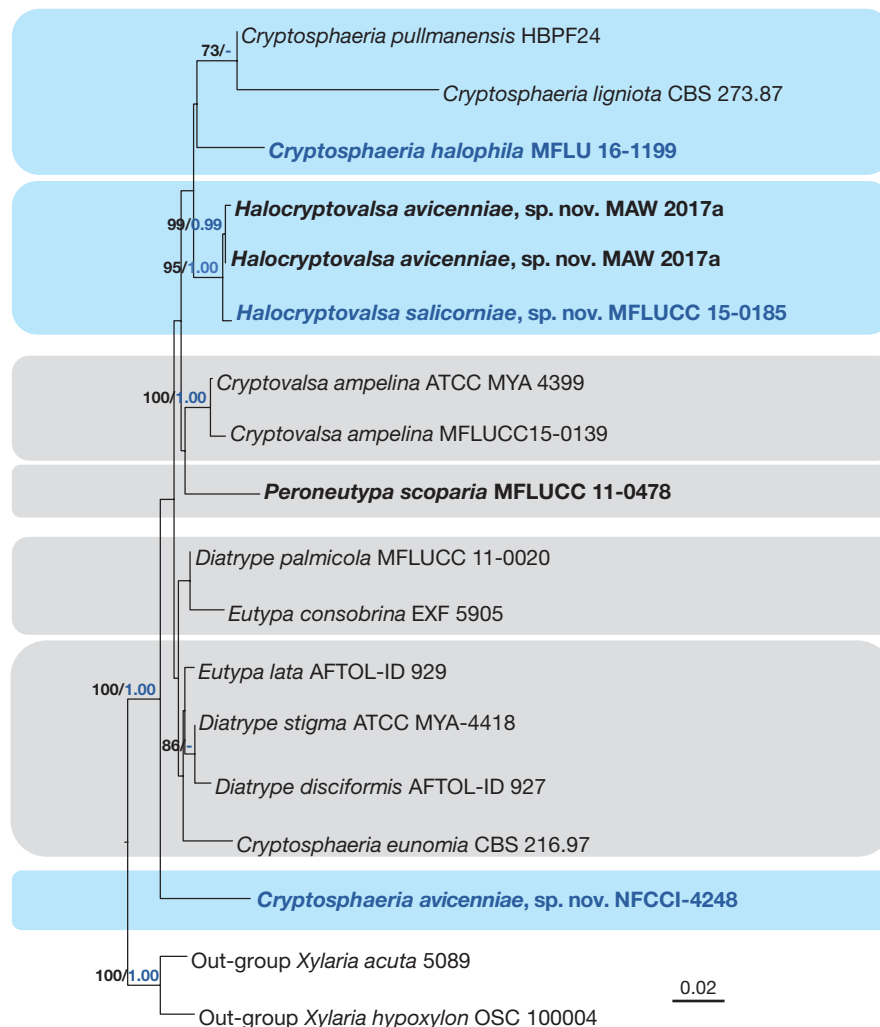


FIG. 3. — Phylogram generated from the best scoring RAxML tree based on combined LSU and SSU sequence data. Bootstrap support values for maximum likelihood (ML, **blue**) equal or greater than 60 % are given above the nodes. Bayesian posterior probabilities (PP, **green**) equal or greater than 0.90 are shown above the branches. The tree is rooted to *Xylaria hypoxylon* (OCS 100004) and *Xylaria acuta* (5089). All sequences from ex-type strains are in **bold**. Scale bar: 0.02 (expected number of nucleotide substitutions per site per branch).

The phylogeny resulting from the analyses of concatenated SSU+LSU showed that tree topology of MP analysis was different from that of ML and BI analyses (Figs 3; 4).

LSU and SSU phylogeny

The following significance differences were observed in analyses with combined SSU+LSU gene sequences (Figs 3; 4); In the MP, ML and BI analyses *Halocryptovalsa salicorniae* Dayarathne & K.D.Hyde, sp. nov. (MFLUCC 15-0185) grouped with two strains of *Hcr. avicenniae* (CBS H-22563) and apart from *Cryptovalsa* species. Hence, support for the genus *Halocryptovalsa* Dayarathne & K.D.Hyde, gen. nov., is provided. *Halocryptovalsa salicorniae* Dayarathne & K.D.Hyde, sp. nov. (MFLUCC 15-0185) formed a separate lineage from *Hcr. avicenniae* strains with significant statistical support (95% ML, 100% MP, 1.00 PP) (Figs 3; 4). *Cryptosphaeria halophila* Dayarathne & K.D.Hyde, sp. nov. (MFLUCC 16-0536) clustered in a clade with *Cr. pullmanensis* (HBPF24) and *Cr. ligniota* (CBS 273.87) (Fig. 3) as a basal lineage with no statistical

support in the ML and BI analyses. *Cryptosphaeria halophila* Dayarathne & K.D.Hyde, sp. nov. (MFLUCC 16-0536) formed a separate clade with *Cr. avicenniae* basal to a clade comprising *Cr. ligniota* (CBS 273.87) and *Cr. pullmanensis* (HBPF24) in the MP analysis.

TAXONOMY

Cryptosphaeria Ces. & De Not.

Commentario della Società Crittogamologica Italiana 1 (4): 231 (1863).

NOTES

Cryptosphaeria Ces. & De Not. was introduced by Greville (1822). Taxonomic significance of this genus remained unclear as the original author incorporated a number of disparate taxa under this genus *viz.* *Botryosphaeria* species, due to some

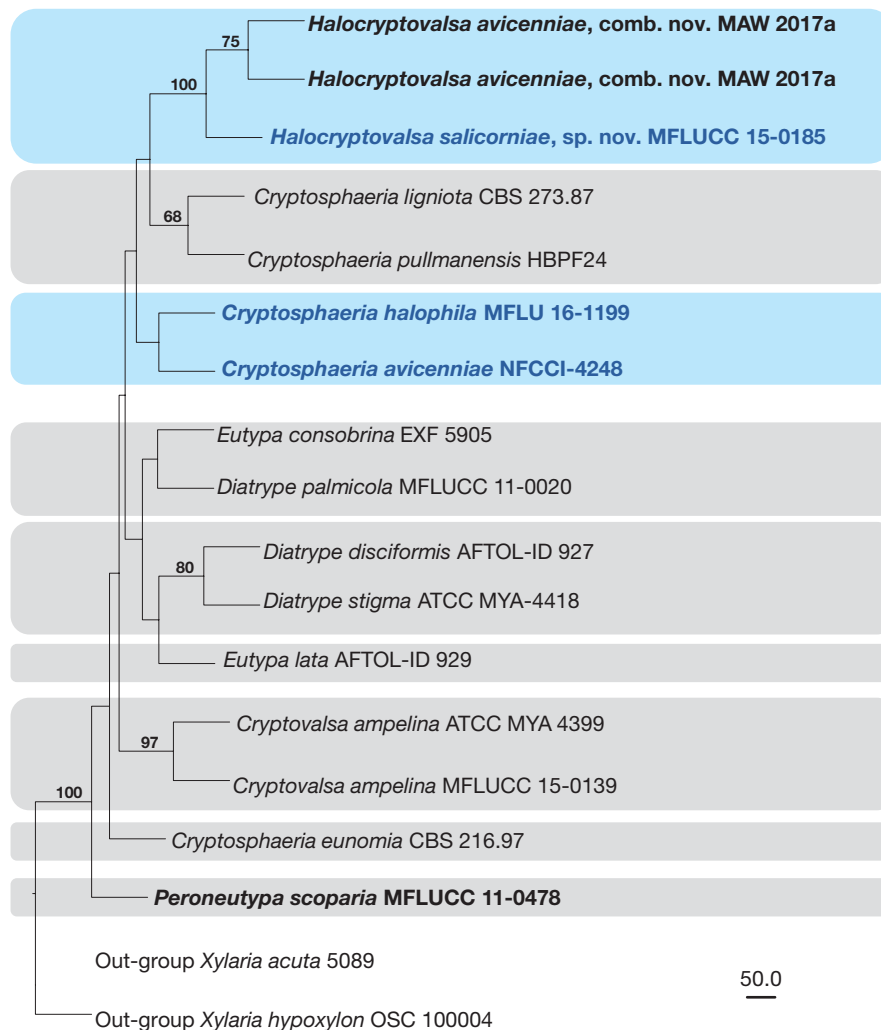


FIG. 4. — Phylogram generated from the best scoring MP tree based on combined LSU and SSU sequence data. Bootstrap support values for maximum parsimony (MP) equal or greater than 60 % are given above the nodes. The tree is rooted to *Xylaria hypoxylon* (OCS 100004) and *Xylaria acuta* (5089). Scale bar: 50 (expected number of nucleotide substitutions per site per branch).

morphological similarities such as ascostromata characters (Rappaz 1987). Cesati & De Notaris (1863) re-used the name *Cryptosphaeria* and designated *Cryptosphaeria millepunctata* as the type species, although *Cr. eunomia*, is now the widely accepted name for the type (Clement & Shear 1931). *Cryptosphaeria* Ces. & De Not. (1863) has been adopted in favour of *Cryptosphaeria* Grev. (Rappaz 1989). *Cryptosphaeria* species produce 8-spored, spindle-shaped asci with long stipitate and subolivaceous to brown ascospores (Glawe & Rogers 1984; Rappaz 1987; Trouillas *et al.* 2011). This genus comprises 13 species of which *Cr. eunomia* and *Cr. mangrovei* have been reported as saprobes from marine habitats (Trouillas *et al.* 2015; Jones *et al.* 2015). Recently, *Cr. mangrovei* has been synonymized with *Halodiatrype mangrovei*, based on morphological characteristics (Dayarathne *et al.* 2016) (see description and illustration under *Halodiatrype mangrovei*). Currently, combined ITS (ITS1, 5.8s and ITS2 regions) and Btub gene sequence data coupled with morphological characteristics are used to differentiate *Cryptosphaeria* species (Acero *et al.* 2004,

Trouillas *et al.* 2010a). Our phylogenetic analyses showed that *Cryptosphaeria* is polyphyletic, as reported by Shang *et al.* (2017) and Senwana *et al.* (2017).

Cryptosphaeria avicenniae
Devadatha & V.V.Sarma, sp. nov.
(Figs 5; 6)

MYCOBANK. — MB 824296.

FACESOFFUNGI NUMBER. — FoF 04596.

ETYMOLOGY. — Name referring the host genus, *Avicennia*.

CULTURE CHARACTERISTICS. — Ascospores germinating on seawater agar within 24 hours, germ tubes arising from both sides of the ascospores. Colonies on MEA reaching 40-60 mm diameter after 15 days incubation at room temperature, white to cream, reverse pale yellow to black in middle, cottony, surface undulate, irregular. Culture isolated from single ascospores remained non-sporulating after incubation for one month.

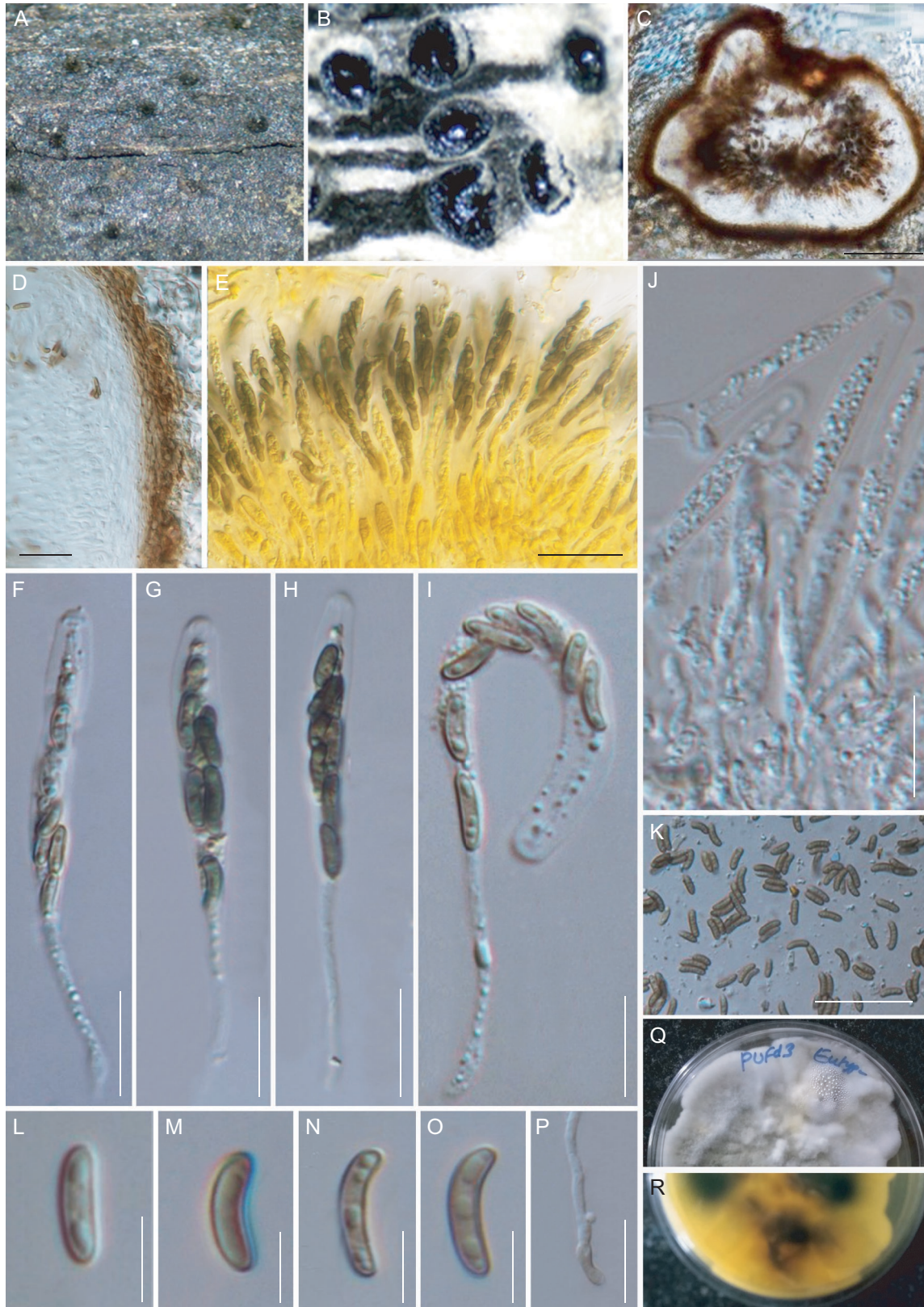


FIG. 5. — Sexual morph of *Cryptosphaeria avicenniae* Devadatha & V.V.Sarma, sp. nov. (AMH-9952 – holotype): **A**, ascomata erumpent, immersed in decaying wood of *Avicennia marina*; **B**, horizontal sections of ascomata; **C**, vertical section of ascomata; **D**, peridium; **E-I**, immature and mature asci; **J**, paraphyses; **K-O**, ascospores; **P**, germ tube develop from apical side of ascospore; **Q, R**, culture on PDA (Q-upper, R-lower). Scale bars: C, 100 μ m; D, E, 50 μ m; F-I, J, K = 20 μ m; L-P, 5 μ m.

MATERIAL EXAMINED. — **India**, Tamil Nadu, Tiruvarur, Muthupet mangroves, 10.4°N, 79.5°E, on decaying wood of *Avicennia marina* (Acanthaceae), 24.XII.2016, B. Devadatha (holo-, AMH[AMH-9952]), ex-type living culture NFCCI-4248.

DISTRIBUTION. — India.

DESCRIPTION

Saprobic on decaying wood of *Avicennia marina*.

Sexual morph

Stromata. 0.5–1 cm long as black spots, blackening the wood surface, entostroma prosenchymatous, poorly developed, dorsally limited by a black zone binding the fruiting areas.

Ascomata. Immersed, spherical to flattened, numerous, 300–600 µm high, 200–700 µm diameter ($\bar{x}$ = 479 × 450 µm, n = 10), regularly spaced, and sometimes deeply buried.

Ostiole. 100–350 µm long and 60–160 wide ($\bar{x}$ = 205 × 120 µm, n = 10), periphysate, not uniformly raised from blackened wood surface, or weakly raised, then wood surface blackened only under the ascomata.

Peridium. 35–80 µm ($\bar{x}$ = 50 µm, n = 10), composed of thin white line under the black hymenium, composed of two layers; a subhymenial layer of hyaline hyphae of textura globosa-angularis and outermost layer made up of light brown cells of textura angularis fused with wood elements.

Hamathecium. Composed of numerous, hyaline paraphyses, persistent, 1–2 µm wide.

Asci. 50–95 × 7–14 µm ($\bar{x}$ = 64 × 9 µm, n = 30), pedicel 40–70 × 2.5–7 µm ($\bar{x}$ = 49 × 3.7 µm, n = 30), 8-spored, unitunicate, clavate to spindle shaped, long pedunculated, J- in Lugol's reagent, persistent.

Ascospores. 5–13 × 1.5–3 µm ($\bar{x}$ = 8 × 2 µm, n = 50), allantoid, light brown, containing oil droplets and limited by a thin episore, lacking sheath or appendages.

Asexual morph

Conidiomata. Immersed, sub-globose to globose, 150–450 × 145–250 µm ($\bar{x}$ = 242 × 181 µm, n = 6), solitary to aggregated, deeply immersed in a stroma with the ascomata of the sexual stage, pale yellow to light brown.

Peridium. 15–25 ($\bar{x}$ = 21 µm, n = 6) thick, comprising brown, thick-walled textura angularis and pseudoparenchymatous cells merged with the host tissue.

Conidiophores. 35–55 × 1–3.5 ($\bar{x}$ = 45.5 × 2 µm, n = 10), aseptate, straight or curved, hyaline, rarely branched with one conidiogenous cell.

Conidiogenous cells. 15–35 × 1–2.5 ($\bar{x}$ = 26.5 × 1.6 µm, n = 10), cylindrical, mostly straight, discrete or integrated,

arising from pseudoparenchymatous cells, hyaline, unicellular, with wide base producing conidia at the apex.

Conidia. 20–50 × 0.5–2 ($\bar{x}$ = 30.6 × 1 µm, n = 20), hyaline, numerous, filiform, straight, curved or hook like, with blunt ends.

NOTES

Cryptosphaeria avicenniae Devadatha & V.V.Sarma, sp. nov., has a wide, white line under the black hymenium in the ascomata, which is akin to *Cr. bathurstensis* (synonym of *Eutypa bathurstensis*). *Cryptosphaeria avicenniae* Devadatha & V.V.Sarma, sp. nov., and *Cr. bathurstensis* have similar morphological characteristics with overlapping dimensions of the ascomata (300–585 × 200–700 vs 300–600 × 800 µm) and ascospores (5–13 × 1.5–3 vs 6–12 × 2–2.8 µm). *Cryptosphaeria avicenniae* Devadatha & V.V.Sarma, sp. nov., has shorter necks and light brown ascospores when compared to *Cr. bathurstensis* (100–350 µm vs 500 µm). *Cryptosphaeria avicenniae* Devadatha & V.V.Sarma, sp. nov., has larger asci bearing spore part (50–95 × 7–14 µm), light brown ascospores, and found on *Avicennia marina*. *Cryptosphaeria bathurstensis* (K.D.Hyde & Rappaz) Dayarathne & K.D.Hyde, comb. nov., has smaller asci bearing spore part (30–50 × 8–10 µm), olive-brown ascospores and is known on branches of *Avicennia* sp. located in the upper intertidal region. Unfortunately, the type of *Cr. bathurstensis* lacks sequence data for a comparison. *Halodiatrype avicenniae* is obviously distinct from *Cryptosphaeria avicenniae* Devadatha & V.V.Sarma, sp. nov., in having deeply immersed smaller ascomata in a darkened pseudostroma and larger asci and ascospores. Morphological similarities that *Cr. avicenniae* Devadatha & V.V.Sarma, sp. nov., has with other *Cryptosphaeria* species are the widely effuse and poorly developed stromata, spindle-shaped, long-stipitate asci with light brown ascospores. Multigene phylogenetic analyses of combined datasets of ITS+Btub and ITS showed that *Cr. avicenniae* Devadatha & V.V.Sarma, sp. nov., nested with *Cryptosphaeria* species. *Cryptosphaeria avicenniae* Devadatha & V.V.Sarma, sp. nov., showed a sister relationship with *Cr. pulmanensis*, *Cr. ligniota* and *Cr. subcutanea* with moderate statistical support (ITS+Btub = 60% ML, 0.94 PP) (ITS = 60% ML, 0.95 PP) (clade F in Fig. 1, clade N in Fig. 2). Morphologically *Cr. avicenniae* Devadatha & V.V.Sarma, sp. nov., is distinct from *Cr. ligniota* and *Cr. pulmanensis* in having light brown ascospores containing oil droplets whereas *Cr. ligniota* have pale yellow ascospores and *Cr. pulmanensis* have brown ascospores and by occurring in a marine habitat. *Cryptosphaeria ligniota*, *Cr. pullmanensis* and *Cr. subcutanea* are specific to their host plants in *Salicaceae* (*Populus* and *Salix* spp.) from terrestrial habitats (Rappaz 1987). Ascospores of *Cryptosphaeria* species are distinct: *Cr. pullmanensis* with oblong to reniform, occasionally septate, brown ascospores; *Cr. subcutanea* allantoid to cylindrical, brown ascospores; *Cr. ligniota* allantoid, pale yellow ascospores. *Cryptosphaeria ligniota* and *Cr. subcutanea* have J+ asci, while the other species discussed in this paper have J- asci. Hence, a new species *Cr. avicenniae* Devadatha & V.V.Sarma, sp. nov., is introduced based on both morphological and phylogenetic analysis. The asexual morph of *Cr. avicenniae* Devadatha &

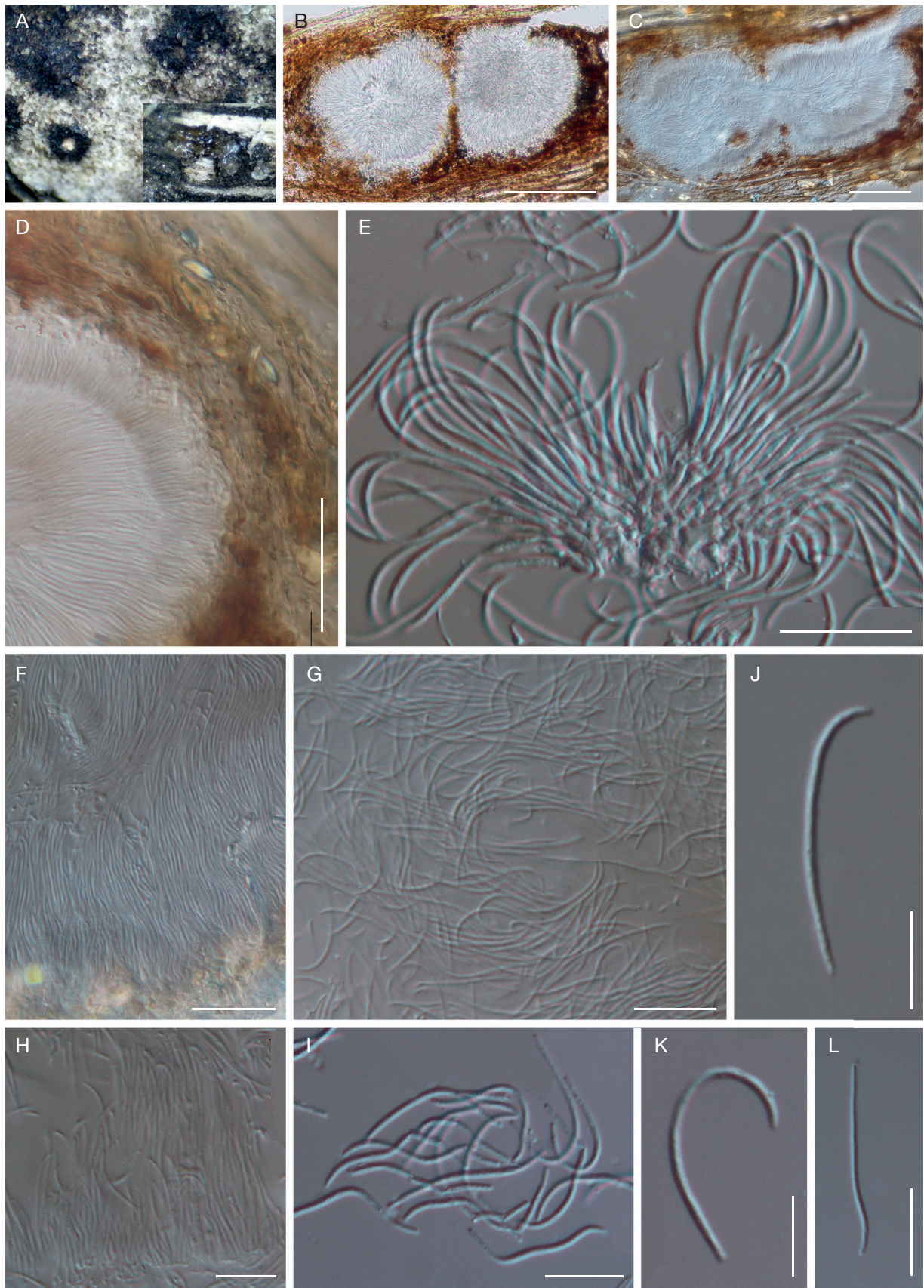


FIG. 6. — Asexual morph of *Cryptosphaeria avicenniae* Devadatha & V.V.Sarma, sp. nov. (AMH-9952 – holotype): **A**, conidiomata on host (*Avicennia marina*); **B, C**, horizontal section through conidioma; **D**, peridium; **E, F**, conidiophores and conidiogenous cells; **G–L**, conidia. Scale bars: B–C, 100 µm; D, 50 µm; E–L, 10 µm.

V.V.Sarma, sp. nov., is similar to the anamorph reported for *Diatrypaceae* members, with filiform, hyaline conidia that are straight or curved with blunt ends.

Cryptosphaeria bathurstensis (K.D.Hyde & Rappaz)
Dayarathne & K.D.Hyde, comb. nov.
(Fig. 7)

Eutypa bathurstensis K.D.Hyde & Rappaz, *Mycological Research* 97 (7): 861 (1993).

MYCOBANK. — MB 825271.

FACESOFFUNGI NUMBER. — FoF 04597.

MATERIAL EXAMINED. — Australia, North Queensland, *Avicennia* sp., Bathurst Heads, 10.VII.1991, K. D. Hyde (holo-, BRIP[BRIP-78339]).

DISTRIBUTION. — Australia, Bahamas, Egypt, Hong Kong, India, Malaysia, Taiwan, Thailand.

DESCRIPTION

Sexual morph

Stromata. Up to 1-2 cm long, immersed, blackening the wood surface.

Entostroma. Poorly developed, dorsally limited by a black zone binding the stromatic area.

Ascomata. 450-520 × 600-750 µm, spherical to sub-spherical, regularly spaced, submerged in the wood, occasionally deeply buried, long necked, raised, blackening the wood surface.

Ostiole. 100-270 × 120-220 µm, poorly developed or conical, not sulcate.

Peridium. 35-45 µm wide, comprising thin white line under the black hymenium, composed of three layers; a subhymenial layer of hyaline hyphae of textura globosa-angularis mixed with ascogenous elements, a middle layer comprising guttulate hyaline cells, forming a textura globosa, an outermost layer composed of melanized cells interspersed with wood elements, wider near the ostiolar canal.

Hamathecium. Lining the whole cavity.

Paraphyses. Numerous, hyaline, aseptate, persistent.

Asci. 35-40 × 7-10 µm ($\bar{x}$ = 35.5 × 8 µm, n = 10) (spore bearing part), 8-spored, clavate, J-, long pedicellate.

Ascospores. 6-10 × 2-2.6 µm ($\bar{x}$ = 8 × 2.2 µm, n = 30), olive-brown, aseptate, allantoid, guttulate.

Asexual morph

Undetermined.

NOTES

Cryptosphaeria bathurstensis (K.D.Hyde & Rappaz) Dayarathne & K.D.Hyde, comb. nov., was first collected on branches of *Avicennia* located in the upper intertidal region, inundated by seawater for several days each month at Bathurst Heads, northeast Queensland. This (and an unidentified *Eutypa* and *Eutypella*) was the first species of *Diatrypaceae* collected in such an “unusual habitat” (Hyde & Rappaz 1993). It is unusual amongst the *Diatrypaceae* in possessing a thick, hyaline wall under the hymenium (Hyde & Rappaz 1993). The wall comprised three strata: subhymenial, median, and external layers. Hyde & Rappaz (1993) described the presence of numerous crystals in middle and outermost layers, which were interspersed with the peridium cells, but we did not observe this in our study. Hyde & Rappaz (1993) described the asexual morph of *Cryptosphaeria bathurstensis* (K.D.Hyde & Rappaz) Dayarathne & K.D.Hyde, comb. nov., as hyaline, filiform conidia in axenic cultures, which were similar to those previously described within the *Diatrypaceae* (Glawe & Rogers 1982, 1986; Rappaz 1987). Our morphological studies showed that this species is similar to *Cryptosphaeria* species, comprises exclusively corticolous species of the *Diatrypaceae*, with widely effuse and poorly developed stromata that often are covered by the periderm, which is penetrated only by the separately emerging ostioles. Asci are generally spindle-shaped, long-stipitate, with subolivaceous to brown ascospores (Glawe & Rogers 1984; Rappaz 1987). This species also resembles *Halodiatrype* species in lacking stromatic tissues and ascospore morphology. However, ascomata of *Halodiatrype* species are deeply immersed in a darkened pseudostroma while stromata of *Cryptosphaeria bathurstensis* (K.D.Hyde & Rappaz) Dayarathne & K.D.Hyde, comb. nov., are immersed but blackening the wood surface with a poorly developed entostroma. *Cryptosphaeria bathurstensis* (K.D.Hyde & Rappaz) Dayarathne & K.D.Hyde, comb. nov., lacks the unique characteristics of *Eutypa* species, such as well-developed stromata, flask-shaped ascomata, scattered evenly in to a single layer just beneath the surface, often prominent sulcate ostioles or ostioles that are distinctly beaked, black, sometimes ornamented with radial furrows and hyaline or yellowish ascospores (Wehmeyer 1975; Glawe & Rogers 1984). *Cryptosphaeria avicenniae* Devadatha & V.V.Sarma, sp. nov., grouped with *Cryptosphaeria* species in our phylogenetic analyses. Considering the above morphological observations and phylogenetic placement of other morphologically related species we transfer *Eutypa bathurstensis* to the genus *Cryptosphaeria*.

Cryptosphaeria eunomia (Fr.) Fuckel

Jahrbücher des Nassauischen Vereins für Naturkunde 23-24: 212 (1870).

Sphaeria eunomia Fr., *Systema mycologicum* (Lundae) 2 (2): 377 (1823).

DISTRIBUTION. — Denmark, Germany, Poland, Portugal, Russia, Sweden, Switzerland, Ukraine, as *Cryptosphaeria millepunctata* (synonym of *Cryptosphaeria eunomia*), United States Marine based specimens from Pohnpei, Federated States of Micronesia western Pacific Ocean.

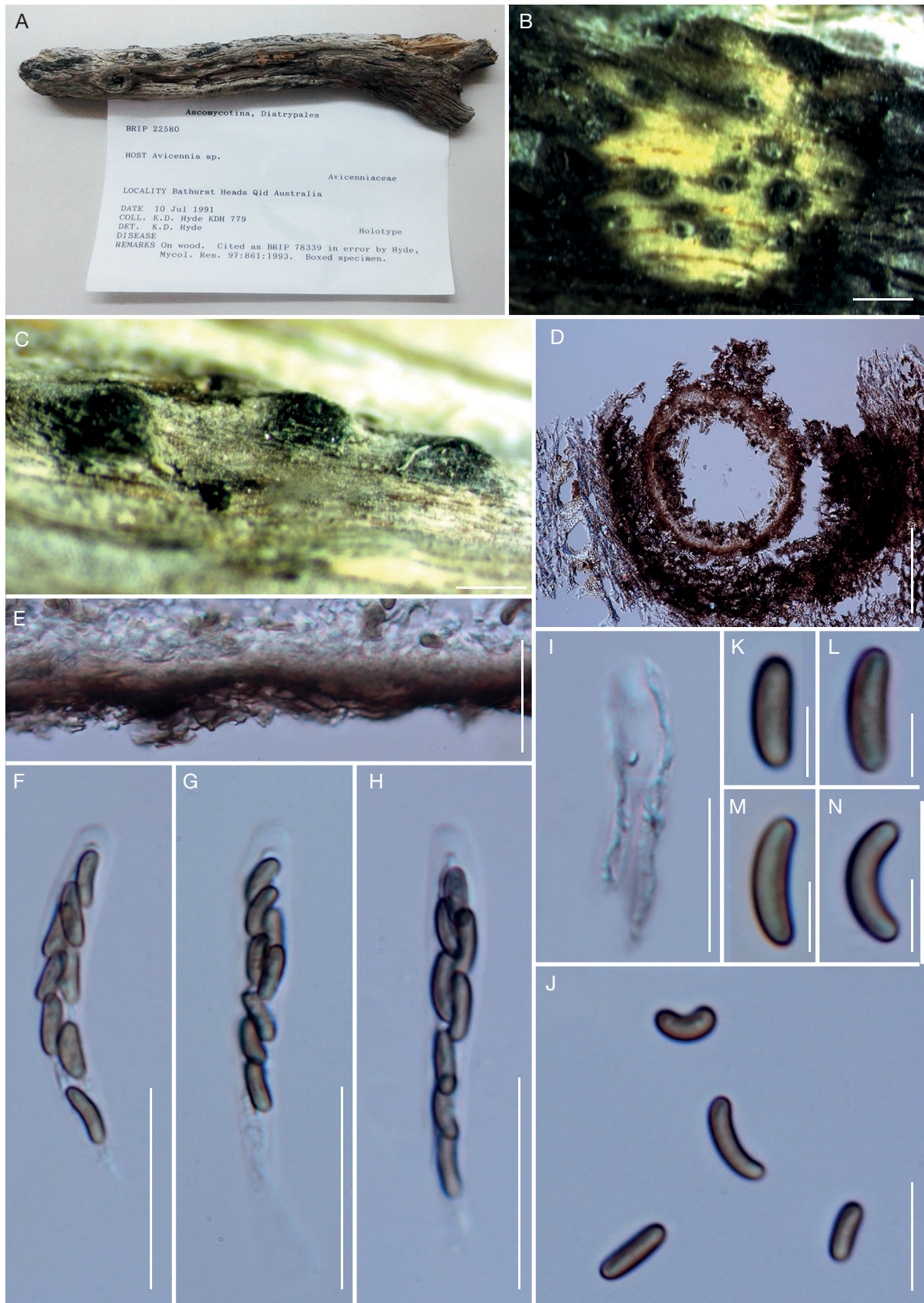


FIG. 7. — *Cryptosphaeria bathurstensis* (K.D.Hyde & Rappaz) Dayarathne & K.D.Hyde, comb. nov. (BRIP 78339 – holotype): **A**, herbarium material; **B**, horizontal section through ascostroma; **C**, appearance of ascostromata on host; **D**, section through ascoma; **E**, peridium; **F–H**, asci; **I**, paraphyses; **J–N**, ascospores. Scale bars: **B**, 500 µm; **C**, 1000 µm; **D**, 100 µm; **E–H**, 20 µm; **I**, 10 µm; **J–N**, 5 µm.

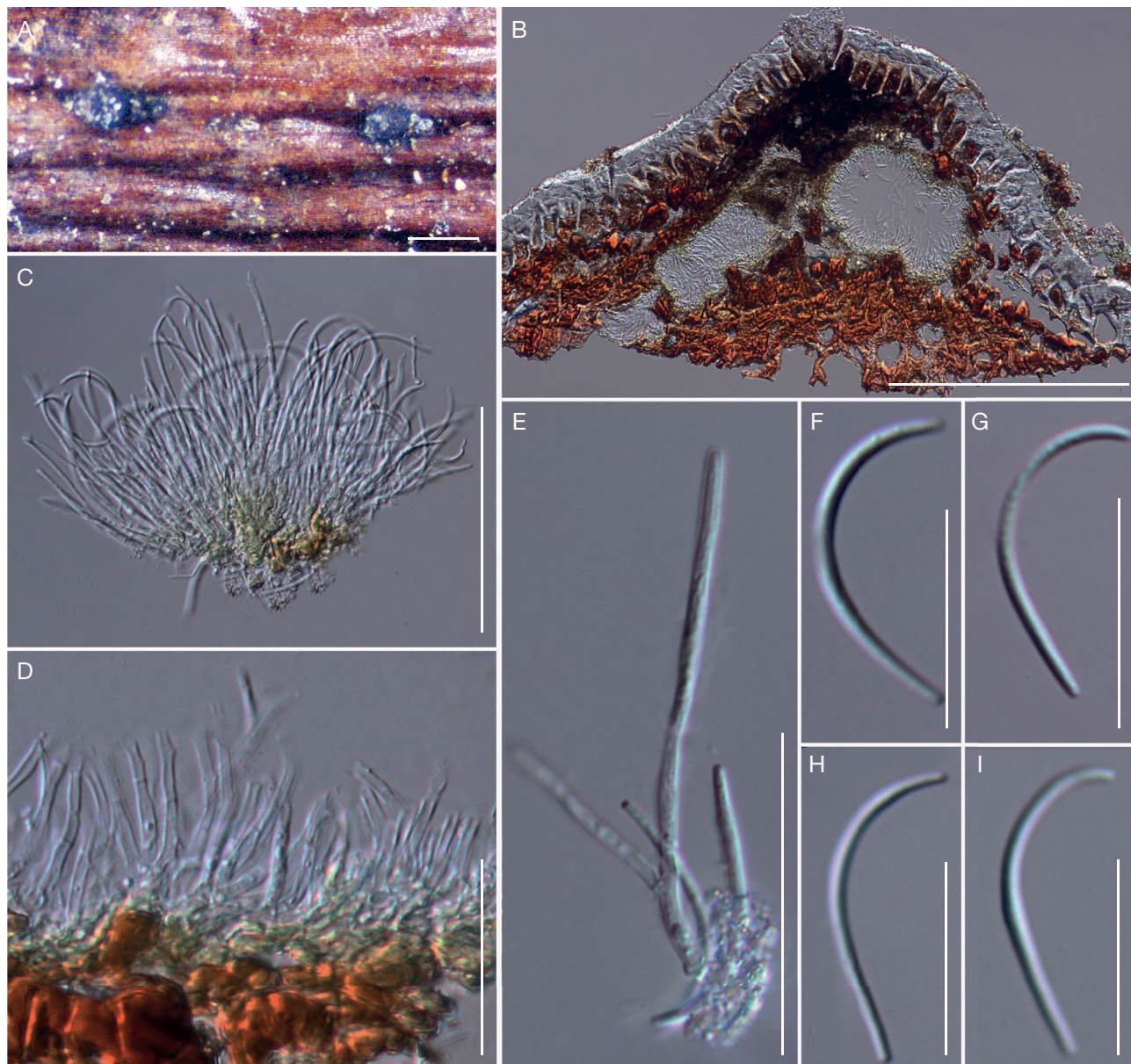


FIG. 8. — *Cryptosphaeria halophila* Dayarathne & K.D.Hyde, sp. nov. (MFLU 16-1199 – holotype): **A**, host (*Avicennia* sp.); **B**, horizontal section through conidioma; **C–E**, conidiophores and conidiogenous cells; **F–I**, conidia. Scale bars: A, 100 µm; B–E, 50 µm; F–I, 20 µm.

NOTES

Cryptosphaeria eunomia possesses a widely effused stroma within bark tissues that is slightly elevated, light colored or darkened, with separate, rounded or stellate ostioles at the surface. Asci are clavate or cylindrical, 8-spored, usually with long stalks, and paraphysate with allantoid, hyaline or brownish ascospores. It is widely known from *Fraxinus* spp., *Juglans regia*, and *Robinia pseudoacacia* (Rappaz 1987; Grand 1985; Dudka *et al.* 2004; Farr & Rossman 2018). It has also been isolated from an unidentified marine sponge from Pohnpei, and which yielded the anti-mycobacterial compounds diaporthein A and B (Kim 2013). Unfortunately, we were unable to obtain herbarium material of *Cryptosphaeria eunomia* collected from a marine habitat and there are no sequences generated from marine based strains.

We used two strains of *Cr. eunomia* var. *eunomia* (CBS 216.87) and *Cr. eunomia* var. *fraxini* (CBS223.87) in our phylogenetic analyses. They grouped apart from all other *Cryptosphaeria* species and were located in a clade comprising *Eutypa* species (Figs 1; 2).

Cryptosphaeria halophila Dayarathne & K.D.Hyde, sp. nov. (Fig. 8)

MYCOBANK. — MB 824293.

FACESOFFUNGI NUMBER. — FoF 03945.

ETYMOLOGY. — Name referring to the saline environment from which the fungus was derived.

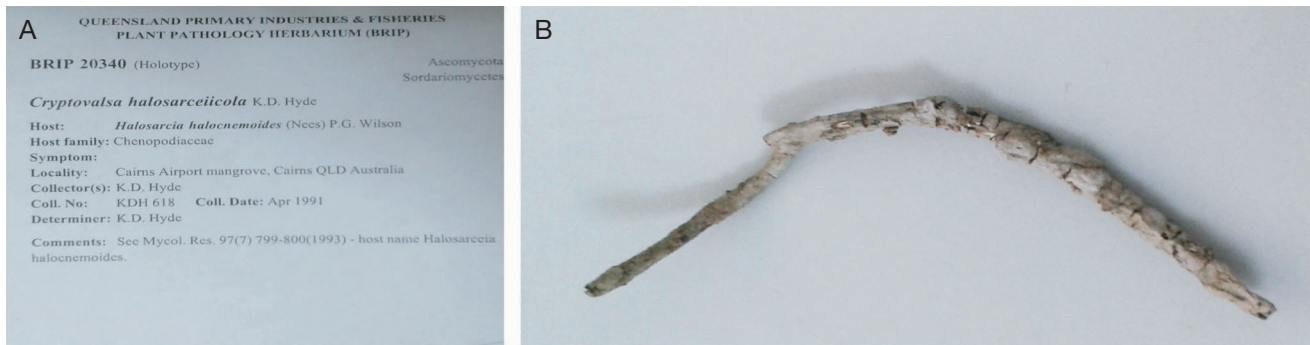


FIG. 9. — *Cryptovalsa halosarceicola* K.D.Hyde (BRIP 20340 – holotype): **A**, **B**, herbarium material.

CULTURE CHARACTERS. — Reaching 2 cm within seven days on PDA, when incubated at 25°C, circular, flat, with diffuse margin, yellow, and becoming yellowish white, bright yellow to dull yellow with age.

MATERIAL EXAMINED. — **Thailand**, Krabi Province, Tha Pom Khlong Nam, 8°12'50.4"N, 98°46'42.7"E, on attached, intertidal decayed wood of *Avicennia* sp. at a mangrove stand, 16.XII.2015, *M. Dayarathne*, KLA006 (holo-, MFLU[MFLU-16-1199]).

DISTRIBUTION. — Thailand.

DESCRIPTION

Saprobic on decaying stem of *Avicennia* sp.

Sexual morph

Undetermined.

Asexual morph

Pycnidia. 140–180 µm in diam., globose to subglobose, ostiole, coriaceous, deeply immersed in a well-developed stroma.

Peridium. 12–20 µm thick around the pycnidial venter, one-layered, yellow-brown to brown, composed of polygonal, cells with thick walls forming *textura angularis*.

Conidiophores. 35–50 × 2–4 µm, 0–2-septate, cylindrical, hyaline, simple or branched, with one or more conidiogenous cells.

Conidiogenous cells. 20–25 × 2.5–3.5 µm, hyaline, unicellular, with wide base and tapering tip, producing one conidium, determinate, conidiogenesis holoblastic.

Conidia. 24–35 × 1–1.5 µm ($\bar{x}$ = 36 × 2 µm, n = 30), one-celled, filiform, straight, curved or hook-like, hyaline to yellowish and apricot in mass.

NOTES

Cryptosphaeria halophila Dayarathne & K.D.Hyde, sp. nov., is the first record of an asexual morph in this genus, reported from a marine habitat. *Libertella*-like asexual morphs have been reported from host substrates and axenic cultures in previous studies by Trouillas *et al.* (2015) and Mehrabi *et al.* (2016). In our phylogenetic analyses (ML and BI) with combined

SSU+LSU sequence data, this species grouped with *Cr. ligniota* and *Cr. pullmanensis* as a separate lineage, but with poor bootstrap support (Fig. 3). MP results showed that this novel species nested with *Cryptosphaeria avicenniae* Devadatha & V.V.Sarma, sp. nov., with no support (Fig. 4). The asexual morph of *Cryptosphaeria avicenniae* Devadatha & V.V.Sarma, sp. nov., is similar to *Cryptosphaeria halophila* Dayarathne & K.D.Hyde, sp. nov., and *Halocryptovalsa avicenniae*, comb. nov. (synonym of *Cryptovalsa avicenniae*) in conidiomatal and conidial morphology. However, our phylogenetic analyses showed that they are phylogenetically distinct (Figs 3–4). No cultures were obtained for this species since conidia did not germinate on any culture media used (WA, MEA/PDA, seawater MEA/PDA or CMA). We did not obtain ITS and Btub sequence data for this species by direct sequencing of fresh fruiting bodies, after several attempts with different temperature profiles. Hence, further taxon sampling, isolation and sequence data are required to further confirm phylogenetic placement of this taxon within this genus.

Cryptovalsa Ces. & De Not. ex Fuckel

Jahrbücher des Nassauischen Vereins für Naturkunde 23–24: 212 (1870) [1869–70].

NOTES

Cryptovalsa contains 24 species, which are reported on woody substrates in a wide range of terrestrial habitats (Wijayawardene *et al.* 2017). The generic type, *Cryptovalsa protracta* lacks sequence data in GenBank (Abdel-Wahab *et al.* 2017). Four *Cryptovalsa* species have been described from marine habitats namely, *C. avicenniae*, *C. halosarceicola*, *C. mangrovei*, *C. suaedicola* (Spooner 1981, Inderbitzin *et al.* 1999, Abdel-Wahab *et al.* 2017). However, based on morphological and phylogenetic data *C. avicenniae* is transferred to the new genus, *Halocryptovalsa* Dayarathne & K.D.Hyde, gen. nov. *Cryptovalsa* is in need of further revision, with detailed modern descriptions, and better illustrations of species, their epitypification, isolation and sequencing to establish phylogenetic relationships to other genera in the family (Abdel-Wahab *et al.* 2017).

TABLE 4. — Synopsis of *Diatrype mangrovei* Dayarathne & K. D. Hyde, sp. nov. and morphologically and geographically related species.

Species name	Asci measurements (µm)	Ascospore measurements (µm)	Ascospore color	Reference
<i>D. atlantica</i>	30–40 × 4–6	(6–)7–9(–10)	Hyaline	Vasilyeva & Stephenson (2009)
<i>D. bullata</i>	25–30 × 5–7	7.5–9	Slightly yellowish	Vasilyeva & Ma (2014)
<i>D. caryae</i>	28–33 × 4–5	5–7	Hyaline	Vasilyeva & Stephenson (2009)
<i>D. decorticata</i>	30–40 × 4–6	6–8	Hyaline	Vasilyeva & Stephenson (2009)
<i>D. enteroxantha</i>	18–28.5 × 5–9	7–10 × 1.5–2.5	Subhyaline	de Almeida <i>et al.</i> (2016)
<i>D. hypoxyloides</i>	(15–)20–25 × 4–6	4–6	Hyaline	Vasilyeva & Ma (2014)
<i>D. mangrovei</i> , sp. nov.	90–120 × 6–8	5–10.5 × 1.5–2.5	Hyaline becoming Yellowish at maturity	In this paper
<i>D. palmicola</i>	70–110 × 7–9	(6–)7–8(–9) × 1.5–2	Hyaline to subhyaline	Liu <i>et al.</i> (2015)
<i>D. spilomea</i>	25–30 × 4–6	5–7	–	Vasilyeva & Ma (2014)
<i>D. stigma</i>	25–30 × 5–7	6–8 × 1.5–2	Hyaline	Vasilyeva & Ma (2014)
<i>D. stigmaoides</i>	20–30 × 5–6	4–6	Hyaline	Vasilyeva & Stephenson (2009)
<i>D. subundulata</i>	35–40 × 5–7	7–9 × 1.7–1.9	Yellowish	Vasilyeva & Ma (2014)
<i>D. thailandica</i>	55–80 × 5–7 ‡	3.8–6.9 × 1–1.4	Pale brown	Li <i>et al.</i> (2016)
<i>D. vulgaris</i>	80–130 × 18–20	(7–)8–10(–12) × 2–2.5	Yellowish in mass	Trouillas <i>et al.</i> (2011)

Cryptovalsa halosarceicola
K.D.Hyde [as “halosarceicola”]
(Fig. 9)

Mycological Research 97 (7): 799 (1993).

MATERIAL EXAMINED. — **Australia**, north Queensland, Cairns, Cairns airport mangrove, on intertidal decaying *Halosarceia halocnemoides* (Nees) P. G. Wilson, IV.1991, K. D. Hyde, (holo-, BRIP[BRIP-20340]).

DISTRIBUTION. — Australia.

DESCRIPTION

Sexual morph

Ascomata. Flask-shaped, black, immersed in a wide-spreading entostroma in the surface layers of the host tissue, with protruding necks, of dark angular cells, with periphyses. Substratum blackened around the ascomata, with a depressed zone between them (seen in section).

Peridium. Comprising an inner layer of hyaline elongate cells, and an outer layer of dark fungal hyphae in the form of *textura intricata*, fusing at the outside with the host tissue.

Paraphyses. Hyphae-like, filamentous, numerous.

Asci. Polysporous, cylindric-fusoid, tapering to the peduncle, tapering in the upper part to a truncate thickened apex, with a faint, non-amyloid subapical ring.

Ascospores. Allantoid, non-septate, hyaline (Description from Hyde 1993).

Asexual morph

Undetermined.

NOTES

Cryptovalsa halosarceicola was associated with the mangrove fungus *Marinosphaera mangrovei* (Hyde 1993). It can be

distinguished by the flask-shaped ascomata immersed in a wide-spreading entostroma with protruding necks, hyphae-like filamentous paraphyses, polysporous asci with non-amyloid subapical ring and allantoid, hyaline ascospores (Hyde 1993). No ascomata of *Cryptovalsa halosarceicola* were present in the type material of the species. Therefore, it is in need of epitypification for future studies. *Cryptovalsa halosarceicola* is morphologically similar to *C. suaedicola* but differs in ascomatal characteristics such as the longer neck lacking furrows, and a two-layered thick peridium. *Cryptovalsa halosarceicola*, *Halocryptovalsa avicenniae*, comb. nov., and the novel species *Halodiatrype salicorniae* share similar morphologies in ascomatal and ascal characteristics. *Cryptovalsa halosarceicola* and *Halodiatrype avicenniae* are easy to differentiate by ascospore colouration, which is yellow-brown to brown in *Halodiatrype avicenniae* and hyaline in *Cryptovalsa halosarceicola*. However, the ascomatal measurements of these two species are considerably disparate (Table 4). There are no molecular data for these species to confirm their phylogenetic affinity with other related taxa within the family.

Cryptovalsa mangrovei Abdel-Wahab & Inderb
(Fig. 10)

In Inderbitzin et al., Mycological Research 103 (12): 1628 (1999).

MATERIAL EXAMINED. — **Hong Kong**, New Territories, Nature Reserve, Mai Po Marshes, Mai Po mangrove, on wood test block of *Kandelia candel* (L.) Druce, M. A. Abdel-Wahab, 6.VIII.1998 (holo-, IMI[IMI-379746]).

DISTRIBUTION. — Hong Kong.

DESCRIPTION

Sexual morph

Saprobic. On in decorticated wood test blocks of *Kandelia candel*.

Ascomata. In groups of 3–8, sometimes confluent, in 1–3 rows, immersed, raising the substratum, or erumpent.



FIG. 10. — *Cryptovalsa mangrovei* Abdel-Wahab & Inderb (IMI 379746 – holotype): **A**, **B**, herbarium material; **C**, **D**, appearance of stromata on host; **E**, section through ascogonium; **F**, neck region; **G**, peridium; **H** paraphyses; **I–L**, asci; **M**, ascospores. Scale bars: **C**, 500 µm; **D**, 200 µm; **E**, **F**, 100 µm; **G**, **H**, **M**, 20 µm; **I–K**, 50 µm.

Entostroma. Effuse, a faint black line between the groups sometimes present, wood softened; a thin layer of white pulvinate fungal material sometimes present around the ascomal venter.

Ascomal venter. 250–278 µm high, 245–352 µm wide, subglobose to broadly ellipsoidal.

Necks. 208–220 µm long, 180–190 µm wide, ostiolate, periphysate, comprising an outer layer of completely melanized cells, and an inner layer of less pigmented, elongate cells; singly erumpent, protruding above the level of the raised substratum; the outermost ascomata in an aggregate often bent towards the centre of the group, with four narrow furrows on the dome shaped apex.

Peridium. 10–25 µm wide, in horizontal section with an outer, layer of small, thick-walled, melanized, rounded cells, and an inner layer, up to 12 µm wide, of hyaline, elongate cells in textura angularis.

Paraphyses. Up to 3–4 µm wide, hyaline, septate, deliquescent.

Asci. 80–150 × 10–14 µm ($\bar{x}$ = 115 × 12 µm, n = 20), polysporous, clavate, truncate, pedicellate; apex up to 3.5 µm thick, with a refractive subapical, non-amyloid ring at the base of an invagination of the ascus apex.

Ascospores. 5–14 × 1–3 µm ($\bar{x}$ = 10 × 2 µm, n = 30), allantoid, pale yellow to pale brown.

Asexual morph

Undetermined.

NOTES

Cryptovalsa mangrovei possesses single or eutypa-like ascomata with polysporous asci (Spooner 1981) which are characteristics of the genus *Cryptovalsa*. *Cryptovalsa mangrovei* differs from *C. halosarceicola* and *C. suaedicola* by its larger ascomata, asci and ascospores, clavate asci, horizontally furrowed necks, pigmented ascospores and deliquescent paraphyses. There is no blackened zone around the ascomatal venters of *C. mangrovei*, which is present in *C. halosarceicola* and *C. suaedicola* (Table 4) (Spooner 1981; Inderbitzin *et al.* 1999). *Halocryptovalsa avicenniae*, comb. nov., and the novel species *Hcr. salicorniae* lack horizontal furrows inside their ascomatal necks and hence are distinguishable from *C. mangrovei*. Further taxon sampling is needed for this species to obtain appropriate molecular data to substantiate its placement within a natural classification system.

Cryptovalsa suaedicola Spooner (Fig. 11)

Transactions of the British Mycological Society 76 (2): 269 (1981).

MATERIAL EXAMINED. — **United Kingdom**, Colne Point Nature Reserve, in salt marsh, on twigs of *Suaeda fruticosa* amongst lichens *Xanthoria parietina* and *Lecanora dispersa*, N. Essex, 13.VII.1976, J. F. Skinner (holo-, IMI[IMI-1399939]).

DISTRIBUTION. — United Kingdom.

DESCRIPTION

Sexual morph

Stromata. 0.9–1.5 mm diam., well developed, visible as black spots on host surface, substratum blackened around the stromata and with a depressed zone between them.

Ascomata. 370–350 × 290–350 µm, flask-shaped, immersed, 1–3 within one stroma, evenly scattered in a single layer in a widespread entostroma in the surface layers of the host tissue, black, the ostioles protruding and bearing 4 vertical furrows.

Peridium. 35–40 µm wide, composed of 8–9 layers of prismatic cells, the outermost cells dark brown and thick walled, becoming paler inwards. A thickened ring of tissue composed of thick walled dark brown cells is present immediately below the ostiolar neck.

Paraphyses. 1–2 µm wide, filiform, usually branched, hyaline, containing a row of small guttules.

Asci. 80–130 × 6–7.5 µm ($\bar{x}$ = 105 × 6.5 µm, n = 20), cylindric-fusoid, tapered in the upper part to a rounded apex, and below to a narrow, stipe-like base, rather thick-walled above, apical apparatus diffusely and weakly amyloid, polysporous.

Ascospores. 4–6 × 1–1.5 µm ($\bar{x}$ = 5 × 1 µm, n = 30), allantoid, non-septate, individually appearing hyaline but greenish in mass within the ascus.

Asexual morph

Undetermined.

NOTES

Cryptovalsa suaedicola reported from temperate *Suaeda* occurred on twigs associated with lichens and probably occurred above the intertidal region (Spooner 1981). The species is unique by the wide-spreading eutypoid ascostroma, separate, immersed perithecia with a neck bearing four vertical furrows and polysporous asci. However, *C. effusa* on stems of *Rosa canina* in Europe (Berlese 1905) appears very similar to this species in possessing solitary perithecia. *Cryptovalsa suaedicola* differs particularly in possessing larger ascospores from other marine *Cryptovalsa* species (Spooner 1981). Four vertical furrows of the ascomatal neck is the most useful characteristic to differentiate this species from all other morphologically similar diatrypaceous species from marine based habitats, such as, *C. halosarceicola*, *C. mangrovei*, *Halocryptovalsa avicenniae*, comb. nov., and *Hcr. salicorniae* (Table 4). Lack of sequence data for this species may lead to taxonomic confusion when determining whether to accommodate this species within the new genus *Halocryptovalsa* Dayarathne & K.D.Hyde, gen. nov.

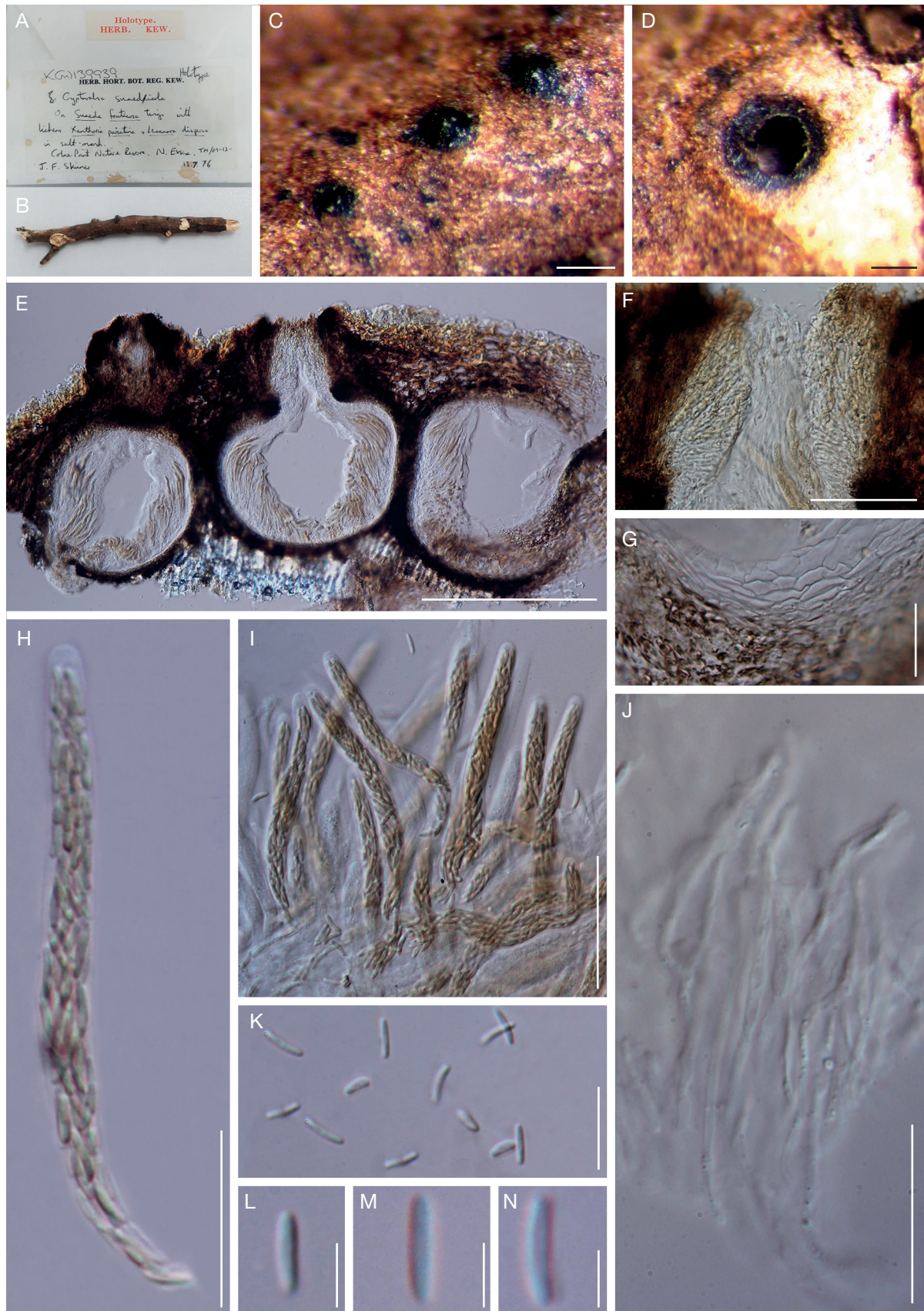


FIG. 11. — *Cryptovalsa suaedicola* Spooner (IMI139939 – holotype): **A, B**, herbarium material; **C**, appearance of stromata on host; **D**, horizontal section through stroma; **E**, section through stroma; **F**, neck region; **G**, peridium; **H–I**, asci; **J**, paraphyses; **K–N**, ascospores. Scale bars: C–E, 200 µm; F, 50 µm; G–J, 20 µm; K–N, 10 µm.

TABLE 5. — Comparative morphology of *Cryptovalsa* Ces. & De Not. ex Fuckel and *Halocryptovalsa* Dayarathne & K.D.Hyde, gen. nov. species from saline habitats.

Characters	Taxa				
	<i>Halocryptovalsa avicenniae</i> , comb. nov.	<i>Halocryptovalsa salicorniae</i> , sp. nov.	<i>Cryptovalsa halosarceicola</i>	<i>Cryptovalsa mangrovei</i>	<i>Cryptovalsa suaedicola</i>
Ascomata (µm)	430-715 × 570-680, blackened zone around ascomata	230-300 × 140-168, blackened zone around ascomata	130-185 × 185-260, blackened zone around ascomata	420-500 × 260-350, no blackened zone around ascomal venter	370-350 × 290-350, blackened zone around ascomata
Necks	No furrows	No furrows	No furrows	With 4 horizontal furrows	With 4 vertical furrows
Asci (µm)	80-130 × 8-20, cylindric-fusoid	87-95 × 9-13, cylindrical	75-95 × 7-9, cylindric-fusoid	80-150 × 10-14, clavate	80-130 × 6-7.5, cylindric-fusoid
Ascospores (µm)	5-8 × 1-2, yellow-brown to brown	3-5 × 1-2, hyaline	4-7 × 1.5-2, hyaline	5-14 × 1-3, pale yellow to pale brown	4-6 × 1-1.5, hyaline
Paraphyses	Persistent	Persistent	Persistent	Deliquescent	Probably persistent
Asexual morph	libertella-like	Not determined	Not determined	Not determined	Not determined

Diatrype Fr.

Summa vegetabilium Scandinaviae: 384 (1849).

NOTES

Diatrype was established by Fries (1849) with *Diatrype disciformis* as the type species. The genus occurs widely on decaying wood. Several species are reported as canker forming pathogens on forest trees (Senanayake *et al.* 2015). Species in this genus are resistant to harsh conditions. The asexual morph of *Diatrype* is reported as libertella-like and dumortieria-like (Kirk *et al.* 2008; Wijayawardene *et al.* 2012; Maharachchikumbura *et al.* 2015, 2016; Senanayake *et al.* 2015). There are no previous records of *Diatrype* species from marine based habitats.

Diatrype mangrovei Dayarathne & K.D.Hyde, sp. nov.
(Fig. 12)

MYCOBANK. — MB 82430.

FACESOFFUNGI NUMBER. — FoF 03949.

ETYMOLOGY. — Referring to the common name of the host ecosystem.

CULTURE CHARACTERISTICS. — Colonies on PDA reaching 5 cm diam., after two weeks at 20-25°C, medium dense, irregular, flat, surface smooth with undulate edge, colony from above yellow at the margin, greenish yellow at the centre; from below yellowish white at the margin, greenish yellow at the centre; mycelium greenish yellow, not produced pigmentation.

MATERIAL EXAMINED. — **Thailand**, Ranong Province, Amphoe Muang, Mu 4 Tambol Ngao, Ranong Mangrove Research Center (9°43'–9°57'N, 98°29'–98°39'E), on fallen decaying twig of *Bruguiera cylindrica*, 6.XII.2016, *Monika C. Dayarathne*, MCD 067 (holo-, MFLU 17-0412), ex-type living culture, MFLUCC 17-0412, ICMP 21769; on fallen decaying twig of *B. cylindrica*, 6.XII.2016, *Monika C. Dayarathne*, MCD 030 (iso-, MFLU 18-0147), ex-type living culture, MFLUCC 17-0391; on fallen decaying twig of *B. cylindrica*, 6.XII.2016, *Monika C. Dayarathne*, MCD 034 (MFLU 18-0148), ex-type living culture, MFLUCC 17-0394.

DISTRIBUTION. — Thailand

DESCRIPTION

Saprobic on submerged decaying wood of *Bruguiera cylindrica*.

Sexual morph

Ascstromata. 1-2 × 0.8-1 cm, scattered or aggregated on host, erumpent, arising through cracks on the bark, edges of ascstromata remaining as pointed, angular parts, carbonaceous, with numerous perithecia immersed in one stroma.

Ostiole. Opening through host bark and appearing as black spots, composed of an outer layer of dark brown, small, tightly packed, thin parenchymatous cells and an inner layer of yellowish white, large, loosely packed, parenchymatous cells.

Ascomata. 480-500 × 300-340 µm ($\bar{x}$ = 490 × 320 µm, n = 0), perithecia immersed in stromatic tissue, aggregated, brown, globose to sub-globose, narrowing towards the apex and very narrow at the base of ostiolar canal, thin-walled, ostiolate; ostiolar canal, periphysate, ostiolar opening covered with carbonaceous, black cells; periphyses hyaline, filamentous.

Peridium. 40-45 µm wide, comprising an outer layer of yellow-brown, thick-walled cells of textura angularis and a thin, inner stratum of yellow, thick-walled cells of textura angularis.

Asci. 90-120 × 6-8 µm ($\bar{x}$ = 105 × 7 µm, n = 30), unitunicate, 8-spored, with long, narrow, thin-walled stalk, with cylindrical, thick-walled, swollen upper portion, apex flat, with J-, cylindrical, conspicuous apical ring.

Ascospores. 5-10.5 × 1.5-2.5 µm ($\bar{x}$ = 7.5 × 2 µm, n = 30), seriate, hyaline becoming yellowish at maturity, allantoid, unicellular, thin-walled, with small fat globules at each end, smooth-walled.

Asexual morph

Undetermined.

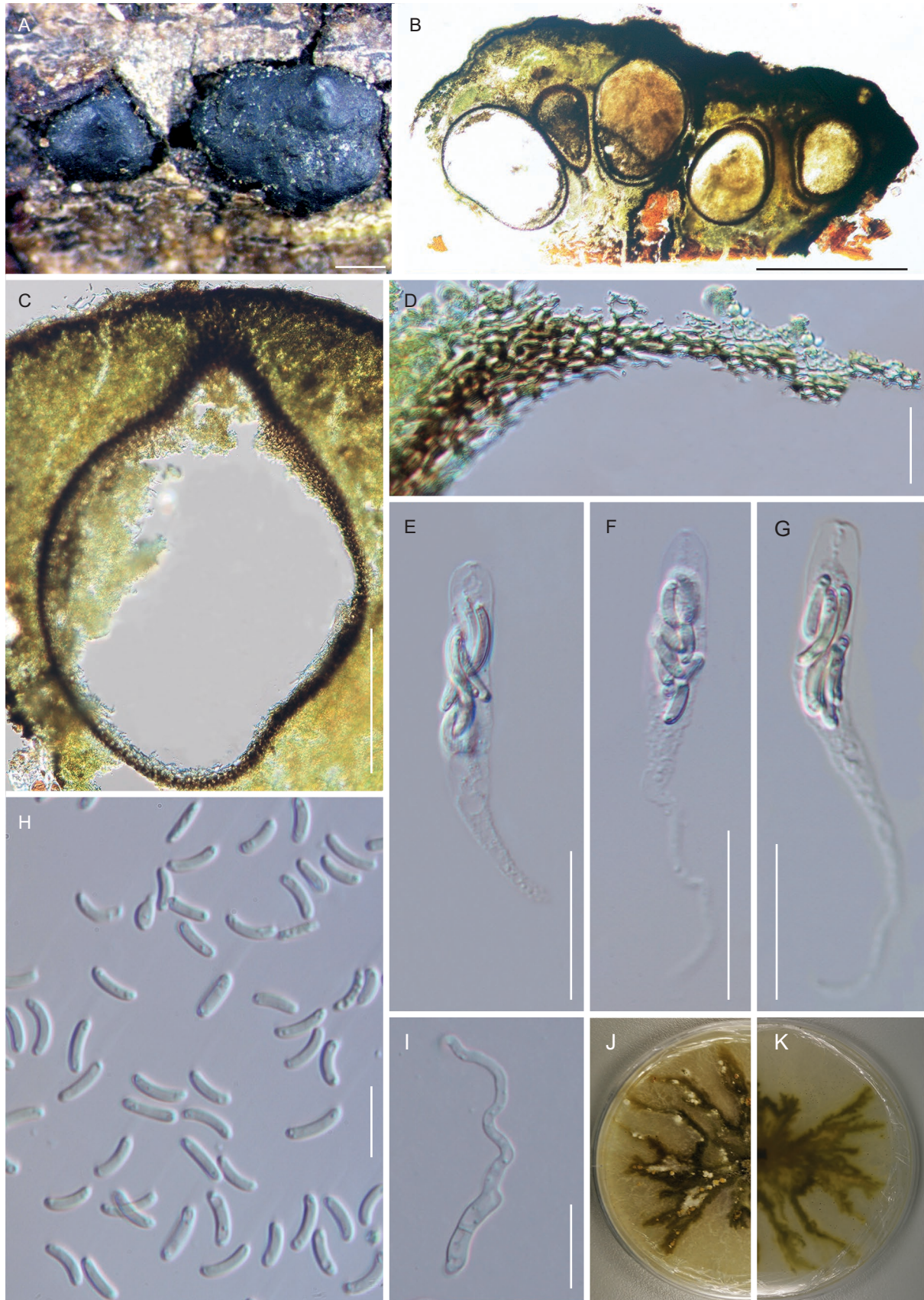


FIG. 12. — *Diatrype mangrovei* Dayarathne & K.D.Hyde, sp. nov. (MFLU 17-0412 – holotype): **A**, appearance of ascostromata on host (*Bruguiera cylindrica*); **B**, horizontal section through ascostroma; **C**, section through ascus; **D**, peridium; **E–G**, asci; **H**, ascospores; **I**, germinating ascospore; **J, K**, culture on PDA (J-upper, K-lower). Scale bars: A, 500 µm; B, 500 µm; C, 100 µm; D–G, 50 µm; H, I, 10 µm.

NOTES

Diatrype mangrovei Dayarathne & K.D.Hyde, sp. nov., was recorded from intertidal attached wood of *Bruguiera cylindrica* from Ranong, Thailand. In the phylogenetic analyses of both ITS and concatenated ITS+Btub data (Figs 1; 2) it grouped in a clade with *Diatrype* and *Diatrypella* species. *Diatrype mangrovei* Dayarathne & K.D.Hyde, sp. nov., shares similar morphological features with the genus *Diatrype* and is distinguished from *Diatrypella* species by being octosporous. *Diatrype enteroxantha* (HUEFS155114, HUEFS155116) showed close phylogenetic affinity to this new species (sub-clade A4 in clade A, Fig. 1) but *D. enteroxantha* has smaller asci ($18\text{--}28.5 \times 5\text{--}9 \mu\text{m}$ vs $90\text{--}120 \times 6\text{--}8 \mu\text{m}$) (de Almeida *et al.* 2016). There are 14 bp differences out of 520 bp (2.69%) between *D. enteroxantha* and *D. mangrovei* Dayarathne & K.D.Hyde, sp. nov., According to ITS phylogeny, *D. mangrovei* Dayarathne & K.D.Hyde, sp. nov., formed an intermediate clade (sub-clade L4 in clade L) to *D. enteroxantha* and *D. oregonensis* (DPL200) (Fig. 2). *Diatrype mangrovei* Dayarathne & K.D.Hyde, sp. nov., is easily distinguishable from *D. oregonensis* by having globose to sub-globose ascumata while the latter species has ovoid or ellipsoid ascumata with a white entostroma that becomes yellow to brown (Trouillas *et al.* 2010a). However, there are 16 bp differences out of 526 bp (3.04%) in ITS region between *D. oregonensis* and *D. mangrovei* Dayarathne & K.D.Hyde, sp. nov., Morphological differences of *D. mangrovei* Dayarathne & K.D.Hyde, sp. nov., and related taxa are summarized in the Table 5. This is the first record of *Diatrype* species from a mangrove habitat.

Diatrypasimilis J.J.Zhou & Kohlm

Mycologia 102 (2): 432 (2010).

NOTES

Diatrypasimilis was proposed by Chalkley *et al.* (2010) to accommodate a marine xylarialean fungus, *Diatrypasimilis australiensis* isolated from roots of *Rhizophora* sp. (mangrove) in Australia. This genus has morphological features similar to both *Diatrypaceae* and *Xylariaceae*, such as relatively thick stroma on wood surface, erumpent, subglobose, ostiolate and carbonaceous, black ascumata with a conical neck, hamathecium consisting of paraphyses, 8-spored, cylindrical, unilocular asci, with an apical apparatus and uniseriate, ellipsoidal, 1-celled, dark brown ascospores with a germ slit (Chalkley *et al.* 2010; Abdel-Wahab *et al.* 2014). Molecular phylogenetic analyses of the combined nuclear ribosomal RNA genes and their internal transcribed spacers placed the genus in a basal position in the *Diatrypaceae* clade of the order *Xylariales* (Chalkley *et al.* 2010; Abdel-Wahab *et al.* 2014). The asexual morph produces synnemata-like structures from yellow-orange to dark brown and distributed irregularly on mycelia developing on an aged culture. It produces hyaline, unicellular, cylindrical, or clavate conidia, which are holoblastic, produced singly on conidiogenous cells (Abdel-Wahab

et al. 2014). However, none of the diatrypaceous taxa was sufficiently close to *Diatrypasimilis australiensis* to allow a clear placement within *Diatrypaceae* (Abdel-Wahab *et al.* 2014). Only LSU, SSU and ITS sequence data are available for this species. Therefore, it is necessary to obtain Btub sequence data to confirm whether *Diatrypasimilis australiensis* is a representative of a new family in the *Xylariales* or a member of *Diatrypaceae*.

Diatrypasimilis australiensis J.J.Zhou & Kohlm

Mycologia 102 (2): 432 (2010).

DESCRIPTION AND ILLUSTRATION. — See Abdel-Wahab *et al.* (2014).

DISTRIBUTION. — Australia, Saudi Arabia.

NOTES

Diatrypasimilis australiensis has characters that are common to the *Diatrypaceae*, but the ellipsoidal ascospores, with a germ slit are unique. Members of *Diatrypaceae* usually have allantoid ascospores and lack germ pores or slits (Chalkley *et al.* 2010; Abdel-Wahab *et al.* 2014). However, the original authors did not fully characterize the morphology of the fungus on natural substrates, apparently because of a lack of material (Abdel-Wahab *et al.* 2014). Abdel-Wahab *et al.* (2014) re-described this fungus based on a culture isolated from unidentified driftwood at Yanbu beach, Saudi Arabia. This isolate of *Diatrypasimilis australiensis* was different from the type species in having larger, deeply immersed ascumata (Abdel-Wahab *et al.* 2014). However, the difference between the two collections did not warrant separation at the species level. The strain from Saudi Arabia (Abdel-Wahab *et al.* 2014) produced holoblastic conidia singly, while in the type strain, the conidiophores proliferated either sympodially or annelidically, or possibly by a combination of both, producing conidia on minute denticles (Chalkley *et al.* 2010). Abdel-Wahab *et al.* (2014) noted that LSU sequences of the two strains were 99% similar. According to our phylogenetic analysis with combined ITS+Btub *Diatrypasimilis australiensis* groups in a clade (clade K) comprising *Monosporascus cannonballus* (ATCC 26931 and CMM3646) as a basal lineage (Fig. 1). ITS analysis yielded a single clade (clade M) comprising *Halocryptovalsa salicorniae* Dayarathne & K.D.Hyde, sp. nov. (MFLUCC 15-0185) and *Diatrypasimilis australiensis* but with no statistical support (Fig. 2). These two species are morphologically different from each other.

Eutypella (Nitschke) Sacc.

Atti della Società Veneziana-Trentina-Istria di Scienze Naturali 4: 80 (1875).

NOTES

Eutypella was introduced by Saccardo (1875) with *Eutypella cerviculata* (Fr.) Sacc. as type species. *Eutypella* species can

be distinguished by their erumpent ascostromata through the host bark, clustered, sulcate perithecial necks, 8-spored, clavate asci with long stalks and allantoid, hyaline or yellowish ascospores (Glawe & Rogers 1984; Vasilyeva & Stephenson 2006). Croxall (1950) provided an account of the asexual morph of *Eutypella* with conidia produced from phialides. Glawe & Rogers (1982) described some asexual morphs of *Eutypella* producing holoblastic conidia from sympodial or percurrently proliferating conidiogenous cells, but not from phialides. Morphologically *Eutypa* and *Eutypella* species are hard to differentiate from each other. Hence, Tiffany & Gilman (1965) classified *Eutypella* species under the name *Eutypa* (Vasilyeva & Stephenson 2009). *Eutypella* species occur on a wide range of hosts, especially associated with canker diseases in *Vitis vinifera* (Vasilyeva & Stephenson 2006; Trouillas *et al.* 2011; Luque *et al.* 2012). There are 248 species epithets listed in Index Fungorum (2019), but few species have sequence data. Phylogenetic analyses of *Diatrypaceae* have shown that *Eutypella* is polyphyletic (Acero *et al.* 2004; Chacón *et al.* 2013; de Almeida *et al.* 2016; Shang *et al.* 2017; Senwanna *et al.* 2017). Most *Eutypella* strains exhibit large differences in the length of ITS1 region, in some cases with a different distribution of the tandem-repeat sequences. This was the most heterogeneous group at the sequence level within family *Diatrypaceae* (Acero *et al.* 2004).

Eutypella naqsii K.D.Hyde
(Fig. 13)

Mycological Research 99 (12): 1462 (1995).

MATERIAL EXAMINED. — **Australia**, north Queensland, Bathurst Heads, on intertidal branch of *Avicennia* sp., VII.1991, K. D. Hyde (holo-, BRIP[BRIP-22588]).

DISTRIBUTION. — Australia.

DESCRIPTION

Sexual morph

Stromata. Forming a blackened crust on the host surface, with ecostromatal cushions occurring around each ascoma, comprising host cells and intracellular blackened fungal hyphae.

Ascomata. 460–500 × 550–650 µm, forming beneath, raised stromata on the host surface, with 3–5 ascomata per stroma, globose or subglobose, with periphysate necks collectively erumpent through pustulate discs.

Peridium. 50–70 µm wide, comprising an inner layer of thin-walled, compressed, hyaline cells and an outer layer of pigmented, globose, fungal and host cells, fusing with the stroma at the outside.

Paraphyses. 5–7 µm wide at the base, hypha-like, sparse, septate, hyaline, and tapering distally.

Asci. 30–40 × 4–6 µm, 8-spored, cylindric-clavate, long pedunculate, thin-walled, unitunicate, apically truncate, with J- apical ring, asci forming from the base and sides of the ascoma.

Ascospores. 6–8 × 1–2 µm, allantoid, straight or mostly curved, hyaline to pale yellow.

Asexual morph

Undetermined.

NOTES

This taxon has characteristics typical of *Eutypella* such as small groups of ascomata, which develop under blackened stroma with necks collectively erumpent through a pustulate disc; which splits at maturity to reveal an inconspicuous powdery white ring a faint ridge may ring the pustule where the black zone meets the inner surface of the bark. Asci are also unitunicate with an apical thickening and ascospores are hyaline and allantoid (Wehmeyer 1976; Rappaz 1987; Hyde 1995).

Halocryptovalsa

Dayarathne & K.D.Hyde, gen. nov.

MYCOBANK. — MB 824308.

FACESOFFUNGI NUMBER. — FoF 04597.

ETYMOLOGY. — Referring to the morphological resemblance to the genus *Cryptovalsa* and the saline environment from which the taxon was collected.

TYPE SPECIES. — *Halocryptovalsa avicenniae* (Abdel-Wahab, Bahkali & E.B.G.Jones) Dayarathne & K.D.Hyde, comb. nov.

DESCRIPTION

Saprobic on intertidal decayed wood of mangroves and decaying stems of salt marsh plants.

Sexual morph

Stromata. Poorly developed, flask-shaped, black, immersed in the surface layers of the host tissue, raising the surface of the substrate in little bumps, with protruding necks, substrate slightly modified between ascomata or more or less necrotic when they are close together.

Ascomata. Partially or deeply immersed in wide-spreading stroma, globose to subglobose, dark brown to black, single or aggregated and sometimes confluent, ostiolate, papillate.

Necks. 290–400 µm long, 270–290 µm wide, ostiolate, periphysate, with a small, globular-conical papilla immersed in a wide-spreading entostroma, which protrude above the substrate surface, lacking apical furrows.

Peridium. 11–52 µm wide, comprising an outer, brown, thick-walled layer of polygonal melanized cells, interspersed

with cells of the substrate and inner, hyaline, thick-walled, several cell layers of *textura angularis*.

Hamathecium. Comprising aseptate, numerous paraphyses, narrowing and tapering towards the apex.

Asci. Multi-spored, unitunicate, with narrow, thin-walled pedicel, with cylindrical, thick-walled, swollen upper portion, apex flat, with J-, cylindrical, conspicuous apical or sub apical ring.

Ascospores. Hyaline or yellow-brown to brown, allantoid, straight or slightly curved, unicellular, thin-walled, with small, fat globules at the ends, smooth-walled.

Asexual morph

Pycnidia. Globose to subglobose, ostiolate, coriaceous, deeply immersed in a well-developed stroma with or without ascomata of the sexual stage.

Necks. Papillate, coriaceous.

Peridium. 12–22 µm thick around the pycnidial venter, one-layered, yellow-brown to brown, composed of polygonal cells with thick walls forming *textura angularis*.

Conidiophores. 0–2-septate, cylindrical, hyaline, simple or branched, with one or more conidiogenous cells.

Conidiogenous cells. Hyaline, unicellular, with wide base and tapering tip, producing one conidium, determinate. Conidiogenesis holoblastic.

Conidia. One-celled, filiform, straight, curved or hook-like, hyaline to yellowish and yellow/apricot in mass.

NOTES

Halocryptovalsa Dayarathne & K.D.Hyde, gen. nov., comprises cryptovalsa-like marine based diatrypaceous fungi with poorly developed stromata that lack horizontal or vertical furrows within the ascomatal necks. *Halocryptovalsa* Dayarathne & K.D.Hyde, gen. nov., can be clearly distinguish by having deeply immersed perithecia in the wood with relatively long, wide necks (290–430 µm long, 270–290 µm wide) while *Cryptovalsa* mostly comprises several ascomata arranged at different depth in the bark with relatively short necks (Mehrabi *et al.* 2015). Necks of each ascoma of *Halocryptovalsa* Dayarathne & K.D.Hyde, gen. nov., appear as a small papilla protruding above the substrate, whereas protruding ascomatal necks of *Cryptovalsa* form a cluster of little bumps (Mehrabi *et al.* 2015; Trouillas *et al.* 2015). Furthermore, the ascomatal outer surface of *Cryptovalsa* species is often with a white powdery entostroma (Trouillas *et al.* 2015), while *Halocryptovalsa* Dayarathne & K.D.Hyde, gen. nov., species do not have a white powdery entostroma. *Halocryptovalsa* Dayarathne & K.D.Hyde, gen. nov., includes only marine derived taxa

while *Cryptovalsa* species are prevalent in terrestrial habitats. *Cryptovalsa halosarceicola* morphologically resembles *Halocryptovalsa* Dayarathne & K.D.Hyde, gen. nov., species, however, there are no sequence data in GenBank for *Cryptovalsa halosarceicola* to confirm its phylogenetic relationship to our new genus. In our combined analysis of ITS+Btub the new genus formed a separate lineage with low statistical support (Fig. 1). In ITS phylogeny *Halocryptovalsa avicenniae*, comb. nov., grouped in a clade with *Diatrypasimilis australiensis* (Fig. 2). However, 117 bp are different out 522 bp between *Halodiatrype avicenniae* and *D. australiensis* in ITS loci. Therefore, depending on the combined phylogenetic analyses data and considerable morphological differences of this taxon to all the other genera in *Diatrypaceae*, we introduce the genus *Halocryptovalsa* Dayarathne & K.D.Hyde, gen. nov., to accommodate *Halocryptovalsa avicenniae*, comb. nov., and *Halocryptovalsa salicorniae* Dayarathne & K.D.Hyde, sp. nov.

Halocryptovalsa avicenniae

(Abdel-Wahab, Bahkali & E.B.G.Jones)

Dayarathne & K.D.Hyde, comb. nov.

Cryptovalsa avicenniae Abdel-Wahab, Bahkali & E.B.G.Jones, in Abdel-Wahab *et al.*, *Botanica Marina* 60 (4): 469–488.

MYCOBANK. — MB 825272.

FACESOFFUNGI NUMBER. — FoF 03947.

DESCRIPTION AND ILLUSTRATION. — see Abdel-Wahab *et al.* (2017).

DISTRIBUTION. — Saudi Arabia.

NOTES

Halocryptovalsa avicenniae, comb. nov. (synonym of *Cryptovalsa avicenniae*) and its asexual stage (libertella-like) is known from *Avicennia marina* from Australia and on driftwood from Saudi Arabia (Abdel-Wahab *et al.* 2017). This species morphologically resembles *Cryptovalsa* species as well as the new species, *Halocryptovalsa salicorniae* Dayarathne & K.D.Hyde, sp. nov. *Halocryptovalsa avicenniae*, comb. nov., has larger ascomata than other members of *Diatrypaceae*, lacks papillal furrows on the ascomata and has more ascospores per ascus (Abdel-Wahab *et al.* 2017). Therefore, it can be clearly distinguished from the previously described marine species, *Cryptovalsa halosarceicola*, *C. mangrovei* and *C. suaedicola*. The presence of the asexual stage (libertella-like) in the same stroma is characteristic of this species. Morphological variation between *Hcr. avicenniae* and *Hcr. salicorniae* are compared in Table 4.

Halocryptovalsa Dayarathne & K.D.Hyde, gen. nov., species do not form a stable position in our phylogenetic study. In our phylogenetic analyses with combined ITS+Btub neither *Cryptovalsa rabenhorstii* strains nor any other *Cryptovalsa* species grouped with *Halocryptovalsa* Dayarathne & K.D.Hyde, gen. nov., species, confirming

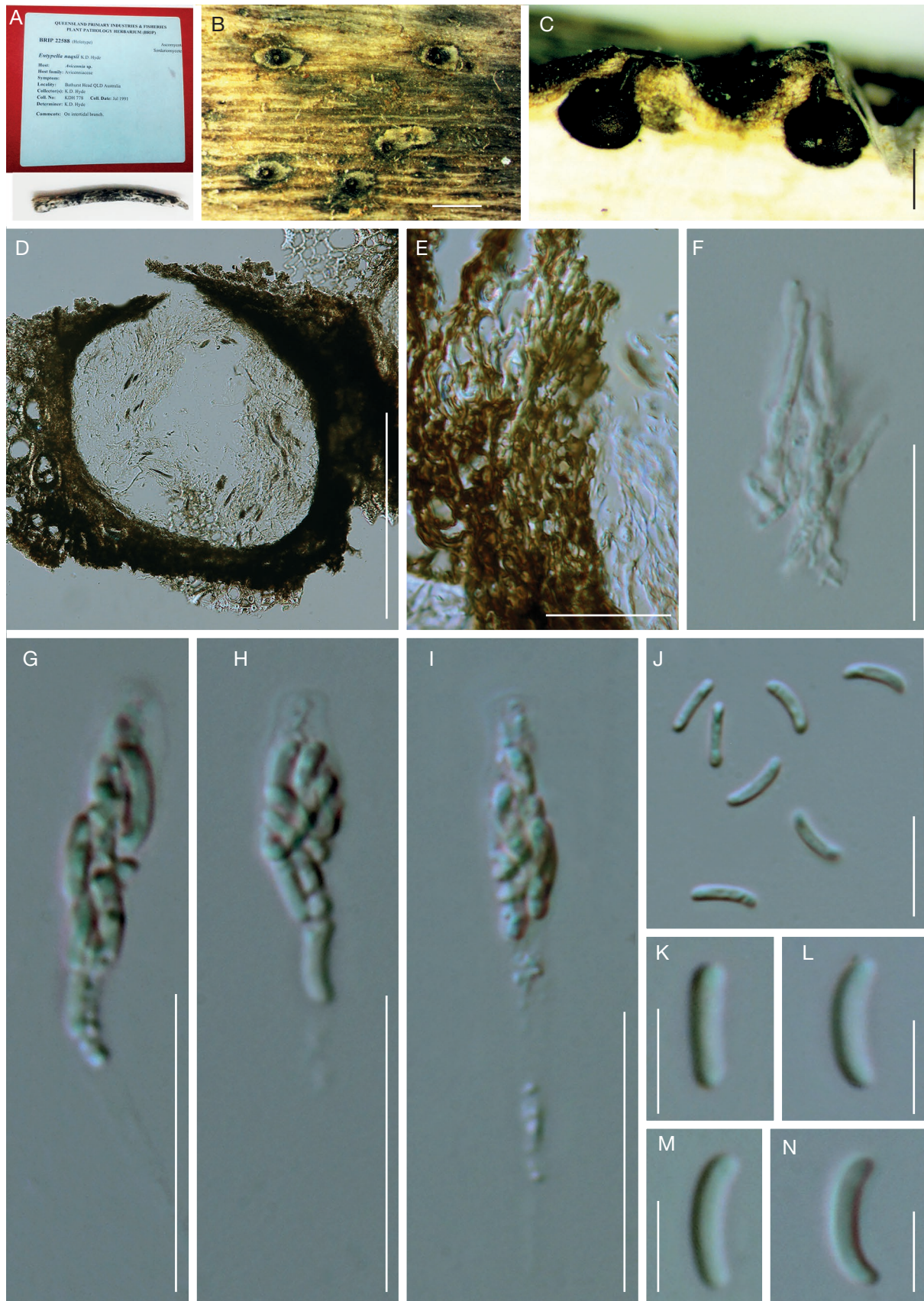


FIG. 13. — *Eutypella naqsii* K.D.Hyde (BRIP 22588, holotype). **A**, herbarium material; **B**, horizontal section through ascostroma; **C**, **D**, vertical section through ascostroma; **E**, peridium; **F**, paraphyses; **G**–**I**, asci; **J**–**N**, ascospores. Scale bars: **B**, 1000 μ m; **C**, 500 μ m; **D**, 100 μ m; **E**, **F**–**I**, 20 μ m; **J**, 10 μ m; **K**–**N**, 5 μ m.

Halocryptovalsa Dayarathne & K.D.Hyde, gen. nov., and *Cryptovalsa* as phylogenetically distant. *Halocryptovalsa avicenniae*, comb. nov., lack of ITS and BTUB sequence data in the GenBank. Therefore, we conducted a separate phylogenetic study with combined 18S and 28S rDNA sequences by including both *Hcr. avicenniae* and *Hcr. salicorniae* with selected diatrypaceous species following Abdel-Wahab *et al.* (2017) (Figs 3; 4). According to our second phylogenetic analyses of 18S and 28S rDNA sequences, *Halocryptovalsa avicenniae*, comb. nov., strains formed a single clade with *Hcr. salicorniae*. Hence, by considering both morphological and phylogenetic affinities we accommodated these two species under the newly introduced genus *Halocryptovalsa* Dayarathne & K.D.Hyde, gen. nov.

Halocryptovalsa salicorniae
Dayarathne & K.D.Hyde, sp. nov.
(Fig. 14)

MYCOBANK. — MB 824309.

FACESOFFUNGI NUMBER. — FoF 03948.

ETYMOLOGY. — Referring to the host genus, *Salicornia*.

CULTURE CHARACTERS. — Reaching 2 cm within 7 days on PDA, when incubated at 25 °C, circular, flat, with diffuse margin, white, and becoming yellowish white, bright yellow to dull yellow with age.

MATERIAL EXAMINED. — **Thailand**, Chang Wat Prachuap Khiri Khan Province, Amphoe Bang Saphan, Tambon Thong Chai, on decaying *Salicornia* sp. stem, 16.VIII.2015, Monika Dayarathne, CHAM018 (MFLU 16-0551 holotype); ex-type living culture, MFLUCC 15-0185 and ICMP.

DISTRIBUTION. — Thailand.

DESCRIPTION

Saprobic on decaying stem of *Salicornia* sp.

Sexual morph

Stromata. Poorly developed, flask-shaped, black, immersed in the surface layers of the host tissue, raising the surface of the substrate in little bumps, with protruding necks, substrate slightly modified between ascomata or more or less necrotic when they are close together.

Ascomata. 230–300 µm high, 140–168 µm diam. ($\bar{x}$ = 265 × 154 µm, n = 5), uni-perithecial, immersed in stromatic tissues, globose to subglobose, dark brown to black, ostiolate, papillate; papilla 76–90 µm high, 55–62 µm wide ($\bar{x}$ = 83 × 58.5 µm, n = 20), globular-conical, immersed in a wide-spreading entostroma in the surface layers of the host tissue, periphysate.

Peridium. 11–16 µm wide ($\bar{x}$ = 13 µm, n = 20), comprising an outer, brown, thick-walled layer, consisting of polygonal melanized cells, brown to dark-brown, interspersed with cells

of the substrate; and inner, hyaline, thick-walled, several cell layers of textura angularis.

Hamathecium. Comprising aseptate paraphyses, narrowing and tapering towards the apex.

Asci. 87–95 × 9–13 µm ($\bar{x}$ = 91 × 11 µm, n = 20), multi-spored, unitunicate, with narrow, thin-walled pedicel, with cylindrical, thick-walled, swollen upper portion, apex flat, with J-, cylindrical, conspicuous apical ring.

Ascospores. 3–5 × 1–2 µm ($\bar{x}$ = 4 × 1.5 µm, n = 20), hyaline, allantoid, straight or slightly curved, unicellular, thin-walled, with small fat globules at the ends, smooth-walled.

Asexual morph

Undetermined.

NOTES

Phylogenetic analyses with ITS and ITS+Btub sequences of *Halocryptovalsa salicorniae* Dayarathne & K.D.Hyde, sp. nov., proved their conspecificity and placement in *Diatrypaceae* as a separate species from all other genera (clade J) (Figs 1; 2). According to our phylogenetic analyses with ITS and combined ITS+Btub, stability of this genus within the family needs to be re-considered with more taxon sampling as taxa grouped in different positions. Our second analysis with LSU+SSU sequence data confirmed its phylogenetic relationship to *Halocryptovalsa avicenniae*, comb. nov. (Figs 3; 4). Morphologically, they differ in length and colour of ascospores (5–8 µm, yellow-brown to brown in *Hcr. avicenniae* and 3–5 µm, hyaline in *Hcr. salicorniae*). Because *Halocryptovalsa avicenniae*, comb. nov., and *Hcr. salicorniae* and distantly placed from *Cryptovalsa* species, we accommodated these species in a new genus *Halocryptovalsa* Dayarathne & K.D.Hyde, gen. nov. Comparative morphological features of this species and *Halocryptovalsa avicenniae*, comb. nov., *Cryptovalsa halosarceicola*, *C. mangrovei* and *C. suaedicola* are summarized in Table 4.

Halodiatrype Dayarathne & K.D.Hyde

Mycosphere 7 (5): 612–627 (2016).

TYPE SPECIES. — *Halodiatrype salinicola* Dayarathne & K.D.Hyde, in *Mycosphere* 7 (5): 612–627 (2016).

DESCRIPTION

Sexual morph

See Dayarathne *et al.* (2016).

Asexual morph

(on PDA after 60 d at 25°C) libertella-like, in black conidial drops. Conidia falcate, hyaline, 1-celled, smooth, upper end subacute, base truncate, curved to nearly semicircular.

NOTES

Halodiatrype was introduced by Dayarathne *et al.* (2016) and is significantly different to other genera in this family by having asco-

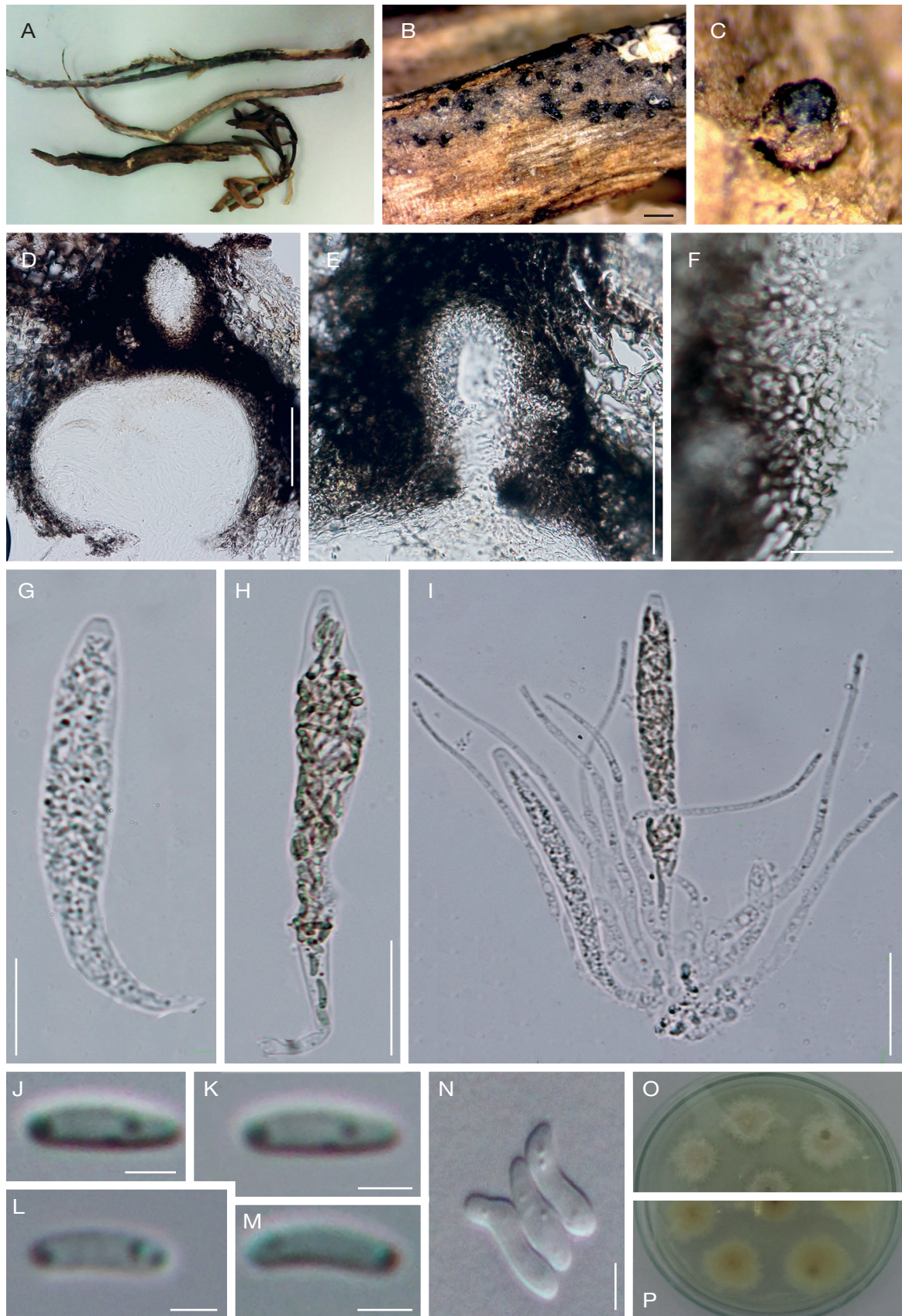


FIG. 14. — *Halocryptovalsa salicorniae* Dayarathne & K.D.Hyde, sp. nov. (MFLU 16-0551 – holotype): **A**, host (*Salicornia* sp.); **B**, **C**, appearance of ascostromata on host; **D**, horizontal section through ascostroma; **E**, section through neck region; **F**, peridium; **G**, **H**, asci; **I**, asci with paraphyses; **J**–**M**, ascospores; **N**, germinating ascospores; **O**, **P**, culture on PDA (O–upper, P–lower). Scale bars: **B**, 500 µm; **D**–**F**, 100 µm; **G**–**I**, 50 µm; **J**–**N**, 5 µm.

mata lacking stromatal tissues, comparatively large ascospores with septa and a libertella-like asexual morph. Generally, *Diatrypaceae* species have well-developed ascostromata with aseptate ascospores (Maharachchikumbura *et al.* 2015). In our phylogenetic analyses, species belonging to this genus formed a well-separated (75% ML, 0.92 PP) clade (clade B) along with the marine genus *Pedumispora*. *Halodiatrype* formed a well-separated (99% ML, 90% MP, 1.00 PP) clade within *Diatrypaceae* (Fig. 1) supported by ITS phylogenetic data (Fig. 2). This study is the first report of an asexual morph for this genus from an axenic culture of *Halodiatrype avicenniae*.

Halodiatrype salinicola Dayarathne & K.D.Hyde
(Fig. 15)

Mycosphere 7 (5): 612-627 (2016).

DESCRIPTION AND ILLUSTRATION. — see Dayarathne *et al.* (2016).

DISTRIBUTION. — Thailand.

NOTES

Halodiatrype salinicola has immersed ascomata with a cylindrical or subconical, periphysate ostiole, apically rounded, clavate asci and allantoid, 0-1-septate, light brown ascospores. *Halodiatrype salinicola* is distinguish from *H. avicenniae* by having unique ascomatal characters and apex composed of brown outer amorphous layer and inner yellow cells of *textura porrecta* and aseptate ascospores becoming 1-septate at maturity. This species shares some common features with *Cryptosphaeria* species such as ascomata that lack stromatic tissues and allantoid, light brown ascospores. However, our phylogenetic survey proved that this species is phylogenetically distantly placed from *Cryptosphaeria*, as reported by Dayarathne *et al.* (2016). Two strains of *H. salinicola* and strains of *H. avicenniae* formed a well-separated clade from all other genera in *Diatrypaceae* with high bootstrap support (99% ML/ 90% MP/ 1.00 PP).

Halodiatrype avicenniae Dayarathne & K.D.Hyde
(Fig. 15)

Mycosphere 7 (5): 612-627 (2016).

CULTURE CHARACTERISTICS. — Colonies on PDA reaching 8 cm diam., after two weeks at 20-25°C, medium dense, irregular, slightly raised, surface smooth with undulate edge, cottony, colony from above white at the margin, yellowish white at the centre; from below yellowish white at the margin, yellow to pale brown at the centre; mycelium greenish grey, no pigmentation on PDA media. Conidiomata forming on culture media, concentrated at colony margin, appearing as black, slimy bubbles with conidial mass.

MATERIAL EXAMINED. — **Thailand**. Phetchaburi Province, Hat Chao Samran, 47°43'30.216"E, 40°15'1.368"N 0 m a.s.l., on intertidal decayed wood of *Avicennia* sp. at a mangrove stand, 28.VIII.2015, *M. Dayarathne*, CHAM020 (holo-, MFLU 16-1185), ex-type living culture, MFLUCC15-0953, ICMP 21767;

CHAM010 (MFLU 16-1176), ex-type living culture, MFLUCC 15-0948. — Krabi province, Tha pom Khlong Nam, 08°12'50.4"N, 98°46'42.7"E, 0 m a.s.l., on intertidal decayed wood of *Avicennia* sp. at a mangrove stand, 16.XII.2015, *M. Dayarathne*, KLA002 (MFLU 16-1196), ex-type living culture, MFLUCC 16-0532; KLA003 (MFLU 16-1197), ex-type living culture, MFLUCC 16-0533. — Ranong province, Amphoe Maung, Mu 4 Tambol Ngao, Ranong Mangrove Research Center, 9°43'-9°57'N, 98°29'-98°39'E, 0 m a.s.l., on intertidal decayed wood of *Bruguiera cylindrica* at a mangrove stand, 6.XII.2016, *M. Dayarathne*, MCD037 (MFLU 18-0150), ex-type living culture, MFLUCC 17-0396, ICMP 21765.

DISTRIBUTION. — Thailand.

DESCRIPTION

Sexual morph

See Dayarathne *et al.* (2016).

Asexual morph

(On PDA after 60 days at 25°C) libertella-like, in back conidial drops.

Conidia. Falcate, 26-38 × 1-2 µm ($\bar{x}$ = 32 × 1.5 µm, n = 30), hyaline, 1-celled, smooth, upper end subacute, base truncate, curved to nearly semicircular.

NOTES

Halodiatrype avicenniae is morphologically distinguishable from *H. salinicola* by having aseptate, larger ascospores (45-52 × 10-14 µm vs 7.5-8.5 × 2.5-3 µm), which are hyaline to light brown. *Halodiatrype avicenniae* is similar to *H. mangrovei* in its ascomata, asci, ascospore shape and colour (Hyde 1993), but *H. mangrovei* has 1-4-septate ascospores, while they are aseptate in *H. avicenniae*. Unfortunately, there are no molecular data to compare the phylogenetic affinities of these two species. This study amends the species description by describing asexual morph characteristics of *H. avicenniae*. This study also reports *Bruguiera cylindrica* as a new host for this species.

Halodiatrype mangrovei
(K.D.Hyde) Dayarathne & K.D.Hyde
(Fig. 16)

Mycosphere 7 (5): 612-627 (2016).

Cryptosphaeria mangrovei K.D.Hyde, *Transactions of the Mycological Society of Japan* 34 (3): 311 (1993).

MYCOBANK. — MB 551350.

FACESOFFUNGI NUMBER. — FoF 04598.

MATERIAL EXAMINED. — **Thailand**, in intertidal mangrove on dead roots of *Rhizophora apiculata*, K.D.Hyde (holo-, BRIP[BRIP-19869]).

DISTRIBUTION. — Thailand.

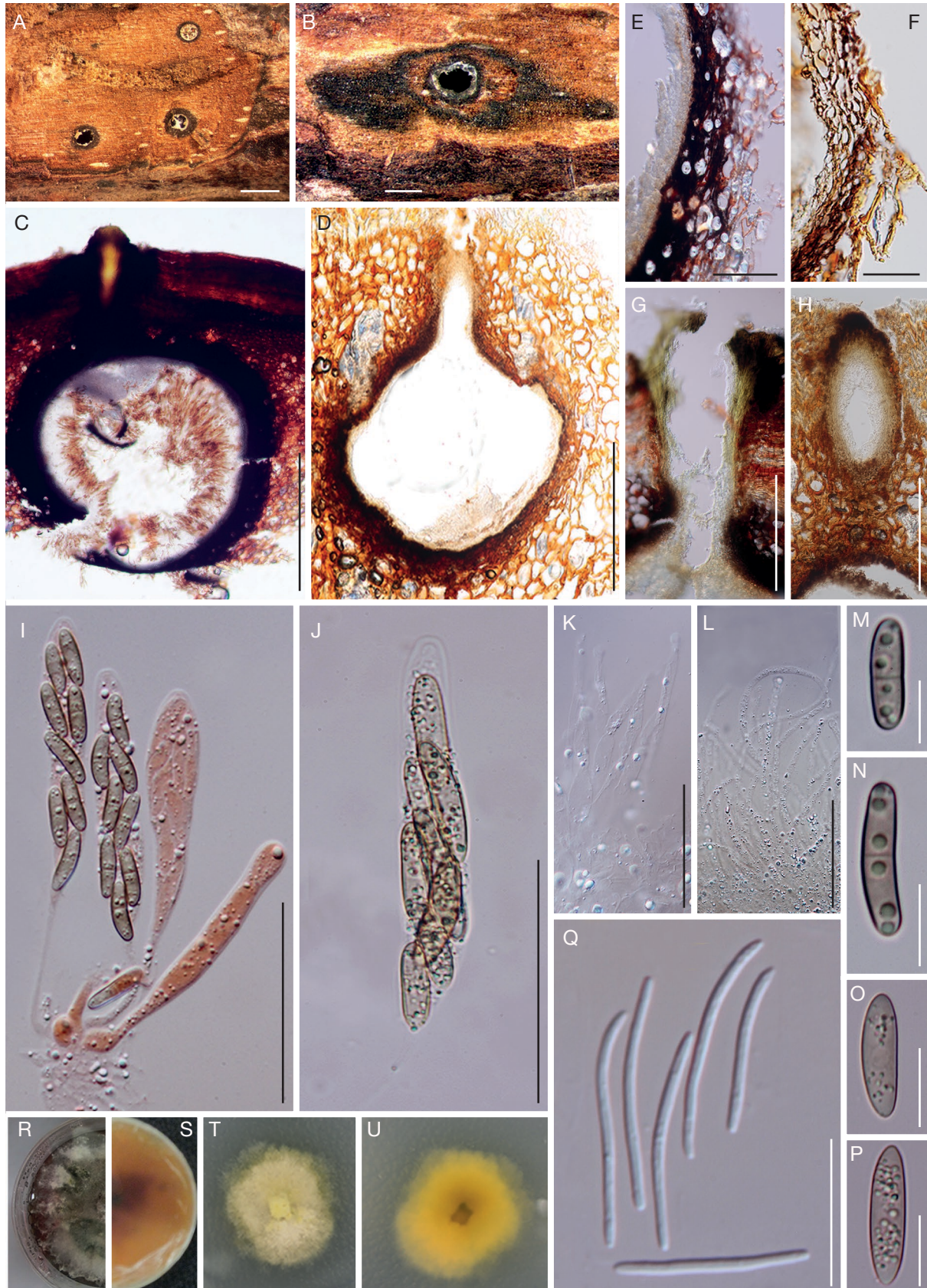


FIG. 15. — **B, C, F, H, I, K, M-P, R, S**, *Halodiatrype salinicola* Dayarathne & K.D.Hyde (MFLU 15-0179 – holotype); **A, D, E, G, J, L, O, P, T, U**, *Halodiatrype avicenniae* Dayarathne & K.D.Hyde (MFLU 16-1185 – holotype and MFLU – 16-1197); **A, B**, horizontal section of ascoma (MFLU 16-1185, MFLU 15-0179); **C, D**, vertical section through ascoma (MFLU 15-0179, MFLU 16-1185); **E, F**, peridium (MFLU 16-1185, MFLU 15-0179); **G, H**, section through neck (MFLU 16-1185, MFLU 15-0179); **I, J**, asci (MFLU 15-0179 (in Congo red), MFLU 16-1185); **K, L**, paraphyses (MFLU 15-0179, MFLU 16-1185); **M-P**, ascospores (MFLU 15-0179, MFLU 16-1185); **Q**, conidia from culture on PDA (MFLU 18-0150); **R-U**, culture on PDA (MFLU 15-0179, MFLU 16-1185) Scale bars: A, 1000 µm; B, 500 µm; C, D, I-L, 100 µm; E, F, Q, 20 µm; G-H, 50 µm; M-P, 10 µm.

DESCRIPTION

Sexual morph

Ascomata. 520-990 × 740-880 µm, dark brown to black, solitary to gregarious, immersed in the darkened pseudostroma, globose to subglobose, uni-loculate, papillate, ostiolate.

Ostioles. Central, ostiolar canal filled with periphyses.

Peridium. 90-135 µm wide, composed of several layers of dark brown to black cells of textura angularis, outer cell layer fusing with the host cells.

Paraphyses. 1.5-3 µm wide, arising from base of perithecia, long, narrow, unbranched, septate, guttulate, narrowing and tapering towards the apex.

Asci. 70-90 × 10-12 µm ($\bar{x}$ = 80 × 11 µm, n = 20), 8-spored, bi- or triseriate, clavate, unitunicate, extremely thin-walled with an indistinct apical thickening, somewhat slightly truncate, without any apical apparatus, apical oil globules in immature asci, J-.

Ascospores. 10-15.8 × 3-5 µm ($\bar{x}$ = 14.5 × 4 µm, n = 20), allantoid or subinequilateral, 0-1 septate, hyaline when immature, yellowish to yellowish brown at maturity, side walls thickened, guttulate, without appendages.

Asexual morph

Undetermined.

NOTES

Cryptosphaeria mangrovei, which was reported from dead roots of *Rhizophora apiculata* in intertidal mangroves in Thailand (Hyde 1993) is characterized by clavate, extremely thin-walled, slightly truncate asci, with an indistinct apical thickening, lacking an apical ring, and with allantoid or subinequilateral, one-celled guttulate ascospores. This species is similar to species of *Halodiatrype* in having allantoid or subinequilateral, light brown ascospores and was collected from intertidal mangrove on dead roots of *Rhizophora apiculata* (Rhizophoraceae). Therefore, we make the new combination of *Halodiatrype mangrovei*.

Pedumispora K.D.Hyde & E.B.G.Jones

Mycological Research 96: 78 (1992).

NOTES

Pedumispora was described from prop roots of *Rhizophora apiculata* (Hyde & Jones 1992). The fungus is characterized by erumpent pustules containing 1-4 immersed ascomata, unitunicate, deliquescent asci and filiform ascospores (Hyde & Jones 1992; Klayubun *et al.* 2014). Filiform ascospores and deliquescent asci are widely found in many unitunicate marine ascomycetes and are regarded as adaptations to the aquatic environment (Hyde *et al.* 1999, 2000). The genus shares similarities with *Prosthecium* and *Winterella* in the

Diaporthales (Hyde & Jones 1992). Klayubun *et al.* (2014) showed by molecular analyses that *P. rhizophorae* was distantly placed from the Diaporthales, and groups in the *Diatrypaceae*, *Xylariales* with strong support.

Pedumispora rhizophorae K.D.Hyde & E.B.G.Jones

(Fig. 17)

Mycological Research 96 (1): 78 (1992).

Material examined. — **Thailand**, Ranong, on twig of *Rhizophora apiculata*, XI.1988, K. D. Hyde (BRIP 19201 holotype).

DISTRIBUTION. — Micronesia, Seychelles, Thailand.

DESCRIPTION

Ascomata. 120-130 µm high, 420-500 µm in diameter, brown to black, subglobose, coriaceous, ostiolate, papillate, pseudostromatic tissues surrounding each ascoma. Necks erumpent.

Paraphyses. 4-8 µm thick, filiform and simple.

Asci. 200-248 × 20-37 µm, 8-spored, irregularly fusiform, pedicellate, unitunicate, thin-walled, without an apical ring.

Ascospores. 153-210 × 4-5.5 µm, filiform, tapering towards both ends, the end cells lack cytoplasmic contents and appear curved or hook-shaped at one end, 12-13-septate, not constricted at the septa, with longitudinal striations running the length of the ascospore, slightly brown.

NOTES

Pedumispora rhizophorae is seldom reported from tropical mangrove habitats (Jones *et al.* 2009, 2013). It was originally collected from decayed intertidal prop roots and twigs of *Rhizophora apiculata* at Ranong Province, southern Thailand (Hyde & Jones 1992). Later collections were made on *R. mucronata* from Seychelles (Hyde & Jones 1992) and mangrove wood from Guam, (Sakayaroj *et al.* 2005). Hyde & Jones (1992) included *Pedumispora rhizophorae* in Melanconidaceae, Diaporthales, as it has similar characters to *Prosthecium* and *Winterella*. A preliminary phylogenetic study, based on LSU sequence data of the strain obtained from Guam, revealed that *Pedumispora rhizophorae* has an affinity with the Xylariales, and in particular with the *Diatrypaceae* (Sakayaroj *et al.* 2005; Jones *et al.* 2009). Klayubun *et al.* (2014) re-examined the morphology of this fungus and confirmed its taxonomic position within Diatrypaceae through a molecular phylogenetic study with LSU and ITS sequences.

DISCUSSION

Phylogenetic analyses of combined ITS and Btub sequence data revealed five main genera *Cryptosphaeria*, *Diatrype*, *Diatrypella*, *Eutypa* and *Eutypella* to be polyphyletic within Diatrypaceae, which is in agreement with Acero *et al.* (2004), Trouillas *et al.*

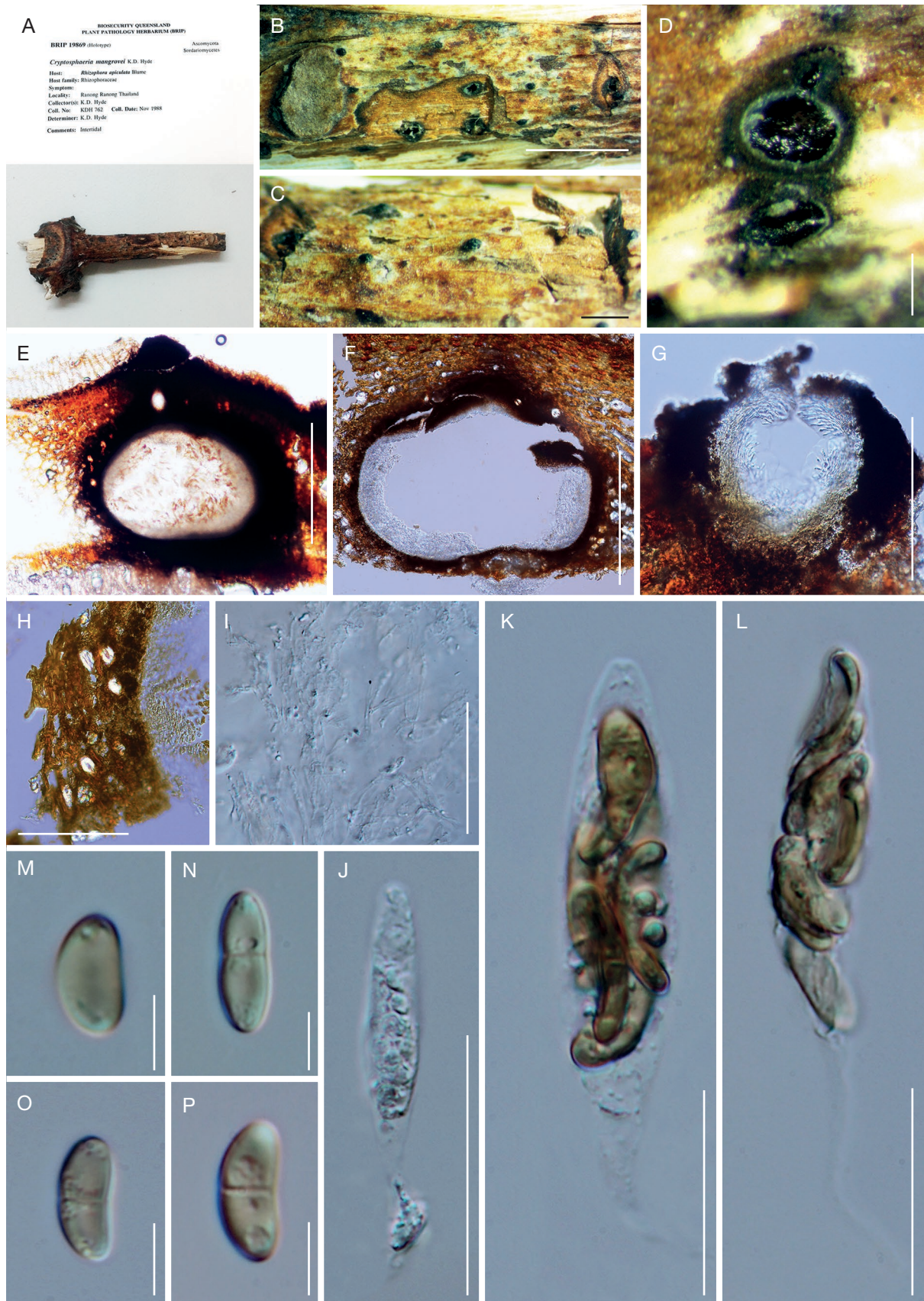


FIG. 16. — *Halodiatrype mangrovei* (K.D.Hyde) Dayarathne & K.D.Hyde (BRIP 19869 – holotype); **A**, herbarium material; **B**, **C**, appearance of ascomata on host surface; **D**–**F**, vertical section through ascoma; **G**, vertical section through neck region; **H**, peridium; **I**, paraphyses; **J**–**L**, asci; **M**–**P**, ascospores. Scale bars: **B**, **E**, **F**, 500 µm; **C**, 1000 µm; **D**, 200 µm; **G**, 50 µm; **H**, **K**–**L**, 20 µm; **M**–**P**, 10 µm.

(2011), Chacón *et al.* (2013), de Almeida *et al.* (2016), Shang *et al.* (2017) and Senwanna *et al.* (2017). Although the monophyly of the Diatrypaceae is well-supported by morphology and molecular data, delineation of genera in the family is not fully resolved (de Almeida *et al.* 2016; Shang *et al.* 2017; Senwanna *et al.* 2017; Dayarathne *et al.* 2016) and thus the family is in need of a revision. Typical morphological characteristics of Diatrypaceae are long-stalked, club-shaped to cylindrical asci mostly with an apical ring, which sometimes contain numerous ascospores (polysporous), and unicellular ascospores (Glawe & Rogers 1984). Marine diatrypaceous species have relatively distinct characters that distinguish them from the terrestrial species such as deeply immersed, long-necked stromata, generally larger, septate, filiform ascospores and deliquescing asci that are believed to be adaptations to the aquatic environment (Hyde *et al.* 2000).

Most marine diatrypaceous species were introduced based on morphological observations and there is a lack of molecular data. Previous illustrations of most species are two-toned images or only line drawings. Hence, we re-examined type materials of *Cryptosphaeria bathurstensis* (K.D.Hyde & Rappaz) Dayarathne & K.D.Hyde, comb. nov., *Cryptovalsa mangrovei*, *Cryptovalsa suaedicola*, *Eutypella naqsii* and *Halodiatrype mangrovei* and provide colour images using modern technology. Our re-examination of the holotype of *Cryptovalsa halosarceicola* revealed that the material lacks fruiting bodies. Hence, there is an urgent need of epitypification of this species (*sensu* Ariyawansa *et al.* 2014).

Of 15 diatrypaceous taxa, which have been reported only from marine habitats, only eight species have molecular data in GenBank including our newly generated sequences. Among them, only *Cryptosphaeria avicenniae* Devadatha & V.V.Sarma, sp. nov., *D. mangrovei* Dayarathne & K.D.Hyde, sp. nov., *Halocryptovalsa salicorniae* Dayarathne & K.D.Hyde, sp. nov., *Halodiatrype mangrovei* and *Halodiatrype avicenniae* have both ITS and Btub data, which are widely used in phylogenetic analyses of this family. *Pedumispora rhizophorae* and *Diatrypasimilis australiensis* do not have Btub data in GenBank. Furthermore, LSU and SSU data are available for *Halocryptovalsa avicenniae*, comb. nov., and *Cryptosphaeria halophila* Dayarathne & K.D.Hyde, sp. nov. Due to lack of ITS and Btub data for these species we conducted a separate phylogenetic analysis with combined SSU and LSU data of selected taxa to resolve their phylogenetic affinities with present data. Consequently, the placement of some marine diatrypaceous species within the natural classification system is still unresolved. Hence, more taxon sampling and molecular data of both ribosomal and protein loci are necessary to resolve their phylogenetic affinities. We provide sequence data for 12 newly collected strains obtained from marine habitats.

The asexual morphs of many species have not yet been determined (Acero *et al.* 2004). Kliejunas & Kuntz (1972) reported the coelomycetous asexual morph of *Eutypella parasitica* occurring on the host substrate and sporulating in cultures. Libertella-like asexual morph of *Cryptovalsa ampelina* sporulated in culture but it has not been seen on host substrate (Mostert *et al.* 2004). Four marine based

diatrypaceous taxa have been linked to their asexual morphs viz. *Diatrypasimilis australiensis*, *Cryptosphaeria bathurstensis* (K.D.Hyde & Rappaz) Dayarathne & K.D.Hyde, comb. nov., *Halocryptovalsa avicenniae*, comb. nov., and *Halodiatrype avicenniae*; *Cryptosphaeria halophila* Dayarathne & K.D.Hyde, sp. nov., is known only from its asexual morph occurring on the host substrate (Hyde & Rappaz 1993; Chalkley *et al.* 2010; Abdel-Wahab *et al.* 2017). Conidia of Diatrypaceae are usually unicellular, hyaline, cylindrical, filiform or allantoid, slightly curved and produced in a slime mass (Glawe & Rogers 1982, 1984; Glawe 1983; Mostert *et al.* 2004; Luque *et al.* 2006). Most species of *Cryptosphaeria*, *Eutypella*, *Eutypa* are well known as parasites and cause canker and dieback diseases. Further studies of marine diatrypaceous fungi may aid in identifying potential pathogens of marine plant species, especially mangrove species.

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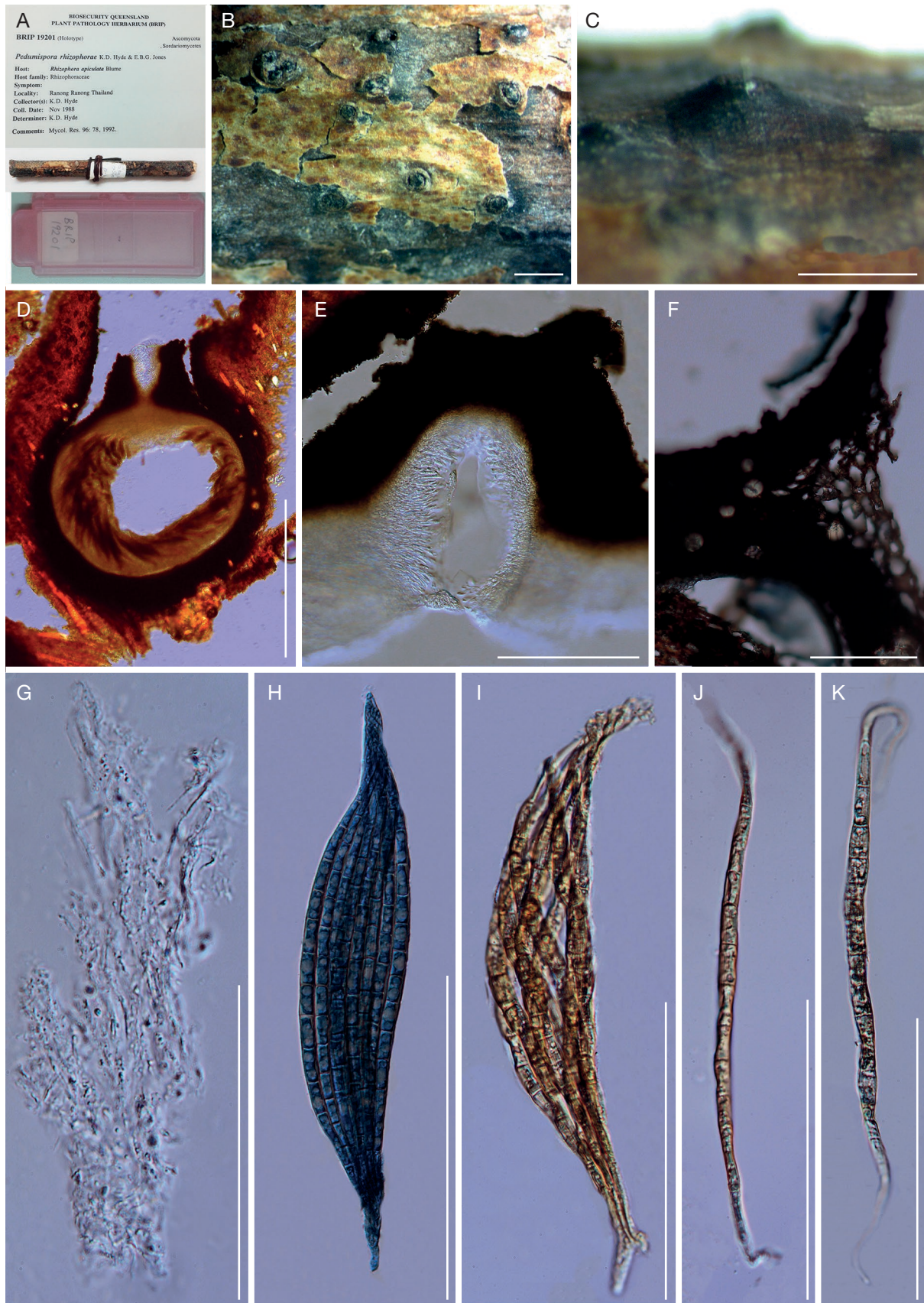


FIG. 17. — *Pedumispora rhizophorae* K.D.Hyde & E.B.G.Jones (BRIP 19201 – holotype): **A**, herbarium material; **B**, **C**, appearance of ascostromata on host; **D**, section through ascoma; **E**, section through neck region; **F**, peridium; **G**, paraphyses; **H**, **I**, asci; **J**, **K**, ascospores. Scale bars: **B**, 1000 μ m; **C**, 500 μ m; **D**, 50 μ m; **E**–**G**, 20 μ m; **H**–**K**, 100 μ m.

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APPENDIX 1. — List of diatrypaceous fungi reported from marine habitats.

- Cryptosphaeria* Grev., *Scottish Cryptogamie Flora* (Edinburgh) 1: pl. 13 (1822)
Cryptosphaeria avicenniae Devadatha & V. V. Sarma, sp. nov.
Cryptosphaeria bathurstensis (K. D. Hyde & Rappaz) Dayarathne & K. D. Hyde, comb. nov.
Cryptosphaeria eunomia (Fr.) Fuckel, *Jahrbücher des Nassauischen Vereins für Naturkunde* 23-24: 212 (1870)
Cryptosphaeria halophila Dayarathne & K. D. Hyde, sp. nov.
Cryptovalsa Ces. & De Not. ex Fuckel, *Jahrbücher des Nassauischen Vereins für Naturkunde* 23-24: 212 (1870) [1869-70]
Cryptovalsa halosarceicola K. D. Hyde [as 'halosarceicola'], *Mycological Research* 97 (7): 799 (1993)
Cryptovalsa mangrovei Abdel-Wahab & Inderb., in Inderbitzin *et al.*, *Mycological Research* 103 (12): 1628 (1999)
Cryptovalsa suaedicola Spooner, *Transactions of the British Mycological Society* 76 (2): 269 (1981)
Diatrype Fr., *Summa vegetabilium Scandinaviae, Sectio Posterior* (Stockholm): 384 (1849)
Diatrype mangrovei Dayarathne & K. D. Hyde, sp. nov.
Diatrypasimilis J. J. Zhou & Kohlm., *Mycologia* 102 (2): 432 (2010)
Diatrypasimilis australiensis J. J. Zhou & Kohlm., *Mycologia* 102 (2): 432 (2010)
Eutypa Tul. & C. Tul., *Selecta Fungorum Carpologia* 2: 52 (1863)
Eutypa bathurstensis K. D. Hyde & Rappaz, *Mycological Research* 97 (7): 861 (1993)
Eutypella (Nitschke) Sacc., *Atti della Società veneto-trentina di scienze naturali* 4: 80 (1875)
Eutypella naqsii K. D. Hyde, *Mycological Research* 99 (12): 1462 (1995)
Halocryptovalsa Dayarathne & K. D. Hyde gen. nov.
Halocryptovalsa avicenniae (Abdel-Wahab, Bahkali & E. B. G. Jones) Dayarathne & K. D. Hyde, comb. nov.
Halocryptovalsa salicorniae Dayarathne & K. D. Hyde, sp. nov.
Halodiatrype Dayar. & K. D. Hyde, *Mycosphere* 7 (5): 617 (2016)
Halodiatrype avicenniae Dayarathne & K. D. Hyde, *Mycosphere* 7 (5): 618 (2016)
Halodiatrype mangrovei (K. D. Hyde) Dayarathne & K. D. Hyde, *Mycosphere* 7 (5): 618 (2016)
Halodiatrype salinicola Dayar. & K. D. Hyde, *Mycosphere* 7 (5): 617 (2016)
Pedumispora K. D. Hyde & E. B. G. Jones, *Mycological Research* 96: 78 (1992)
Pedumispora rhizophorae K. D. Hyde & E. B. G. Jones, *Mycological Research* 96 (1): 78 (1992)

APPENDIX 2. — Authorships of taxa quoted in this article.

- Acer* L.
Acer saccharum Marshall
- Allocryptovalsa* Senwanna, Phookamsak & K.D.Hyde
Allocryptovalsa cryptovalsoidea Trouillas, W.M.Pitt & Gubler ex Senwanna, Phookamsak & K.D.Hyde
Allocryptovalsa polyspora Senwanna, Phookamsak & K.D.Hyde
Allocryptovalsa rabenhorstii (Nitschke) Senwanna, Phookamsak & K.D.Hyde
- Alnus* Mill.
Alnus glutinosa L.
- Anthostoma* Nitschke
Anthostoma decipiens (DC.) Nitschke
- Avicennia* L.
Avicennia marina (Forssk.) Vierh.
- Bruguiera* Lam.
Bruguiera cylindrica (Linnaeus) Blume
- Ceratocystis* Ellis & Halst.
Ceratocystis chinaeucensis S.F.Chen, Jol.Roux, M.J.Wingf. & X.D.Zhou
- Cryptosphaeria* Ces. & De Not.
Cryptosphaeria avicenniae, Devadatha & V.V.Sarma, sp. nov.
Cryptosphaeria bathurstensis (K.D.Hyde & Rappaz) Dayarathne & K.D.Hyde, comb. nov.
Cryptosphaeria eunomia (Fr.) Fuckel
Cryptosphaeria halophila Dayarathne & K.D.Hyde, sp. nov.
Cryptosphaeria ligniota (Fr.) Auersw.
Cryptosphaeria mangrovei K.D.Hyde
Cryptosphaeria millepunctata Grev.
Cryptosphaeria moravica Petr. & Sacc.
Cryptosphaeria pullmanensis Glawe
Cryptosphaeria subcutanea (Wahlenb.) Rappaz
- Cryptovalsa* Ces. & De Not. ex Fuckel
Cryptovalsa mangrovei Abdel-Wahab & Inderb.
Cryptovalsa suaedicola Spooner
Cryptovalsa ampelina (Nitschke) Fuckel
Cryptovalsa avicenniae Abdel-Wahab, Bahkali & E.B.G.Jones
Cryptovalsa halosarceicola K.D.Hyde
Cryptovalsa mangrovei Abdel-Wahab & Inderb.
Cryptovalsa protracta (Pers.) De Not.
Cryptovalsa rabenhorstii (Nitschke) Sacc.
Cryptovalsa suaedicola Spooner
- Diatrypasimilis* J.J.Zhou & Kohlm.
Diatrypasimilis australiensis J.J.Zhou & Kohlm.
- Diatrype* Fr.
Diatrype bullata (Hoffm.) Fr.
- Diatrype disciformis* (Hoffm.) Fr.
Diatrype enteroxantha (Sacc.) Berl.
Diatrype macowaniana Thüm.
Diatrype mangrovei Dayarathne & K.D.Hyde, sp. nov.
Diatrype oregonensis (Wehm.) Rappaz
Diatrype palmicola Jian K.Liu & K.D.Hyde
Diatrype stigma (Hoffm.) Fr.
Diatrype undulata (Pers.) Fr.
Diatrypella atlantica D.A.C.Almeida, Gusmão & A.N.Mill.
Diatrypella favaceae (Fr.) Ces. & De Not.
Diatrypella frostii Peck
Diatrypella major (Berl.) Lar.N.Vassiljeva
Diatrypella pulvinata Nitschke
Diatrypella tectonae Doilom, Q.J.Shang & K.D.Hyde
Diatrypella verruciformis (Ehrh.) Nitschke
Diatrypella vulgaris Trouillas, W.M.Pitt & Gubler
- Eutypa* Tul. & C.Tul.
Eutypa armeniacae Hansf. & M.V.Carter
Eutypa astroidea (Fr.) Rappaz
Eutypa bathurstensis K.D.Hyde & Rappaz
Eutypa consobrina (Mont.) Rappaz
Eutypa flavovirens (Pers.) Tul. & C.Tul.
Eutypa laevata (Nitschke) Sacc.
Eutypa lata (Pers.) Tul. & C.Tul.
Eutypa lejoplaca (Fr.) Cooke
Eutypa leptoplaca (Durieu & Mont.) Rappaz
Eutypa maura (Fr.) Sacc.
Eutypa microasca E.Grassi & Carmarán
Eutypa sparsa Romell
Eutypella caricae (De Not.) Berl.
Eutypella cerviculata (Fr.) Sacc.
Eutypella citricola Speg.
Eutypella leprosa (Pers.) Berl.
Eutypella microtheca Trouillas, W.M.Pitt & Gubler
Eutypella naqiiv K.D.Hyde
Eutypella parasitica R.W.Davidson & R.C.Lorenz
Eutypella (Nitschke) Sacc.
Eutypella semicircularis S.Chacón & M.Piepenbr.
Eutypella vitis (Schwein.) Ellis & Everh.
- Halocryptovalsa* Dayarathne & K.D.Hyde, gen. nov.
Halocryptovalsa avicenniae (Abdel-Wahab, Bahkali & E.B.G.Jones) Dayarathne & K.D.Hyde, comb. nov.
- Halocryptovalsa salicorniae* Dayarathne & K.D.Hyde, sp. nov.
Halocryptovalsa salinicola Dayarathne & K.D.Hyde
- Halodiatrype* Dayarathne & K.D.Hyde
Halodiatrype avicenniae (Abdel-Wahab, Bahkali & E.B.G.Jones) Dayarathne & K.D.Hyde
Halodiatrype mangrovei (K.D.Hyde) Dayarathne & K.D.Hyde
Halodiatrype salicorniae Dayarathne & K.D.Hyde
Halodiatrype salinicola Dayarathne & K.D.Hyde

APPENDIX 2. — Continuation.

<i>Halosarceia</i> Nees	<i>Prunus</i> L.
<i>Halosarceia halocnemoides</i> (Nees) Paul G. Wilson	<i>Prunus armeniaca</i> L.
<i>Hevea</i> Aubl.	<i>Quaternaria</i> Tul. & C. Tul.
<i>Hevea brasiliensis</i> Müll. Arg.	<i>Quaternaria quaternata</i> (Pers.) J. Schröt.
<i>Juglans</i> L.	<i>Quercus</i> L.
<i>Juglans regia</i> L.	<i>Quercus agrifolia</i> Née
<i>Kandelia</i> (DC.) Wight & Arn.	<i>Rhizophora</i> L.
<i>Kandelia candel</i> (L.) Druce	<i>Rhizophora apiculata</i> Blume
<i>Kretzschmaria</i> Fr.	<i>Robinia</i> L.
<i>Kretzschmaria deusta</i> (Hoffm.) P.M.D. Martin	<i>Robinia pseudoacacia</i> L.
<i>Lecanora</i> Ach.	<i>Rosa</i> L.
<i>Lecanora dispersa</i> (Pers.) Röhl.	<i>Rosa canina</i> L.
<i>Marinosphaera</i> K.D. Hyde	<i>Solanum</i> L.
<i>Marinosphaera mangrovei</i> K.D. Hyde	<i>Solanum cernuum</i> Vell.
<i>Monosporascus</i> Pollack & Uecker	<i>Sphaeria</i> Haller
<i>Monosporascus cannonballus</i> Pollack & Uecker	<i>Sphaeria eunomia</i> Fr.
<i>Nypa</i> Steck	<i>Suaeda</i> Forssk. ex J.F. Gmel.
<i>Nypa fruticans</i> Wurm	<i>Suaeda fruticosa</i> (L.) Forssk.
<i>Pedumispora</i> K.D. Hyde & E.B.G. Jones	<i>Vitis</i> L.
<i>Pedumispora rhizophorae</i> K.D. Hyde & E.B.G. Jones	<i>Vitis vinifera</i> L.
<i>Peroneutypa</i> Berl.	<i>Xanthoria</i> (Fr.) Th. Fr.
<i>Peroneutypa alsophila</i> (Durieu & Mont.) Carmarán & A.I. Romero	<i>Xanthoria parietina</i> (L.) Th. Fr.
<i>Peroneutypa comosa</i> (Speg.) Carmarán & A.I. Romero	<i>Xylaria</i> Hill ex Grev.
<i>Peroneutypa curvispora</i> (Starbäck) Carmarán & A.I. Romero	<i>Xylaria acuta</i> Peck
<i>Peroneutypa kochiana</i> (Rehm) Carmarán & A.I. Romero	<i>Xylaria hypoxylon</i> (L.) Grev.
<i>Peroneutypa mackenziei</i> Q.J. Shang, Phook. & K.D. Hyde	
<i>Peroneutypa scoparia</i> (Schwein.) Carmarán & A.I. Romero	