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Anthostomelloides krabiensis gen. et sp. nov. (Xylariaceae) from *Pandanus odorifer* (Pandanaceae)

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Abstract: An *Anthostomella*-like taxon was obtained from *Pandanus odorifer* (Forssk.) Kuntze (Pandanaceae) collected in Krabi Province in Thailand. Morphological data plus phylogenetic analyses of combined ITS, LSU, RPB2, and β-tubulin sequence data clearly separate this *Anthostomella*-like taxon from other known genera in Xylariaceae. In this paper, we introduce this taxon as a new genus, *Anthostomelloides*, in the family Xylariaceae, with *A. krabiensis* as the type. A detailed morphological description, phylogenetic tree, photomicrographs of *A. krabiensis*, keys to *Anthostomella*-like genera, and a comparison of *A. krabiensis* with the morphologically similar taxa in Xylariaceae are provided.

Key words: *Anthostomella*-like genera, multigene phylogeny, sexual morph, taxonomy, *Xylariales*

1. Introduction

Xylariaceae is one of the largest families of Ascomycota (Lumbsch and Huhndorf, 2010; Stadler et al., 2013; Maharachchikumbura et al., 2015; Maharachchikumbura et al., 2016). The family Xylariaceae (*Xylariales*, *Sordariomycetes*), introduced by Tulasne and Tulasne in 1863, has a high diversity in the tropical regions, but its members are cosmopolitan, ubiquitous wood-degraders, and some genera are typically encountered on dung or are associated with insect nests. The family comprises the highest number of bioactive secondary metabolite producers within the fungal kingdom (Stadler and Hellwig, 2005; Kuhnert et al., 2014; Senanayake et al., 2015). According to Maharachchikumbura et al. (2016), 85 genera are included in this family.

The genus *Pandanus* (Pandanaceae) is distributed throughout Africa, Australia, Borneo, India, Madagascar, Malaya, Mauritius, New Caledonia, New Guinea, the Philippines, Sao Tomé Island, Seychelles, Solomon Islands, and Thailand (Nadaf and Zanan, 2012) and it comprises about 600 species (Whitton et al., 2012). Whitton et al. (2012) and various fungal databases (Farr and Rossman, 2016) list five genera from Xylariaceae, which were recorded from the genus *Pandanus*, namely *Anthostomella* Sacc., *Astrocystis* Berk. and Broome, *Fasciatispora* K.D. Hyde, *Pandanicola* K.D. Hyde, and *Rosellinia* De Not.

In this paper, we introduce a new monotypic genus, *Anthostomelloides*, in the family Xylariaceae. We provide a detailed analysis of combined ITS, LSU, RPB2, and β-tubulin sequence data to infer the phylogenetic placement of the new taxon that was collected from *Pandanus odorifer* (Forssk.) Kuntze in Krabi Province, Thailand. A comparison of the new taxon with morphologically similar taxa in Xylariaceae, a comprehensive description and micrographs of the new taxon, and a key to *Anthostomella*-like taxa are also provided.

2. Materials and methods

2.1. Sample collection and specimen examination

A fresh specimen of *Anthostomelloides krabiensis* was obtained from dead leaves of *Pandanus odorifer* (Forssk.) Kuntze (Pandanaceae, R.Br.) collected from Muang

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District, Krabi Province, Thailand, in December 2014. The leaves were examined following the methods outlined by Tibpromma et al. (2016a, 2016b). All photographs of microscopic structures were measured using the Tarosoft Image Framework program v.0.9.0.7.

2.2. Description of cultures

Malt extract agar (MEA; 20 g/L of malt extract, 16 g/L of agar, 20 g/L of dextrose, 6 g/L of peptone) was used as a medium for culturing the isolated fungi. Single spore isolation was performed as described by Chomnunti et al. (2014). Germinating ascospores were aseptically transferred to MEA and Difco oatmeal agar (OA) media after 24 h. The cultures were incubated at 25–30 °C for 4–6 weeks and colonies were observed. The herbarium specimen was dried using silica gel and deposited in the Mae Fah Luang University Herbarium (MFLU), Chiang Rai, Thailand, and the Kunming Institute of Botany Academia Sinica (HKAS), Kunming, China. The ex-type was deposited at the Mae Fah Luang University Culture Collection (MFLUCC). Facesoffungi (FoF) and Index Fungorum (IF) numbers were registered as described by Jayasiri et al. (2015) and Index Fungorum (2016).

2.3. DNA extraction, PCR amplification, and sequencing

Isolates were grown on MEA at room temperature for 4 weeks, and the fungal mycelium was scraped off and transferred to 1.5-mL microcentrifuge tubes. The fungal genomic DNA extraction was performed using the cetyltrimethylammonium bromide (CTAB) method as detailed by Thambugala et al. (2015). Polymerase chain reaction (PCR) was used to amplify three DNA regions, i.e. the large subunit of nuclear ribosomal RNA (LSU), nuclear internal transcribed spacer (ITS), and RNA polymerase II (RPB2). PCRs were carried out according to Thambugala et al. (2015) and Daranagama et al. (2015). The total volumes of PCR mixtures for amplifications were 25 µL, containing 9.5 µL of ddH_2O, 12.5 µL of 2X PCR Master Mix (TIANGEN Co., China), 1 µL of DNA template, and 1 µL of forward and reverse primers (10 µM each). The quality of PCR products was checked on 1% agarose gel electrophoresis stained with ethidium bromide. Purification and sequencing of PCR products were carried out by Invitrogen Biotechnology Co., Ltd. (Shanghai, China).

2.4. Phylogenetic analyses

LSU, ITS, and RPB2 sequence data generated in this study were subjected to BLAST searches in GenBank. The newly generated sequence data were analyzed with related taxa of Xylariaceae, which were retrieved from GenBank based on recent publications (Ariyawansa et al., 2015; Daranagama et al., 2015; Liu et al., 2015; Li et al., 2016). *Sordaria fimicola* (Roberge ex Desm.) Ces. & De Not. (CBS 723.96) was used as the outgroup taxon (Table 1). Raw sequences were assembled using geneious v.9.0.5 and aligned using an online version of MAFFT v.6.864b (Katoh and Standley, 2016). Alignments were manually improved where necessary. The individual sequence datasets were combined using BioEdit v.7.2.5 (Hall, 2004). Maximum likelihood analysis (RAxML) was carried out using raxmlGUI v.0.9b2 (Silvestro and Michalak, 2010) to reconstruct the phylogenetic tree and bootstrap support for the branches was generated with 1000 replicates. Substitution models comprised a generalized time reversible (GTR) for nucleotides with a discrete gamma distribution (Silvestro and Michalak, 2011) selected using MrModeltest 2.2 (Nylander, 2004) (Figure 1). Phylograms were figured in FigTree v. 1.2.2 (Rambaut and Drummond, 2008) and edited using Microsoft Power Point 2007 and Adobe Illustrator CS3 (Adobe Systems Inc., USA).

3. Results

3.1. Phylogenetic analyses

Phylogenetic analyses were performed using a combined alignment of LSU, ITS, β-tubulin, and RPB2 sequence data of 61 taxa, including *Sordaria fimicola* (Roberge ex Desm.) Ces. & De Not. (CBS 723.96) as the outgroup taxon (Table 1). The phylogenetic analysis of the combined data matrix showed considerably high bootstrap support and well-resolved clades. The best scoring tree generated from the ML analysis with bootstrap support (BS) values (>70% based on 1000 replicates) is shown in Figure 1. The phylogenetic tree that resulted from this analysis projected similar results as in previous studies by Daranagama et al. (2015) and Maharachchikumbura et al. (2015). The phylogeny showed *Anthostomelloides* as a distinct lineage with other genera in Xylariaceae with high bootstrap support (85% in ML analysis). According to the phylogenic tree *Anthostomelloides* is closely related to the genera *Podosordaria* Ellis & Holw and *Poronia* Willd., while it is well separated from *Anthostomella* Sacc. and *Brunneiperidium* Daranagama, Camporesi & K.D. Hyde (Figure 1).

3.2. Taxonomy

Anthostomelloides Tibpromma & K.D. Hyde, **gen. nov**.

Index Fungorum number: IF552117, Facesoffungi number: FoF 02190

Etymology: *Anthostomelloides*, resembling the genus *Anthostomella*

Saprobic on dead leaves of *Pandanus odorifer* (Forssk.) Kuntze. **Sexual morph:** *Ascomata* immersed, dark brown-black, globose, visible as conical blackened dots, ostioles present. *Peridium* composed of several layers, outwardly comprising brown cells of *textura prismatica* and inwardly comprising hyaline cells of *textura prismatica*. *Hamathecium* comprising numerous, filamentous, septate, tapering paraphyses. *Asci* 6–8-spored, unitunicate, cylindrical, short apedicellate, with a wedge-shaped,

Table 1. Strains and GenBank accession numbers used in the phylogenetic analyses (new taxon is indicated with an asterisk).

Species	Culture collection/ specimen number	GenBank accession numbers			
		LSU	ITS	RPB2	β-tubulin
Amphirosellinia fushanensis	HAST 911112092	–	GU339496	GQ848339	GQ495950
A. nigrospora	HAST 910923082	–	GU322457	GQ848340	GQ495951
Anthocanalis sparti	MFLUCC 14-0010	KP340536	KP297394	KP340522	KP406605
A. sparti	MFLUCC 14-0557	KP340537	KP297395	KP340523	KP406606
Anthostomella conorum	CBS 119333	–	EU552099	–	–
A. formosa	MFLUCC 14-0170	KP340544	KP297403	KP340531	KP406614
A. obesa	MFLUCC 14-0171	KP340546	KP297405	KP340533	KP406616
A. torosa	AFTOL-ID 732	DQ836902	–	DQ836885	–
*Anthostomelloides krabiensis**	MFLUCC 15-0678	KX305928	KX305927	KX305929	–
Astrocystis bambusae	HAST 89021904	–	GU322449	GQ844836	GQ495942
A. concavispora	MFLUCC 14-0174	KP340545	KP297404	KP340532	KP406615
A. mirabilis	HAST 94070803	–	GU322448	GQ844835	GQ495941
Biscogniauxia arima	WSP 122	–	EF026150	GQ304736	AY951672
B. marginata	MFLUCC 12-0740	KJ958408	KJ958407	KJ958409	KJ958406
B. mediterranea	YMJ 147	–	EF026134	GQ844765	AY951684
Brunneiperidium gracilentum	MFLUCC 14-0011	KP340542	KP297400	KP340528	KP406611
B. gracilentum	MFLUCC 14-0559	KP340549	KP297401	KP340529	KP406612
B. involucratum	MFLUCC 14-0009	KP340541	KP297399	KP340527	KP406610
Camillea obularia	ATCC 28093	–	AJ390423	–	–
Collodiscula fangjingshanensis	GZUH0109	KR002591	KR002590	KR002592	KR002589
C. japonica	CBS 124266	–	JF440974	–	–
C. leigongshanensis	GZUH0107	KP054282	KP054281	KR00258	KR002587
Creosphaeria sassafras	CBS 119001	–	KU683754	KU684308	KU684126
Daldinia bambusicola	CBS 122872	–	JX658436	KU684287	KU684127
D. concentrica	CBS 113277	–	AY616683	–	KC977274
Discoxylaria myrmecophila	JDR 169	–	GU322433	GQ844819	GQ487710
Entoleuca mammata	JDR 100	–	AJ246235	GQ844782	GQ470230
Euepixylon sphaeriostomum	JDR 261	–	GU292821	GQ844774	GQ470224
Fasciatispora nypae	MFLUCC 11-0382	KP744484	–	–	–
*Hypoxylon jaklitschii_*	JF13037	–	KM610290	–	KM610304
H. sublenormandii	JF13026	–	KM610291	–	KM610303
Kretzschmaria guyanensis	HAST 89062903	–	GU300079	GQ844792	GQ478214
Lopadostoma americanum	CBS 133211	–	KC774568	KC774525	–
L. insulare	LG32	–	KC774588	KC774541	–
L. lechatii	CBS 133694	–	KC774590	KC774543	–
L. linospermum	CBS 133208	–	KC774591	KC774544	–
Lunatiannulus irregularis	MFLUCC 14-0014	KP340540	KP297398	KP340526	KP406609
Nemania maritima	HAST 89120401	DQ840074	GU292822	DQ631946	GQ470225
N. serpens	HAST 235	DQ840075	GU292820	GQ844773	GQ470223
Neoanthostomella pseudostromatica	MFLUCC 11-0610	KU863146	KU940158	–	–

Table 1. (Continued).

Obolarina dryophila	CCF 3915	–	GQ428314	–	GQ428320
Phylacia poculiformis	MUCL 51706	–	FN428830	–	–
Podosordaria mexicana	WSP 176	–	GU324762	GQ853039	GQ844840
P. muli	WSP 167	–	GU324761	GQ853038	GQ844839
Poronia pileiformis	WSP 88113001	–	GU324760	GQ853037	GQ502720
Pyriformiascoma trilobatum	MFLUCC 14-0012	KP340543	KP297402	KP340530	KP406613
Rhopalostroma angolense	CBS 126414	KM186298	FN821965	KM186297	KM186299
R. brevistipitatum	MFLUCC 15-0007	KT305986	KT253585	KT359352	–
Rosellinia buxi	JDR 99	–	GU300070	GQ844780	GQ470228
R. merrillii	HAST 89112601	–	GU300071	GQ844781	GQ470229
R. necatrix	HAST 89062904	AY083824	EF026117	GQ844779	EF025603
Rostrohypoxylon terebratum	CBS 119137	DQ840069	DQ631943	DQ631954	DQ840097
Ruwenzoria pseudoannulata	MUCL 51394	–	GU053568	–	–
Sordaria fimicola	CBS 723.96	AF132330	AY681188	DQ368647	DQ840087
Stilbohypoxylon elaeicola	JDR 173	–	EF026148	GQ844826	EF025616
S. quisquiliarum	HAST 89091608	–	EF026120	GQ853021	EF025606
Thamnomyces camerunensis	MUCL 51396	–	FN428828	–	–
Vamsapriya bambusicola	MFLUCC 11-0477	KM462837	KM462835	KM462834	KM462833
V. indica	MFLUCC 12-0544	KM462840	KM462839	KM462841	KM462838
Xylaria grammica	HAST 479	JQ862638	JQ862677	GQ844813	GQ487704
X. hypoxylon	CBS 122620	KM186301	AM993141	KM186302	KM186300

ATCC: American Type Culture Collection; AFTOL: Assembling the Tree Of Life; CCF: Culture Collection of Fungi, Department of Botany, Faculty of Sciences, Charles University, Prague, Czech Republic; CBS: Centraalbureau voor Schimmelcultures, Utrecht, the Netherlands; GZUH: herbarium of Guizhou University; HAST: Herbarium, Research Centre for Biodiversity, Academia Sinica, Taipei; JDR: Herbarium of Jack D. Rogers; JF: J. Kohlmeyer; MFLUCC: Mae Fah Luang University Culture Collection, Chiang Rai, Thailand; MUCL: Université Catholique de Louvain Belgium, Louvain-la-Neuve; YMJ: Herbarium of Yu Ming Ju; WSP: Washington State University, USA.

J+, apical ring. *Ascospores* uniseriate, inequilaterally oblong-ellipsoidal, initially yellowish brown, becoming dark brown at maturity, guttulate, with a conspicuous mucilaginous sheath, germ slit straight, less than the spore length. **Asexual morph:** Undetermined.

Type species: ***Anthostomelloides krabiensis*** Tibpromma & K.D. Hyde

Notes: We compared *Anthostomelloides* with *Anthostomella* and *Brunneiperidium* and found that our new genus can be differentiated by its immersed, globose ascomata and a peridium comprising cells of *textura prismatica*. In *Anthostomella,* ascomata are immersed or semiimmersed, with a periphysate ostiolar canal, sometimes with small cells or appendages at the ends of the ascospores, which have a basal, dwarf cell, sometimes surrounded by a mucilaginous sheath, with a straight or spiral germ slit or absence of germ slit. *Brunneiperidium* has semiimmersed ascomata with a peridium comprising cells of *textura irregularis* with ellipsoidal, brown ascospores and germ slit present or absent, if present straight and slightly curved at the edges with not full length (Daranagama et al., 2015). *Anthostomelloides* morphologically resembles the palm genera *Fasciatispora* K.D. Hyde and *Nipicola* K.D. Hyde in Xylariaceae, but *Fasciatispora* has ellipsoid, oval to rhomboid ascospores with a wide equatorial pallid band, while *Nipicola* possesses broadly cylindrical asci with an amyloid or nonamyloid subapical ring and black ascospores (Fröhlich and Hyde, 2000).

Anthostomelloides krabiensis Tibpromma & K.D. Hyde, **sp. nov.**

Index Fungorum number: IF552118, Facesoffungi number: FoF 02191

Etymology: Species epithet *krabiensis* refers to the name of the province where the holotype was collected

Holotype: MFLU16-0543

Saprobic on dead leaves of *Pandanus odorifer* (Forssk.) Kuntze. **Sexual morph:** *Ascomata* 139–275 µm high, 124–266 µm diam. ($\overline{x}$ = 185 × 190 µm, n = 5), immersed,

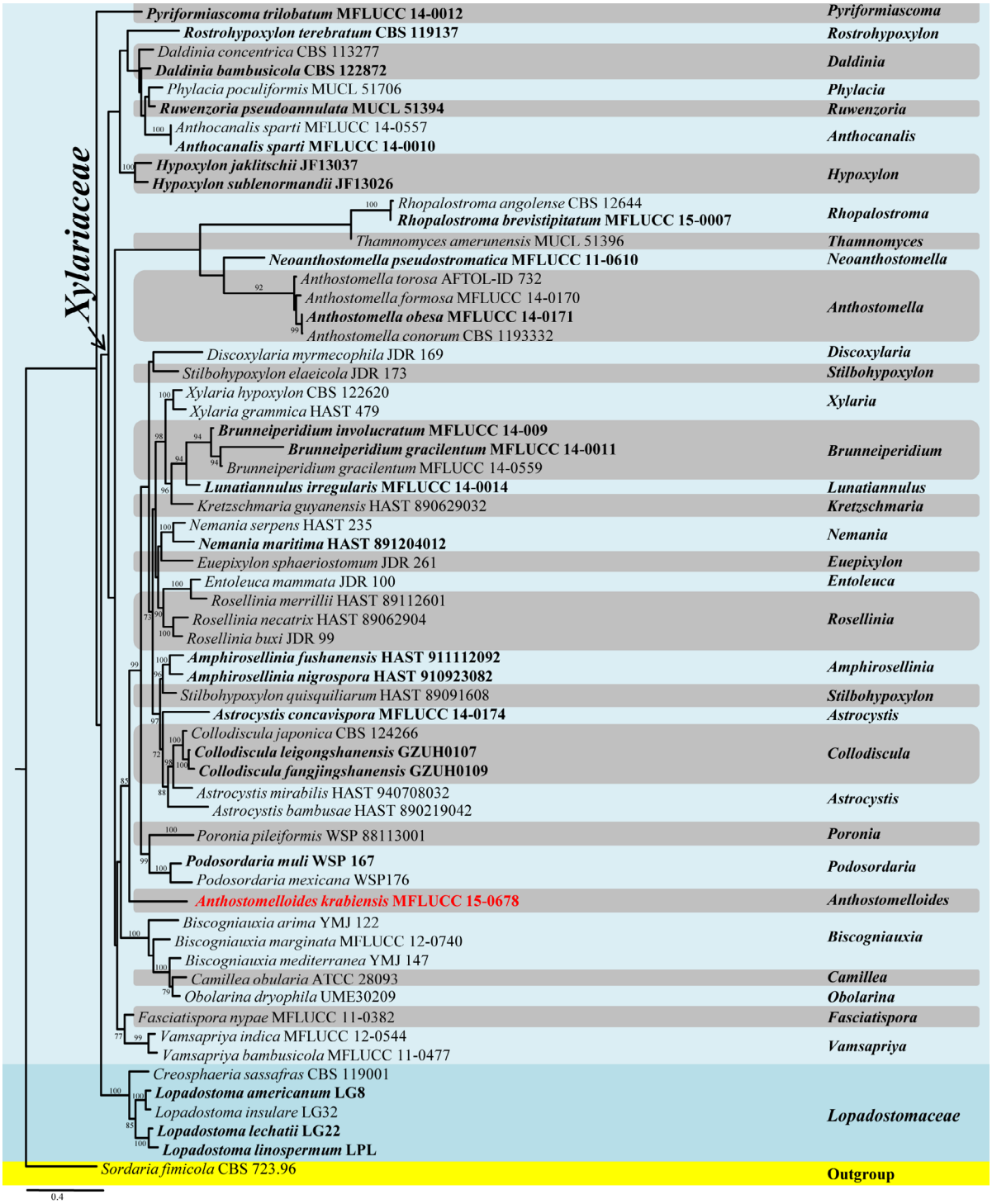

Figure 1. The best-scoring RAxML tree based on combined LSU, ITS, β-tubulin, and RPB2 sequenced data of taxa from the family Xylariaceae. Bootstrap support values for maximum likelihood greater than 70% are given at the nodes. The tree is rooted with *Sordaria fimicola* (CBS 723.96). Ex-type strains are in bold. The newly generated sequence is in red.

visible as conical blackened dots, dark brown to black, solitary, globose, ostiole in the center. *Peridium* 16–32 µm ($\overline{x}$ = 22 µm, n = 15), composed of several layers, outwardly comprising reddish brown cells of *textura prismatica* and inwardly comprising hyaline cells of *textura prismatica*. *Hamathecium* comprising numerous, 2.9–6.4 µm in diam.

($\overline{x}$ = 5.2 µm, n = 40), filamentous, unbranched, guttulate, septate paraphyses. *Asci* 96–147 × 12–20 µm ($\overline{x}$ = 120 × 17 µm, n = 20), 6–8-spored, unitunicate, cylindrical, short-pedicellate with club-like pedicellate, apically rounded, with a wedge-shaped, J+, 2–4 × 3–5 µm ($\overline{x}$ = 3 × 4 µm, n = 10), apical ring. *Ascospores* 13–18 × 6–11 µm ($\overline{x}$ = 15 × 8 µm, n = 30), uniseriate, inequilaterally oblong-ellipsoidal, initially yellowish brown, becoming dark brown at maturity, guttulate, surrounded by a conspicuous 9.3–11.4 µm ($\overline{x}$ = 10.3 µm, n = 10) mucilaginous sheath, germ slit straight, less than spore length. **Asexual morph:** Undetermined.

Culture characteristics: Colonies on MEA at room temperature reaching 9 cm at edge of petri dish in 6–8 weeks, circular with curved edges, white mycelium raised from the medium surface. Colonies on Difco OA at room temperature reaching 9 cm at edge of petri dish in 5 weeks, yellow-white, circular with entire edges, smooth surface and flat, not sporulating in culture within 4 months.

Material examined: THAILAND, Krabi Province, Muang District, on dead leaves of *Pandanus odorifer* (Forssk.) Kuntze (Pandanacae), 4 December 2014, S. Tibpromma and K.D. Hyde, SF14-036 (MFLU 16-0543, **holotype**; HKAS 92502, **paratype**); ex-type living cultures, MFLUCC 15-0678.

Notes: *Anthostomelloides krabiensis* is morphologically similar to *Anthostomella calamicola* K.D. Hyde; *A. forlicesenica* Daranagama, E. Camporesi & K.D. Hyde; *A. helicofissa* Daranagama, E. Camporesi & K.D. Hyde; *A. irregularispora* K.D. Hyde; *A. obesa* Daranagama, E. Camporesi & K.D. Hyde; and *Brunneiperidium involucratum* Daranagama, E. Camporesi & K.D. Hyde in the family Xylariaceae, but *A. krabiensis* differs by having a peridium comprising reddish brown cells of *textura prismatica* and 6–8-spored in asci (see Table 2). According to Whitton et al. (2012), many genera from Xylariaceae have been recorded from *Pandanus*. *Nipicola pandani* K.D. Hyde was described from *Pandanus* sp. (Hong Kong) and is similar to *A. krabiensis*, but *N. pandani* is distinguished by having a discoid, J+, apical ascal ring and black, reniform ascospores (Figure 2).

A key to *Anthostomella*-like genera

1. a. Ascospores with germ pores 2
b. Ascospores without germ pores 4
2. a. Ascospores with dwarf cell ..... *Stereosphaeria*
b. Ascospores without dwarf cell 3
3. a. Ascospores with equatorial germ pore ..... *Amphisphaerella*
b. Ascospores with two polar germ pores ..... *Pandanicola*
4. a. Ascospores fusiform 5
b. Ascospores not fusiform 6
5. 4 or 8 spores in ascus ..... *Lunatiannulus*
b. 6–8-spored in ascus ..... *Cocoicola*
6. a. Ascospores with mucilaginous sheath 7
b. Ascospores without mucilaginous sheath 17
7. a. Ascal ring present 8
b. Ascal ring lacking ..... *Neoanthostomella*
8. a. Ascospores with dwarf cell/appendages 9
b. Ascospores without dwarf cell/appendages 11
9. a. Ascospore with germ slit ..... *Anthostomella*
b. a. Ascospore lacking germ slit 10
10. a. Ascospores with a dwarf cell ..... *Brunneiapiospora*
b. Ascospores with blunt polar appendages ..... *Sabalicola*
11. a. Ascospores with equatorial band ..... *Fasciatispora*
b. Ascospores without equatorial band 12
12. a. Ascomata semiimmersed ..... *Brunneiperidium*
b. Ascomata immersed 13
13. a. Ascospores lunate shape ..... *Nipicola*
b. Ascospores not lunate shape 14
14. a. Ascospores with germ slit 15
b. a. Ascospores lacking germ slit ..... *Spirodecospora*
15. a. Germ slit spiral ..... *Leptomassaria*
b. Germ slit straight 16
16. a. Apical ring wedge shape ..... *Anthostomelloides*
b. Apical ring discoid shape ..... *Anthocanalis*
17. a. Ascospores with dwarf cell ..... *Pyriformiascoma*
b. Ascospores without dwarf cell 18
18. a. Ascal ring present 19
b. Ascal ring lacking 21
19. a. Ascospores with long polar appendages ..... *Appendixia*
b. Ascospores without long polar appendages 20
20. a. Cylindrical asci with long pedicel ..... *Nemania*
b. Cylindrical asci with short pedicel ..... *Lopadostoma*
21. a. Ascomata with long ostiolar neck ..... *Anthostoma*
b. Ascomata with short ostiolar neck 22
22. a. Ellipsoidal ascospores ..... *Helicogermslita*
b. Oblong-ellipsoidal to allantoid ascospores ..... *Barrmaelia*

4. Discussion

Anthostomelloides is introduced as a new monotypic genus in Xylariaceae based on both morphological data and phylogenetic analysis. *Anthostomelloides krabiensis* forms a distinct clade in the family Xylariaceae with 85% ML bootstrap support. This new taxon is morphologically different from *Anthostomella* and *Brunneiperidium*, while phylogenetically distant from *Anthocanalis*, *Brunneiperidium*, *Lunatiannulus*, *Neoanthostomella*, and *Pyriformiascoma* (Figure 1). Phylogenetically *Anthostomella brabeiji* and *A. proteae* showed similarities to *A. krabiensis* in blast searches, but are morphologically distinct. We compared ITS gene sequence data of *Anthostomella brabeiji* and *A. proteae* with our new taxon

Table 2. Synopsis of characters of *Anthostomelloides krabiensis* compared with similar taxa in Xylariaceae.

Name	Ascostromata/ Ascomata	Peridium	Paraphyses	Asci	Ascospores	Material examined	Reference
Anthostomelloides krabiensis	Immersed, dark brown-black, globose, ostiole	Outwardly comprising reddish brown cells of *textura prismatica* and inwardly comprising hyaline cells of *textura prismatica*	Filamentous, unbranched, guttulate, septate	6–8-spored, cylindrical, short-pedicellate, apically rounded, J+ apical apparatus, wedge-shaped, subapical apparatus	Inequilaterally oblong-ellipsoidal, yellow brown to dark brown, guttulate with conspicuous mucilaginous sheath, germ slit straight less than spore length	THAILAND, on *Pandanus odorifer* Parkinson (Pandanaceae, R.Br.)	This study
Anthostomella (Sacc. 1875)							
A. calamicola K.D. Hyde	Immersed, visible as minute ostiolar dots, dark-brown, subglobose with periphysate ostiole	Dark-brown *angular elongate* cell	Filamentous, septate	8-spored, cylindrical, thin-wall, pedicellate, apically rounded, J+, wedge-shaped apical apparatus, subapical apparatus	Ellipsoid-fusiform, brown to dark brown, surrounded by a thin spreading mucilaginous sheath, germ slit straight, extending over the full length	QUEENSLAND, on Calamus sp. L. (Arecaceae)	Lu and Hyde (2000)
A .forlicesenica Daranagama, E. Camporesi & K.D. Hyde	Immersed, dark brown-black, globose, witha central periphysate ostiolar canal	Outwardly comprising dark brown cells of *textura globulosa* and inwardly comprising hyaline cells of *textura angularis*	Filamentous, septate	8-spored, cylindrical, short-pedicellate, apically rounded, J+ apical apparatus, discoid	Equilateral with parallel sides, brown, with conspicuous mucilaginous sheath, lacking a germ slit	ITALY, on *Spartium junceum* L. (Fabaceae)	Daranagama et al. (2015)
A. helicofissa Daranagama, E. Camporesi & K.D. Hyde	Immersed, obpyriform, ostioles slightly papillate, ostiolar canal present	Outwardly comprising thick-walled, dark brown cells of *textura angularis* and inwardly comprising thin-walled, hyaline cells of *textura intricata*	Filamentous, septate	Cylindrical, short-pedicellate, apical apparatus not observed	Equilaterally ellipsoidal, dark brown, thin gelatinous sheath present, germ slit, helical	ITALY, on *Cornus sanguineaba* L. (Cornaceae)	Daranagama et al. (2015)
A. irregularispora K.D. Hyde	Immersed, erumpent, ostiolar dots, subglobose, ostiolar canal and a sparse clypeus	Light brown wall	Filamentous, septate	8-spored, cylindrical, pedicellate, apically rounded, J+, discoid, subapical apparatus,	Broadly ellipsoidal or irregularly oblong-ellipsoidal, end acute, dark-brown, thin mucilaginous sheath, one lipid globule in the center, germ slit straight, extending the over full length	PAPUA NEW GUINEA, on *Licuala spinosa Roxb*. (Arecaceae)	Lu and Hyde (2000)
A. obesa Daranagama, E. Camporesi & K.D. Hyde	Immersed, globose to subglobose, ostiolar canal broad	Outwardly comprising dark brown cells and inwardly comprising hyaline cells of *textura irregularis* with a central cell layer of light brown yellow cells of *textura angularis*	Filamentous, septate	8-spored, cylindrical, short–pedicellate, a discoid, J+, apical apparatus	Globose to equilateral ellipsoidal, germ slit, straight	ITALY, on *Cornus* sp. (Cornaceae)	Daranagama et al. (2015)
Bruneiperidium (Daranagama et al., 2015)							
B. involucratum Daranagama, E. Camporesi & K.D. Hyde	Superficial, darkened, ostioles papillate	Outwardly comprising thick-walled, dark brown cells of textura angularis, lined with loosely arranged yellowish brown cells of *textura irregularis* inwardly comprising thin-walled, hyaline cells of *textura irregularis*	Septate	8-spored, cylindrical, short-pedicellate, with discoid, J+, apical apparatus	Equilaterally ellipsoidal, dark brown to black, conspicuous mucilaginous sheath, germ slit straight	ITALY, on cone of *Pinus sylvestris* L. (Pinaceae)	Daranagama et al. (2015)

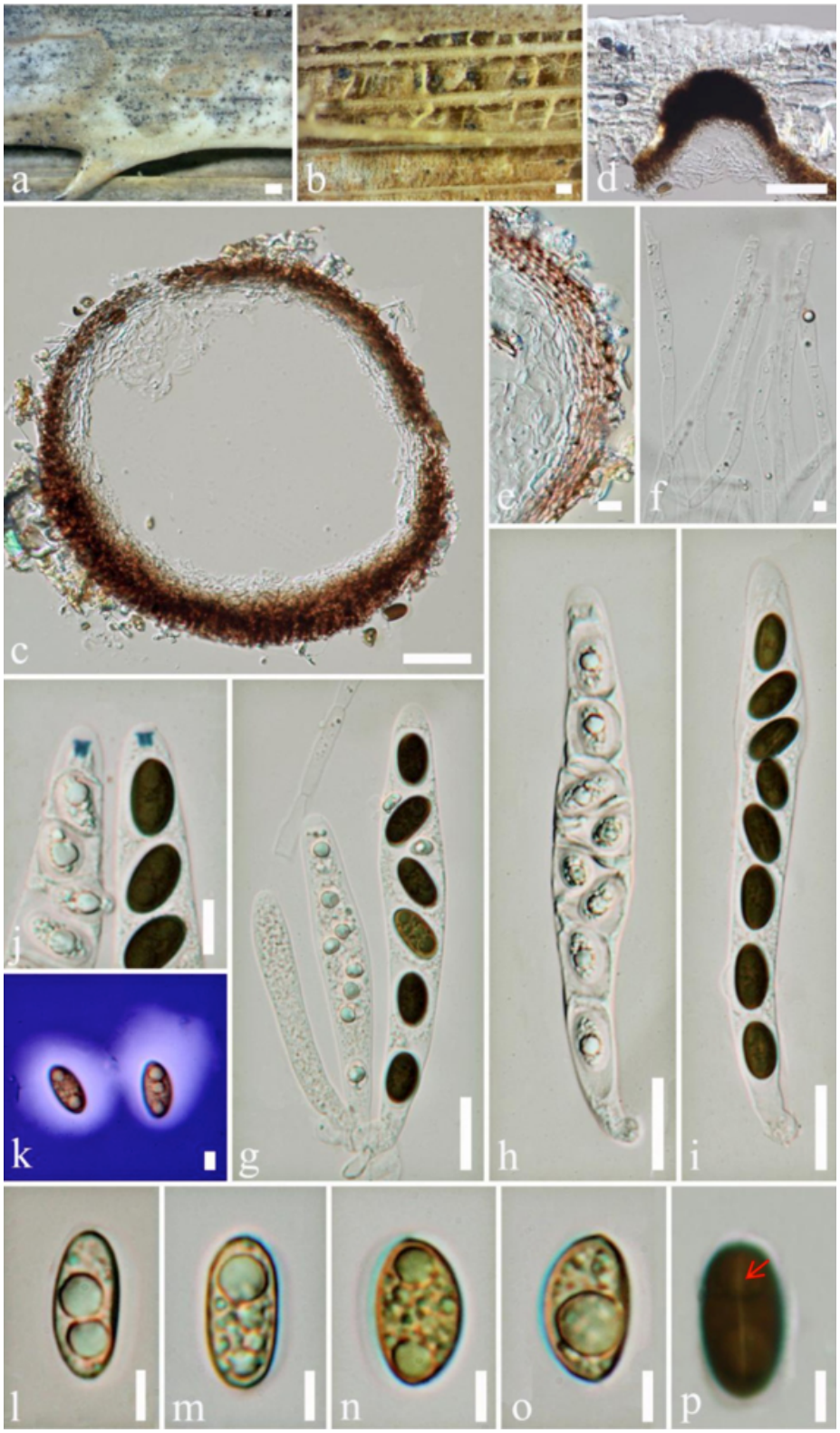

Figure 2. *Anthostomelloides krabiensis* (MFLU16-0543, holotype): a, b- appearance of ascomata on host surface (*Pandanus odorifer*); c- cross-section of ascoma; d- ostiole; e- section of peridium; f- paraphyses; g–i- asci; j- asci in Melzer's reagent with wedge-shaped, J+, apical ring; k- ascospores in Indian ink, highlighting the mucilaginous sheath around ascospores; l–p- ascospores. Note the germ slit in p. Scale bars: a = 500 µm, b = 200 µm, c = 20 µm, d = 50 µm, e–f = 5 µm, g–i = 20 µm, j = 10 µm, k–p = 5 µm.

and found that our new taxon is phylogenetically distinct, but we did not include these in the analyses as only ITS gene sequence data are available in GenBank for *Anthostomella brabeiji* and *A. proteae*. *Neoanthostomella* D.Q. Dai & K.D. Hyde was introduced as a new *Anthostomella*-like genus by Dai et al. (2016) with the support of both morphological and multigene phylogenetic support. *Neoanthostomella* can be distinguished from our new genus by having 2–5 ascomata growing together in a single pseudostroma, ostiolate in center with periphysate, peridium comprising brown to hyaline cells of *textura angularis* and asci without an apical ring and a straight germ slit extending over the full length.

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