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A re-assessment of Elsinoaceae (Myriangiales, Dothideomycetes)

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Abstract

The family Elsinoaceae is a relatively poorly known, but important family within Myriangiales, Dothideomycetes. The genera of this family are mostly plant pathogens and causes disease, such as apple and grape scab. In this paper we revisit the family by examining generic types and analysis of molecular sequence data available in GenBank. Elsinoaceae and Myriangeaceae are morphologically and phylogenetically well-supported families in Myriangiales. In Elsinoaceae, 3 to 10 asci form in locules in light coloured pseudoascostromata, which form typical scab-like blemishes on leaf or fruit surfaces, while Myriangeaceae forms raised, superficial, black ascostromata with single asci in each locule, genera may or may not form scab-like lesions. *Elsinoe* is the type of the family Elsinoaceae and is characterized by forming scab-like blemishes on leaves with few to numerous bitunicate, fissitunicate, globose asci forming inside each locule with a pseudoascostroma containing fungal and host tissues. Following examination of generic type material, *Molleriella* is retained in Elsinoaceae as it has characters similar to *Elsinoe* in forming scab-like lesions with pseudoascostromata containing few to numerous bitunicate asci inside each locule. *Beelia, Butleria*, *Hemimyriangium*, *Hyalotheles, Micularia, Saccardinula, Stephanatheca* and *Xenodium* are excluded from Elsinoaceae and their relative placement in Dothideomycetes is discussed. Fresh collections of these genera are needed so that molecular sequence data can be obtained and analysed to resolve their placement in families or orders of Dothidoemycetes.

Key words: Elsinoaceae, *Elsinoe*, *Molleriella*, morphology, phylogeny

Introduction

The family Elsinoaceae is a relatively poorly known, but important family of Dothideomycetes. Genera of this family are mostly plant pathogens that cause scab and sunken spots on many economically important plants, such as citrus, grapes, mango, peppers and legumes, reducing their fruit and vegetable values (Mchau *et al.* 1998, Condé *et al.* 1997, Ellis & Erincik 2008, Hyun *et al.* 2001). Species also infect *Protea* species, reducing the value of the flowers. Elsinoaceae is characterized by immersed to erumpent pseudoascostromata composed of pale gelatinous thin-walled hyphae or pseudoparenchymatous cells with locules in a single layer or irregularly scattered. Asci are bitunicate, fissitunicate, saccate to globose and with 3 to 10 arranged in locules. Ascospores are trans-septate or sometimes muriform, and hyaline to brown (Kirk & Cannon 2008). The known asexual stages of Elsinoaceae are acervular coelomycetes with polyphialidic conidiogenous cells (Sutton & Pollok 1973). Lumbsch & Huhndorf (2010) listed Elsinoaceae as comprising ten genera *viz Elsinoe, Beelia*, *Butleria, Hemimyriangium, Hyalotheles, Micularia, Molleriella, Saccardinula, Stephanotheca* and *Xenodium*. Li *et al.* (2011) excluded *Beelia, Saccardinula* and *Stephanotheca* based on morphological characters.

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Molecular sequence data is presently only available for *Elsinoe* and its asexual state *Sphaceloma*. The first molecular work on Elsinoaceae was that of Tan *et al.* (1996) who investigated the genetic differences among the citrus scab pathogens *Elsinoe fawcettii* Bitanc. & Jenkins, *E. australis* Bitanc. & Jenkins from South America and *Sphaceloma fawcetii* var. *scabiosa* (McAlpine & Tyron) Jenkins from Australia. Swart *et al.* (2001), Hyun *et al.* (2001), Schoch *et al.* (2006, 2009), Boehm *et al.* (2009), Kerry *et al.* (2011) and Hyde *et al.* (2013) have also carried out higher level molecular studies on Dothideomycetes, which included strains of genus *Elsinoe.*

Historic overview of Elsinoaceae

The family Elsinoaceae was introduced by Saccardo & Trotter (1913). Many classical treatments (Boedijn 1961) have placed Elsinoaceae in synonymy with Myriangiaceae. Höhnel (1909) however, was convinced that the former constituted a separate family because of the difference in the habit and also based on developmental studies. von Arx & Müller (1975) were not of the same opinion based on morphological characters, and placed *Elsinoe* with another 15 genera in Myriangiaceae (Table 1). Barr (1979) and Eriksson (1981) were of the opinion that two separate families should be maintained for Elsinoaceae and Myriangiaceae with the latter predominantly found on branches and former restricted to foliar pathogens. *Molleriella* and *Micularia* were previously placed in Saccardiaceae, also a family of Myriangiales. This family was characterized by superficial stroma and asci arising at one level and Saccardiaceae are no longer considered as a family in order Myriangiales.

Elsinoaceae has also been referred as Plectodiscellaceae a family established by Woronichin (1914) based on *Plectodiscella piri*. Jenkins (1932) treated *Plectodiscella* as a synonym of *Elsinoe* and also confirmed that the conidial states of *Elsinoe* belong to *Sphaceloma* and not to other asexual genera (e.g. *Cladosporium, Gloeosporium*) to which they had been assigned (Frederick *et al*. 1947). Elsinoaceae was placed in the order Myriangiales by Frederick *et al*. (1947) and this was followed by Lumbsch & Huhndorf (2007, 2010). Recent studies based on combine gene analysis of LSU, SSU, RPB1 and RPB2 concluded that Elsinoaceae and Myriangeaceae forms two distinct sub-clades with high bootstrap support in the order Myriangiales (Schoch *et al.* 2006, 2009, Boehm *et al.* 2009, Hyde *et al.* 2013).

We have been studying the genera of Dothideomycetes in order to provide a natural classification of this large class (Boonmee *et al.* 2011, Liu *et al.* 2012, Wu *et al.* 2011, Zhang *et al.* 2012, Hyde *et al.* 2013). Some studies have been based exclusively on morphological characterization and some have integrated molecular analysis (Ariyawansa *et al.* 2013, Chomnunti *et al.* 2011, 2012, Liu *et al.* 2012, Wu *et al.* 2010, Zhang *et al.* 2012). The present study revisits the family Elsinoaceae by examining the types of all genera included by Lumbsch & Huhndorf (2010). We loaned generic types and re-describe and illustrate the species and suggest placements and requirements for future work. We also provide a new phylogenetic tree for Myriangiales based on available sequence data.

TABLE 1. Placement of genera in Elsinoaceae by different authors.

Müller & von Arx (1975)	Barr (1987)	Kirk *et al.* (2001)	Lumbsch & Huhndorf (2007, 2010)	This paper (2014)
Hyalotheles	*Anhelia*	*Elsinoe*	*Beelia*	*Elsinoe*
Micularia	*Butleria*	*Beelia*	*Butleria*	*Molleriella*
Xenodium	*Diplotheca*	*Butleria*	*Elsinoe*	
Molleriella	*Elsinoe*	*Hemimyriangium*	*Hemimyriangium*	
Saccardinula		*Hyalotheles*	*Hyalotheles*	
Beelia		*Micularia*	*Micularia*	
Elsinoe		*Molleriella*	*Molleriella*	
Stephanotheca		*Saccardinula*	*Saccardinula*	
Diplotheca		*Stephanotheca*	*Stephanotheca*	
Myriangium		*Xenodium*	*Xenodium*	
Butleria				
Anhelia				
Cookella				
Pycnoderma				
Uleomyces				

Materials and methods

Type specimens were loaned from BISH, L, LPS, PAD and S (abbreviations follow Index Herbarium, 2013). Ascomata were rehydrated in water and/or 5% KOH prior to examination and sectioning following the methods described by Chomnunti *et al.* (2011). Hand sections were mounted in water for microscopic studies and photomicrography. Figures of *Sphaceloma ampelinum* de Bary were redrawn from Sutton & Pollok (1973) and *Molleriella mirabilis* winter was redrawn from Höhnel (1909) using transparent drawing papers and drawing pens. The details of the fungi were captured in a Nikon ECLIPSE 80i compound microscope with a Canon 450D digital camera accessory. Measurements were made with the Tarosoft (R) Image Frame Work program and images used for figures were processed with Adobe Photoshop CS3 Extended version 10.0 software (Adobe Systems, The United States).

Sequence alignment and phylogenetic analysis

The internal transcribe spacer (ITS), large and small subunits of the nuclear ribosomal RNA genes (LSU, SSU) and two protein coding genes, second largest subunit of RNA polymerase II (RPB2) and translation elongation factor-1 alpha (TEF1) were included in the analysis. All sequences were obtained from GenBank and are listed in Table 2. Sequences were aligned using Bioedit version 7.0.9.0 (Hall 1999) and ClustalX v. 1.83 (Thompson *et al.* 1997). The alignments were checked visually and improved manually where necessary. Phylogenetic analyses were carried by using PAUP v. 4.0b10 (Swofford 2002) for Maximum-parsimony (MP).

Maximum-parsimony analysis was performed to gain the most parsimonious tree. Trees were inferred using the heuristic search option with 1000 random sequence additions. Maxtrees were setup to 5000 and branches of zero length were collapsed and all multiple parsimonious trees were saved. Descriptive tree statistics for parsimony (Tree Length [TL], Consistency Index [CI], Retention Index [RI], Relative Consistency Index [RC] and Homoplasy Index [HI])were calculated for trees generated under different optimality criteria. Kishino-Hasegawa tests (KHT) (Kishino and Hasegawa 1989) were performed in order to determine whether trees were significantly different. Maximum parsimony bootstrap values (MPBP) equal or greater than 50% are given above each node (Fig 1).

TABLE 2. GenBank accession numbers.

Species	Voucher/Culture	SSU	LSU	RPB2	TEF1	ITS
Aliquandostipite khaoyaiensis	CBS 118232	AF201453	GU301796	FJ238360	GU349048	-
Amniculicola immersa	CBS 123083	GU456295	FJ795498	GU456358	GU456273	-
Amniculicola parva	CBS 123092	GU296134	FJ795497	-	GU349065	-
Apiosporina collinsii	CBS 118973	GU296135	GU301798	-	GU349057	-
Bimuria novae-zelandiae	CBS 107.79	AY016338	AY016356	DQ470917	DQ471087	
Botryosphaeria dothidea	CBS 115476	DQ677998	DQ678051	DQ677944	-	DQ767637
Capnodium coffeae	CBS 147.52	DQ247808	DQ247800	DQ247788	DQ471089	AJ244239
Capnodium salicinum	CBS 131.34	DQ677997	DQ678050	-	DQ677889	AJ244240
Cochliobolus heterostrophus	CBS 134.39	AY544727	AY544645	DQ247790	DQ497603	-
Didymella exigua	CBS 183.55	EU754056	EU754155	GU371764	-	GU237794
Dothidea sambuci	DAOM 231303	AY544722	AY544681	DQ522854	DQ497606	AY883094
Dothiora cannabinae	CBS 737.71	DQ479933	DQ470984	DQ470936	DQ471107	AJ244243
Elsinoe brasiliensis	CPC 18528	JN940567	JN940394	-	-	JN943501
Elsinoe centrolobi	AFTOL-ID 1854	DQ678041	DQ678094	-	DQ677934	-
Elsinoe fawcettii	CPC 18570	JN940565	JN940385	-	-	JN943503
Elsinoe fawcettii	CPC 18535	JN940559	JN940382	-	-	JN943496
Elsinoe mimosae	CPC 18518	JN940564	JN940387	-	-	JN943505
Elsinoe phaseoli	CBS 165.31	DQ678042	DQ678095	-	DQ677935	-
Elsinoe veneta	CBS 150.27	DQ767651	DQ767658	-	DQ767641	-
Elsinoe verbenae	CPC 18561	JN940562	JN940391	-	-	JN943499
Gloniopsis praelonga	CBS 112415	FJ161134	FJ161173	FJ161113	FJ161090	-
Glonium circumserpens	CBS 123343	FJ161160	FJ161200	FJ161126	-	FJ161108
Guignardia bidwellii	CBS 237.48	DQ678034	DQ678085	DQ677983	-	-

...... *continued on the next page*

TABLE 2 (continued)

Species	Voucher/Culture	SSU	LSU	RPB2	TEF1	ITS
Hysterobrevium mori	CBS 123336	FJ161164	FJ161204	-	-	-
Jahnula aquatica	R68-1	EF175633	EF175655	-	-	-
Jahnula bipileata	F49-1	EF175635	EF175657	-	-	-
Kalmusia scabrispora	MAFF 239517	AB524452	AB524593	AB539093	AB539106	-
Leptosphaerulina australis	CBS 317.83	GU296160	GU301830	GU371790	GU349070	GU237829
Lophium mytilinum	CBS 269.34	DQ678030	DQ678081	DQ677979	-	DQ677926
Macrovalsaria megalospora	CBS 178150	FJ215707	FJ215701	-	-	-
Montagnula opulenta	CBS 168.34	AF164370	DQ678086	-	DQ677984	-
Mycosphaerella punctiformis	CBS 113265	DQ471017	DQ470968	DQ470920	DQ471092	EU167569
Myriangium duriaei	CBS 260.36	AY016347	DQ678059	DQ677954	DQ677900	-
Myriangium hispanicum	CBS 247.33	GU296180	GU301854	GU371744	GU349055	-
Mytilinidion mytilinellum	CBS 303.34	FJ161144	FJ161184	FJ161119	-	FJ161100
Phaeocryptopus gaeumannii	CBS 267.37	EF114722	EF114698	-	-	EU700365
Phaeotrichum benjaminii	CBS 541.72	AY016348	AY004340	DQ677946	DQ677892	
Phoma exigua	CBS 431.74	EU754084	EU754183	GU371780	GU349080	FJ427001
Pleospora herbarum	CBS 191.86	DQ247812	DQ247804	DQ247794	DQ471090	EF452449
Pyrenophora phaeocomes	DAOM 222769	DQ499595	DQ499596	DQ497614	DQ497607	JN943649
Rhytidhysterium rufulum	CBS 306.38	GU296191	FJ469672	-	GU349031	-
Schismatomma decolorans	DUKE 0047570	AY548809	AY548815	-	DQ883715	DQ883725
Sphaceloma arachidis	CPC 18533	JN940548	JN940372	-	-	JN943485
Sphaceloma arachidis	CPC 18529	JN940547	JN940374	-	-	JN943484
Sphaceloma asclepiadis	CPC 18544	JN940558	JN940383	-	-	JN943495
Sphaceloma asclepiadis	CPC 18532	JN940556	JN940380	-	-	JN943493
Sphaceloma asclepiadis	CPC 18583	JN940557	JN940381	-	-	JN943494
Sphaceloma bidentis	CPC 18586	JN940555	JN940379	-	-	JN943492
Sphaceloma erythrinae	CPC 18530	JN940566	JN940392	-	-	JN943502
Sphaceloma erythrinae	CPC 18540	JN940549	JN940388	-	-	JN943486
Sphaceloma krugii	CPC 18531	JN940551	JN940375	-	-	JN943489
Sphaceloma krugii	CPC 18537	JN940553	JN940376	-	-	-
Sphaceloma krugii	CPC 18554	JN940552	JN940377	-	-	-
Sphaceloma sesseae	CPC 18549	JN940561	JN940393	-	-	JN943498
Sphaceloma terminaliae	CPC 18538	JN940560	JN940371	-	-	JN943497
Stylodothis puccinioides	CBS 193.58	-	AY004342	-	DQ677886	-
Trichodelitschia bisporula	CBS 262.69	GU349000	GU348996	GU371802	GU349020	-
Trichodelitschia munkii	Kruys201	DQ384070	DQ384096	-	-	-
Venturia inaequalis	CBS 594.70	GU296205	GU301879	-	GU349022	-
Venturia populina	CBS 256.38	GU296206	GU323212	-	-	EU035467

Results

Phylogenetic analysis

Phylogeny based on combined ITS, SSU, LSU, RPB2 and TEF1 gene datasets

The combined ITS, SSU, LSU, RPB2 and TEF1 data set utilized 60 taxa with *Schismatomma decolorans* as the out group taxon. The maximum parsimony dataset consists of 5,846 total characters of which 2,974 characters were constant, 1,300 variable characters were parsimony-uninformative and 1,572 characters were parsimony-informative. Kishino-Hasegawa (KH) test showed length= 8935 steps, CI=0.487, RI=0.573, RC= 0.279 and HI=0.513. Eleven MP trees were generated and the first of the most parsimonious tree was selected, (Fig. 1). Phylogenetic trees obtained from maximum parsimony analyses yielded trees with similar overall topology at subclass and family relationship in agreement with previous work based on maximum parsimony (Schoch *et al.* 2006, 2009, Boehm *et al.* 2009).

Phylogenic analysis

The combined ITS, SSU, LSU, RPB2 and TEF1 gene dataset of 15 families in the class Dothideomycetes is shown in Fig. 1. The analysis confirms that the families Elsinoaceae and Myriangeaceae appear to be well-resolved with high bootstrap support (82%). However, in our analysis we used eight sexual strains of *Elsinoe* species, seven asexual strains identified as *Sphaceloma* species and two *Myriangium* species. Once more data becomes available for other genera in these families and trees are better populated we cannot predict if these families will continue to receive strong support. Problematic species were *Elsinoe veneta* (Burkh.) Jenkins and *E. brasiliensis* Bitanc. & Jenkins which clustered separately from the main Elsinoaceae clade in the phylogenetic tree (Fig. 1).

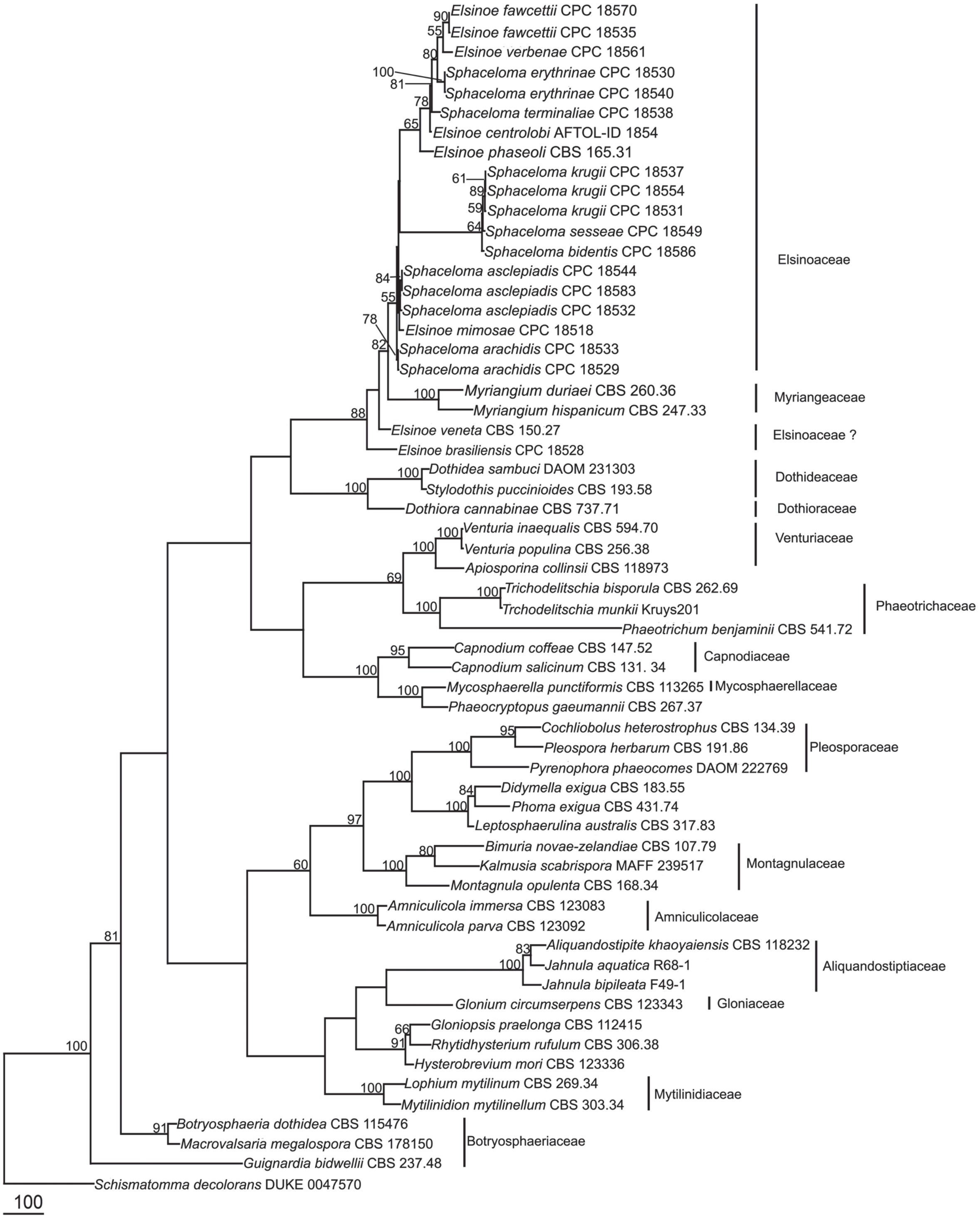

FIGURE 1. Phylogram generated from maximum parsimony analysis based on combined multi-gene sequences (ITS, SSU, LSU, RPB2 and TEF1), showing the phylogenetic relationships of the family Elsinoaceae. The values noted are parsimony bootstraps (>50%). The tree is rooted with *Schismatomma decolorans.*

Taxonomy

Myriangiales

The order Myriangiales was introduced by Starbäck (1899) for the species characterized by having crustose ascostromata and muriform ascospores, based on the type species, *Myrangium duriaei* Mont. & Berk. (Miller 1938, Hyde *et al.* 2013). Multigene phylogenetic studies revealed that the order Myriangiales always clusters in Dothideomycetes (Boehm *et al*. 2009, Schoch *et al.* 2009, Zhang *et al.* 2012, Hyde *et al.* 2013). This order is characterized by pulvinate, irregular ascostromata in which the asci are irregularly arranged in one or more layers in locules. Locules may contain single or multiple asci within each locule. Asci have a minute pedicel and indistinct ocular chambers. Ascospores are irregularly arranged and are liberated only by the breakup of the stromatal layers above them. Asexual states are coelomycetous. Kirk *et al.* (2008) included three families under order Myriangiales, Cookellaceae, Elsinoaceae and Myriangeaceae. Lumbsch & Huhndorf (2010) accepted only Elsinoaceae and Myriangeaceae in Myriangiales based on phylogenetic results. Elsinoaceae is morphologically different from Myriangeaceae as 3 to 10 asci form in locules in light coloured pseudoascostromata, which form typical scab-like blemishes on leaf or fruit surfaces. No molecular data is available for Cookellaceae and its placement in Myriangiales cannot be confirmed.

Elsinoaceae Höhn. ex Sacc. & Trotter [as 'Elsinoëaceae'], Sylloge Fungorum (Abellini) 22: 584 (1913)
Synonyms:
Myxomyrangiaceae (Theiss.) Theiss.
Plectodiscellaceae Woron., Mykol. Zentbl. 4: 232 (1914)
Saccardinulaceae G. Arnaud, Annls Sci. Nat., Bot., sér. 10 7: 647 (1925)

Parasitic or saprotrophic on plant leaves and fruits causing scab and sunken scab-like blemishes. Sexual state: *Pseudoascostromata* usually spread around host veins, solitary, aggregated, or gregarious, wart-like or scab-like blemishes, pulvinate, superficial, globose to subglobose, white, pale yellow to brown, multi-loculate, locules scattered in upper part of pseudoascostromata. *Cells of pseudoascostromata* comprising host cells and inter-dispersed light coloured fungal hyphae, opening by unordered break down of the surface layer. *Locules* with 3–10 asci inside each locule, ostiolate. *Ostioles* minute. *Pseudoparaphyses* absent. *Asci* 8-spored, bitunicate, fissitunicate, saccate to globose, with a minute pedicel, and indistinct ocular chamber. *Ascospores* irregularly arranged, oblong or fusiform with slightly acute ends, with 2–3 transverse septa, hyaline, smooth-walled, lacking a sheath. Asexual state: coelomycetous "Sphaceloma". Lesions circular, dark brown raised margin, cream-brown. *Acervuli* subepidermal, pseudoparenchymatous. *Conidiophores* hyaline to pale-brown, polyphialidic. *Conidiogenous cells* formed directly from the upper cells of the pseudoparenchyma, monophialidic to polyphidalic, integrated or discrete, determinate, hyaline to pale brown, lacking a thickened region around the phialide channel. *Conidia* hyaline, unicellular, ellipsoidal, aseptate, biguttulate.

Lumbsch & Huhndorf (2010) included ten genera in Elsinoaceae. Li *et al.* (2011), Hyde *et al.* (2013) and Dissanayake *et al.* (2014) however, revised the familial positions of *Beelia, Butleria*, *Hyalotheles, Hemimyriangium, Saccardinula, Stephanotheca* and *Xenodium* and supported the separation of Elsinoaceae from the family Myriangiaceae based on phylogenetic analysis. The families are also morphologically distinct. In Elsinoaceae several asci form in locules that develop in pseudoascostromata, that comprises host cells and interdispersed light coloured fungal hyphae. In Myriangiaceae, asci develop singly in locules that are generally scatted in ascostromata. The pseudoascostromata of Elsinoaceae are generally superficial, pulvinate and comprise of light coloured fungal hyphae and darkened host cells. *Saccardinula* shows similar characters to the family Brefeldiellaceae where it is placed (Hyde *et al.* 2013). *Stephanotheca* shows characteristic of the family Asterinaceae where it is retained, whereas *Xenodium* has unitunicate asci and thus excluded from Dothideomycetes. *Hyalotheles* has been placed in Dothideomycetes genera *incertae sedis. Butleria* and *Hemimyrangium* are placed in the family Myriangeaceae by Dissanayake *et al.* (2014). Fresh collections are needed for epitypification and obtaining sequence data.

Type:—*Elsinoe* Racib., Parasitische. Algen und Pilze Java’s (Jakarta) 1: 14 (1900)

Possible synonyms
Sphaceloma de Bary, Ann. Oenol. 4: 165 (1874)
Bitancourtia Thirum & Jenkins, Mycologia 45(5): 781 (1953)
Isotexis Syd., in Sydow & Petrak, Annls mycol. 29 (3/4): 261 (1931)
Plectodiscella Woron., Mykol Zentbl 4: 232 (1914)
Uleomycina Petr., Sydowia 8(1–6): 74 (1954)
Kurosawaia Hara, List of Japanese Fungi: 172. Ed. 4 (1954)
Manginia Viala & Pacotter, C.r. hebd, Séanc. Acad. Sci., Paris 139: 88 (1904)
Melanobasidium Maubl., Bull. Soc. Mycol. Fr. 22: 69 (1906)
Melonobasis Clem. & Shear, Gen. fung., Edn 2 (Minneapolis): 224, 403 (1931)
Melanodochium Syd., Annls mycol. 36 (4): 310 (1938)
Melanophora Arx, Verh. K. ned, Akad, wet., tweede sect. 51(3): 43 (1957)

Parasitic on plant leaves and fruits causing scab and sunken scab-like blemishes. Sexual state: *Pseudoascostromata* usually spread around host veins, solitary, aggregated, or gregarious, wart-like or scab-like blemishes, pulvinate, superficial, globose to subglobose, white, pale yellow to brown, multi-loculate, locules scattered in upper part of pseudoascostromata. *Cells of pseudoascostromata* comprising host cells and inter-dispersed light coloured fungal hyphae opening by unordered break down of the surface layer. *Locules* with numerous 3–8 asci inside each locule, ostiolate. *Ostiole* minute. *Pseudoparaphyses* absent. *Asci* 8-spored, bitunicate, fissitunicate, saccate to globose, apedicellate, with indistinct ocular chamber. *Ascospores* irregularly arranged, oblong or fusiform with slightly acute ends, with 2–3 transverse septa, hyaline, smooth-walled, lacking a sheath. Asexual state: Ceolomycetous “Sphaceloma” *Acervuli* subepidermal, pseudoparenchymatous. *Conidiophores* hyaline to pale-brown, polyphialidic. *Conidiogenous cells* formed directly from the upper cells of the pseudoparenchyma, monophialidic to polyphialidic, lacking a thickened region around the phialidic channel, terminal, integrated, determinate, hyaline to pale brown. *Conidia* hyaline, unicellular, ellipsoidal, aseptate, biguttulate.

Type species:—*Elsinoe canavaliae* Racib. [as '*canavalliae*'], Parasitische. Algen und Pilze Java’s (Jakarta) 1: 14 (1900)

≡ *Uleomyces canavaliae* (Racib.) G. Arnaud, Annales des Sciences Naturelles Botanique 10 5: 685 (1925) MycoBank: 217658 (Figs 2, 3)

Parasitic on leaves, forming scab on lower leaf surface. Sexual state: *Pseudoascostromata* 1–5 × 5–8 mm in diam. ($\bar{x}$= 3.2 × 6.5 mm, n=10), spreading around the host veins, solitary, aggregated, or gregarious, wart-like or scab-like blemishes, pulvinate, superficial, globose to subglobose, white, pale yellow or occassionally brown, in section with numerous locules distributed inside the upper part of pseudoascostromata, with numerous asci within each locule. *Cells of pseudoascostromata* comprising host cells and inter-dispersed light coloured fungal hyphae. *Locules* with 3–8 asci inside each locule, ostiolate. *Ostiole* minute. *Pseudoparaphyses* absent. *Asci* 16–22 ×16–21 μm ($\bar{x}$= 19.7 × 18.9 μm, n=20), 8-spored, bitunicate, fissitunicate, saccate to globose, apedicellate, with indistinct ocular chamber. *Ascospores* 10–14 × 3–5 μm ($\bar{x}$= 12.3 × 4 μm, n=40) irregularly arranged, oblong or fusiform with slightly acute ends, with 2–3 transverse septa, hyaline, smooth-walled, lacking a sheath. Asexual state: “Sphaceloma”, *Acervuli* sub-epidermal, pseudoparenchymatous. *Conidiophores* hyaline to pale-brown, polyphialidic. *Conidiogenous cells* formed directly from the upper cells of the pseudoparenchyma, monophialidic to polyphidalic, integrated or discrete, determinate, hyaline to pale brown, lacking a thickened region around the phialide channel. *Conidia* 8–16 × 3–5 μm ($\bar{x}$= 14.1 × 4 μm, n = 20), hyaline, unicellular, ellipsoidal, aseptate, biguttulate.

Material examined:—Philippines. Laguna Province: Mount Maquiling, near Los Baños, on *Canavalia ensiformis* (Fabaceae), *Baker*, August 1913 (S, F66900!, isotype).

Elsinoe was established by Raciborski (1900) including three species (*E. canavaliae*, *E. antidesmae* Racib., *E. meninspermacearum* Racib.). von Arx & Müller (1975) placed *Elsinoe* in Myriangiaceae based on its immersed or erumpent, pulvinate or irregular ascomata and being parasitic on higher plants causing scab. Later, the genus was placed in the family Elsinoaceae (Barr 1979, Kirk *et al.* 2001, Lumbsch & Huhndorf 2007, 2010). There are 139 species epithets for *Elsinoe* (Index Fungorum 2013) and they are generally parasites on leaves, stems, and fruits. The asexual state of *Elsinoe* is "Sphaceloma" (Wijayawardena *et al.* 2012). Bitancourt & Jenkins (1946) described *Sphaceloma manihoticola* Bitanc. & Jenkins on *Manihot esculenta* Crantz (Zeigler & Lozano, 1983). The relationship between *Sphaceloma* and *Elsinoe* has been resolved by analyzing rDNA sequence data (Cheewangkoon *et al.* 2010). There are 168 species epithets for *Sphaceloma* in Index Fungorum (2013). Most of the *Sphaceloma* species are pathogens that affect flowers, fruits, leaves and stems, causing characteristic scab lesions on the organs that they attack as well as necrotic spots on leaves.

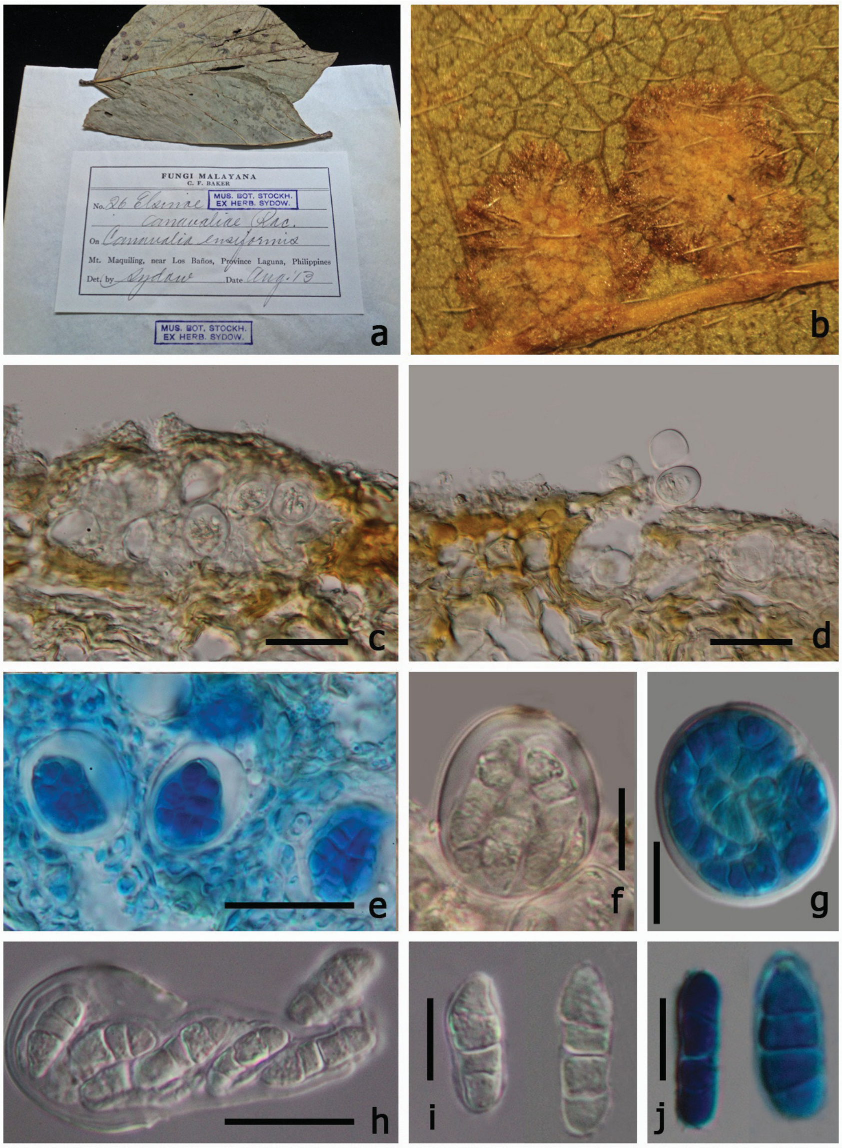
FUNGI MALAYANA
C. F. BAKER
No. 26 Elsinoe
canavaliae Rac.
On Canavalia ensiformis
Mt. Maquiling, near Los Baños, Province Laguna, Philippines
Det. by Sydow Date Aug. 13
MUS. BOT. STOCKH.
EX HERB. SYDOW.

FIGURE 2. *Elsinoe canavaliae* (isotype). a. Herbarium material. b. Pseudoascostromata on host substrate. c–d. Section of pseudoascostroma. e. Asci stained with cotton blue reagent in a section of pseudoascostromata. f–g. Ascus eight irregularly arranged ascospores. h. Fissitunicate dehicnese of the ascus. i. Smooth, hyaline ascospores. j. Ascospore stained with cotton blue . Scale bars: c–d = 100 µm, e = 50 µm, f–h = 20 µm, i–j = 10 µm.

Elsinoe is an important plant pathogenic genus causing scab and anthracnose. This genus is widely known in association with various *Citrus* species. But it also causes diseases in *Malus*, *Rubus*, *Vitis* species and several other plants and effects plant families such as Moraceae, Piperaceae, Sapindaceae, Anacardiaceae, Myrtaceae and Vitaceae. *Elsinoe fawcettii* Bitanc. & Jenkins and *E. australis* Bitanc. & Jenkins cause scab disease of *Citrus* sp. (Hanlin 1989, Timmer *et al.* 1996, Hyun *et al.* 2001, Nelson 2008) and there are many other important pathogens of *Elsinoe* and its asexual states (Table 3). *Elsinoe takoropuku* G.S. Ridl & Ramsfield is a recently introduced species (Ridley & Ramsfield 2006), but differs from *E. canavaliae* markedly as it forms ascostromata on twigs of

Pittosporum tenuifolium Gaertn instead of scabs on leaves. It contains locules each containing single asci. The asci are however, thought to be more similar to *Elsinoe* type even though it has many characters similar with Myriangiaceae.

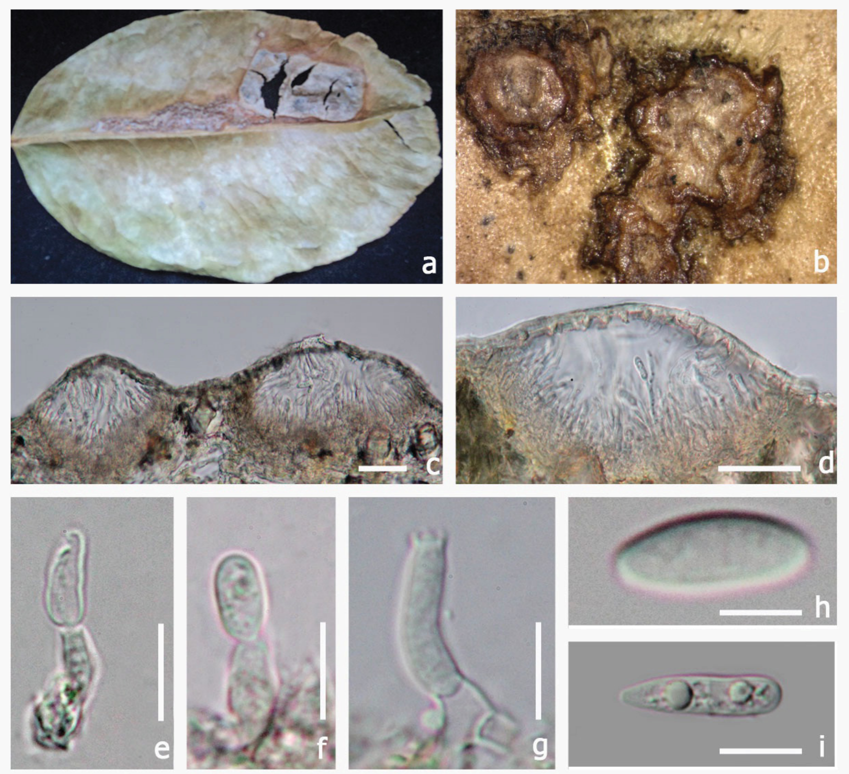

FIGURE 3a. *Sphaceloma* sp. (THAILAND, Chiang Rai, near Phu Chi Fa, on *Citrus* sp., 28 January 2013, MFLU 12-2214). a–b. Conidiomata on host substrate. c–d. Section of conidiomata. e–g. Phialidic conidiogenous cells. h–i. Conidia. Scale bars: e–i = 50 µm, c–d = 20 µm, k = 10 µm.

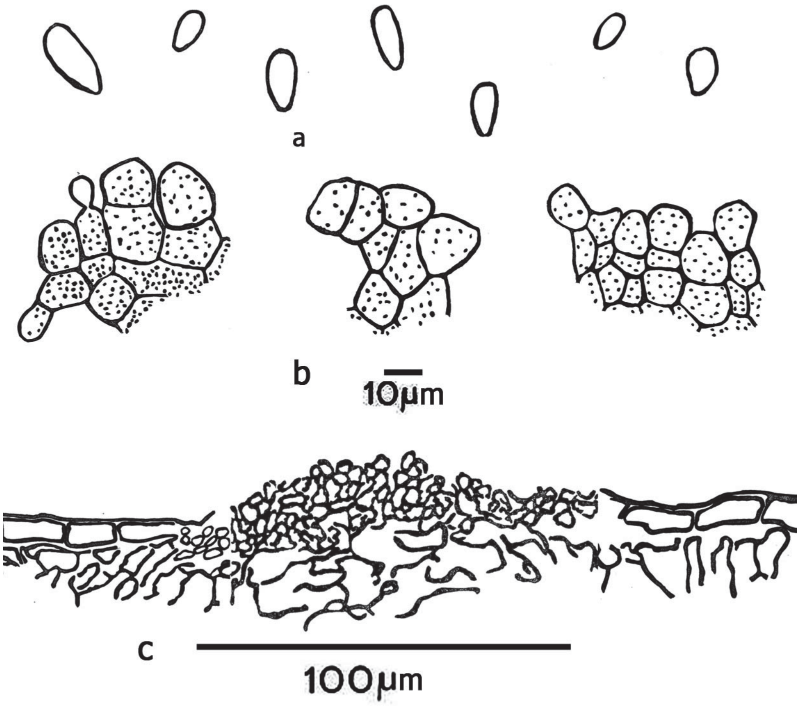

FIGURE 3b. *Sphaceloma ampelinum* material redrawn from Sutton & Pollok (1973) a. Conidia. b. Phialidic conidiogenous cells. c. V.S. of confluent acervuli. Scale bars: a–b = 10 µm, c = 100 µm.

TABLE 3. Some crops affected by *Elsinoe* species.

Species	Crop	Reference
Elsinoe sp.	Proteaceae sp.	Swart 2001
*Sphaceloma*symphoricarpi* Barrus & Horsfall	Snowberry	Kudela & Krejza 2006
Elsinoe mangiferae Bitanc. & Jenkins	Mango	Conde *et al.* 1997
Sphaceloma rosarum (Pass.) Jenkins	Rose	Jenkins 1947
Elsinoe phaseoli Jenkins	Lima bean	Jenkins 1947
Sphaceloma manihoticola Bitanc. & Jenkins	Cassava	Zeigler & Lozano 1983, Reeder *et al.* 2009
Sphaceloma perseae Jenkins	Avocado	Kerry *et al.* 2011
Elsinoe solidaginis Jenkins & Ukkelberg	Goldenrod	Jenkins & Ukkelberg 1935
Elsinoe ampelina Shear	Grape	Jenkins 1942, Ellis & Enrick 2008
Sphaceloma sacchari T.C. Lo	Sugarcane	Lo 1964

Species named as *Sphaceloma* should be synonymized under *Elsinoe* if their relationships are confirmed by molecular data

Schoch *et al.* (2006, 2009) and Boehm *et al.* (2009) showed that there is an obvious subclade among the species of Myriangiaceae (named Elsinoaceae). However, only four *Elsinoe* strains and one *Myriangium* strain were used in Schoch *et al.* (2006) and no *Elsinoe* strains were used in Schoch *et al.* (2009). Thus, molecular data does convincingly resolve the two families. In the study on the taxonomy of the species associated with scab disease of Proteaceae, Swart *et al.* (2001) analyzed ITS sequence of six *Elsinoe* species, *E. banksiae* Pascoe & Crous, *E. leucospermi* L. Swart & Crous, *E. proteae* Crous & L. Swart, *Elsinoe* sp. (from *Citrus*), *Elsinoe* sp. (from *Banksia*), *Sphaceloma protearum* L. Swart & Crous; the molecular analysis supported five species and four were described in their paper. Hyun *et al.* (2001) have done molecular analysis of several *Elsinoe* isolates causing scab disease of *Citrus* sp. in Jeju Island in Korea. Kerry *et al.* (2011) used molecular identification for *Sphaceloma perseae* and its absence. Phylogenetic analysis in for this paper shows that *E. veneta* and *E. brasiliensis* clustered separately from the Elsinoaceae clade. The basionym of *Elsinoe veneta* is *Plectodiscella veneta* Burkh. Jenkins (1932) however, considered *Plectodiscella veneta* to be a species of *Elsinoe* and transferred it to *E. veneta*. In *Elsinoe veneta* and *E. brasiliensis* the pseudoascostromata are multi-loculate, pulvinate, scab-like structures, asci are globose, bitunicate and fissitunicate and ascospores hyaline with three septa which resembles Elsinoaceae. In *Elsinoe veneta* and *E. brasiliensis* there is one ascus per locule (Saccardo 1925–1928). In the type genus *Elsinoe*, multiple asci can be found in each locule (Hyde *et al.* 2013). Further studies are needed to clarify their taxonomic placement.

Several studies have been conducted on Elsinochrome which are non-host selective, light-activated, polyketide-derived toxins produced by *Elsinoe* species (Chung & Liao 2008). Further molecular studies are needed on *Elsinoe* species and also on its asexual state to resolve the correct placement of this taxon. Phylogenetic analysis shows that *Sphaceloma* species cluster with *Elsinoe* species (Fig. 1) and this is also supported by morphological data (Cheewangkoon *et al.* 2010). Based on the available molecular and morphological data it may be necessary to synonymize *Sphaceloma* under *Elsinoe*. However, the type species of *Elsinoe* nor *Sphaceloma* have been sequenced and therefore they should not be synonymized at this time. Therefore we list *Sphaceloma* as a possible synonym only.

Molleriella G. Winter, Boletim da Sociedade Broteriana, Coimbra, sér 1, 4: 199 (1886)
Possible synonyms:
Agrona Höhn., Sber, Akad, Wien, Math-naturw, Kl., Abt. 1, 118: 362 [88 repr.] (1909)
Capnodiopsis Henn., Hedwigia 41: 298 (1902)
Elachophyma Petr., in Sydow & Petrak, Annls. Mycol. 29 (3/4): 258 (1931)
Elenkinella Woron., Bot. Mater. Insr. Sporov. Rast, Glavn, Bot. Sada RSFSR 1: 33 (1922)
Nostocotheca Starbäck, Bih, K. svenska VetenskAkad. Handl., Afd. 3 25 (no. 1): 20 (1899)

Saprotrophic on plant leaves causing scab-like lesions on lower leaf surface. Sexual state: *Pseudoascostromata* solitary, aggregated or gregarious, pulvinate, superficial, globose to oval, pale yellow, multi-loculate, locules scattered in upper part of pseudoascostromata. *Cells of pseudoascostromata* comprising host cells and inter-dispersed light coloured fungal hyphae opening by unordered break down of the surface layer. *Locules* with 4–10 asci inside each locule, ostiolate. *Ostiole* minute, *Paraphyses* absent. *Asci* 8-spored, bitunicate, fissitunicate, globose to subglobose, thick-walled, with a minute pedicel and an ocular chamber. *Ascospores* irregularly arranged, oblong to sub-clavate, 6–8-septate, hyaline. Asexual state: Unknown.

Type:—*Molleriella mirabilis* G. Winter, Boletim da Sociedade. broteriana, Coimbra, sér 1, 4: 199 (1886) MycoBank No: 528389 (Fig 4)

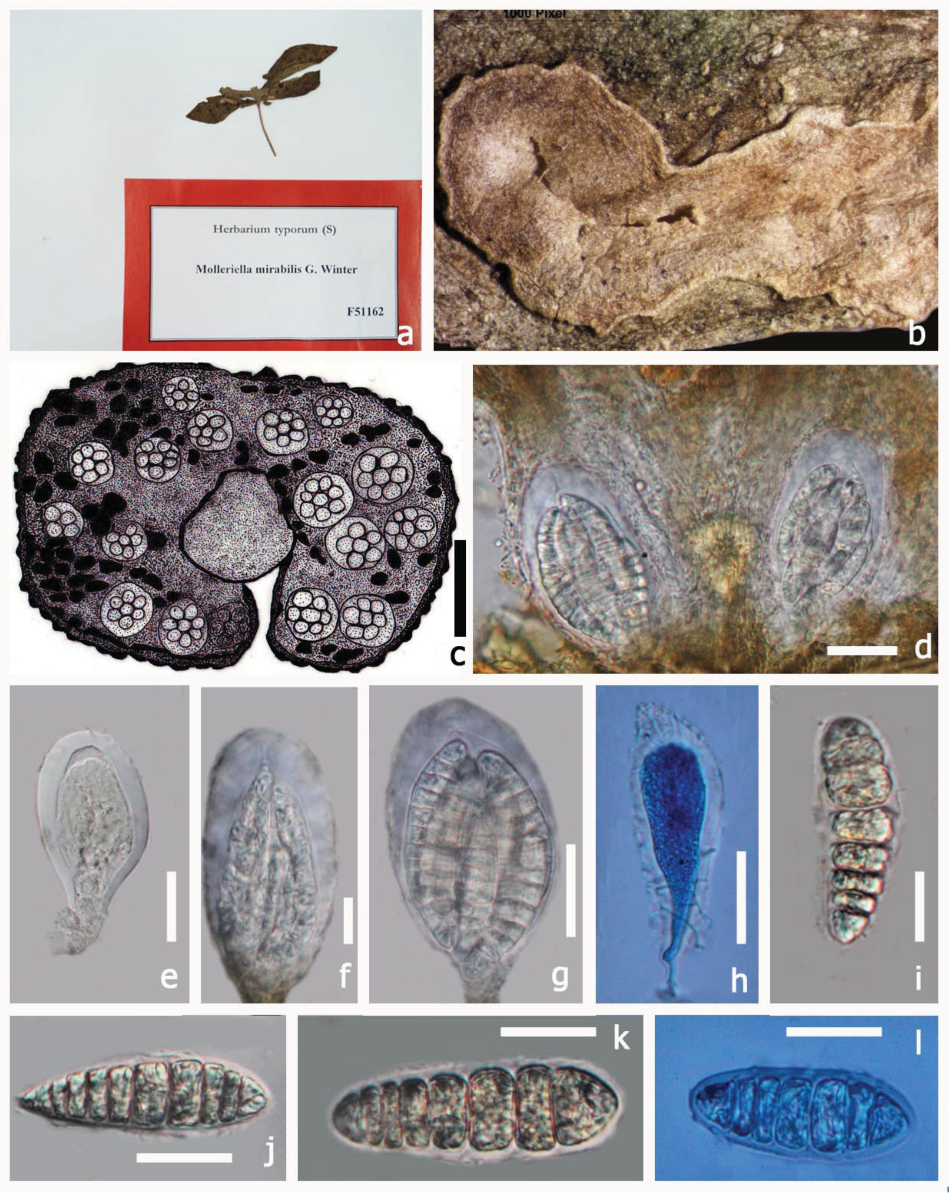

FIGURE 4. *Molleriella mirabilis* (type) material redrawn from Höhnel (1909). a. Herbarium material. b. Pseudoascostromata on host substrate. c. Section through pseudoascostroma. d. Asci. e–f. Immature asci. g. Mature ascus. h. Immature ascus stained in cotton blue reagent. i–k. Irregularly arranged hyaline 6–8-septate ascospores. i. Ascospore stained in cotton blue. Scale bars: c–d = 100 µm, e–l = 10 µm.

Saprotrophic on plant leaves*.* Sexual state: *Pseudoascostromata* 5–8 × 2–3 mm ($\overline{x}$ = 7.5 × 3.1 mm, n = 5) spread on lower surface, solitary, aggregated, or gregarious, pulvinate, superficial, pale yellow, multi-loculate, locules scattered in the upper part of the pseudoascostromata. *Cells of pseudoascostromata* comprising host cells and inter-dispersed light coloured fungal hyphae. *Locules* with 4–10 asci inside each locule, ostiolate. *Ostiole* minute.

Paraphyses not observed. *Asci* 17–37 × 9–21 µm ($\bar{x}$ = 31.4 × 16.1 µm, n = 10) 8-spored, bitunicate, fissitunicate, globose to sub globose, solitary or aggregated, with minute pedicel and an ocular chamber. *Ascospores* 18–24 × 6–8 µm ($\bar{x}$ = 22.7 × 7.3 µm, n = 10) irregularly arranged, smooth, oblong to sub-clavate, often curved, 6–8-septate, muriform, hyaline, no sheath. Asexual state: Unknown.

Material examined:—AFRICA. S. Thomé Insel, pr. Bate-pá, on Convolvulaceae, *A. Moller*, June 1885 (S, F51162!, type)

The genus *Molleriella* was introduced by G. Winter (1886) in the class Discomycetes and later placed in the family Phymatophaeriaceae by Engler *et al.* (1887, 1897) and Hieronymus and Hennings (1901). Boedijn (1961) placed *Molleriella* in the family Saccardiaceae, while Arnaud (1918) and Bessy (1950) had placed *Molleriella* in Myriangiaceae. On the other hand, Kirk *et al.* (2001) placed *Molleriella* in the family Elsinoaceae and Lumbsch & Huhndorf (2007, 2010) followed this. At present there are four species epithets listed in Index Fungorum (2013). This genus differs from the type *Elsinoe* by being saprotrophic and differs in having globose to subglobose sessile asci. This genus is similar to family type *Elsinoe* in having multi-loculate, pulvinate scab-like blemish pseudoascostromata, without paraphyses, and minute ostioles, plus globose asci with indistinct ocular chambers. This genus is retained in the family Elsinoaceae but, fresh collections and molecular analysis are needed to establish natural placement of this genus.

Genera excluded from Elsinoaceae

Asterinaceae

The family Asterinaceae are small obligately biotrophic ascomycetes that are associated with living leaves of a broad range of angiosperms from tropical and subtropical regions (Hyde *et al.* 2013). The important features of Asterinaceae are the superficial, black, web-like colonies that form on the upper and lower surface of leaves, thyriothecia that are closely attached to the host plant cuticle and open at maturity with central star-shaped fissures. The globose bitunicate asci develop vertically in the ascomatal cavity, from the base to the dehiscent opening; this is the important character of the family Asterinaceae which is different from the family Microthyriaceae, where asci are embedded in mucilage and grow horizontally to the host surface and inclined from the thyriothecia rim towards the ostiole. Ascospores are mostly ellipsoidal, 2-celled and hyaline when young and becoming brown at maturity (Hyde *et al.* 2013).

Stephanotheca Syd. & P. Syd., The Phillippine Journal of Science: C Botany 9: 178 (1914)

Foliar epiphytes on plants. Sexual state: *Ascomata* superficial, globose to subglobose, base flattened, black. *Upper wall* of thick-walled cells, forming a *textura porrecta*. *Hamathecium* lacking pseudoparaphyses. *Asci* 16–31 × 16–25 µm ($\bar{x}$ = 25 × 19 µm, n = 20), 8-spored, bitunicate, broadly subglobose to obovoid, arranged around outer layer of ascomata within a palisade layer, short pedicellate, apically rounded, without a distinct ocular chamber and ring structures. *Ascospores* 10–26 × 3–8 µm ($\bar{x}$ = 16 × 5 µm, n = 5), multi-seriate, irregularly arranged, broadly clavate to ellipsoid, ends rounded, hyaline, 3-septate, without distinct gelatinous sheath. Asexual state: Unknown.

Type:—*Stephanotheca micromera* Syd. & P. Syd., The Phillippine Journal of Science: C Botany 9(2): 179 (1914)
MycoBank No: 215191 (Fig 5)

Foliar epiphytes on lower surface of leaves of *Taxotrophis ilicifolia*. Sexual state: *Ascomata* 186–266 µm high × 175–251 µm diam. ($\bar{x}$ = 232 × 212 µm, n = 5), superficial on lower leaf host tissues, globose to subglobose, base flattened, black. *Upper wall* comprising thick-walled cells, forming a *textura porrecta,* lower wall poorly developed. *Hamathecium* lacking pseudoparaphyses. *Asci* 16–31 × 16–25 µm ($\bar{x}$ = 25 × 19 µm, n = 20), 8-spored, bitunicate, broadly subglobose to obovoid, arranged around outer layer of ascomata within a palisade layer, short pedicellate, apically rounded, without a distinct ocular chamber and ring structures. *Ascospores* 10–26 × 3–8 µm (

$\bar{x} = 16 \times 5$ µm, n = 5), multi-seriate, irregularly arranged, broadly clavate to ellipsoid, ends rounded, hyaline, 3-septate, without distinct gelatinous sheath. Asexual state: Unknown.

Material examined:—PHILIPPINES. Palawan, Lake Manguao, on *Taxotrophis ilicifolia* (Moraceae), *E.D. Merril*, April 1913, (S, F6581!, holotype).

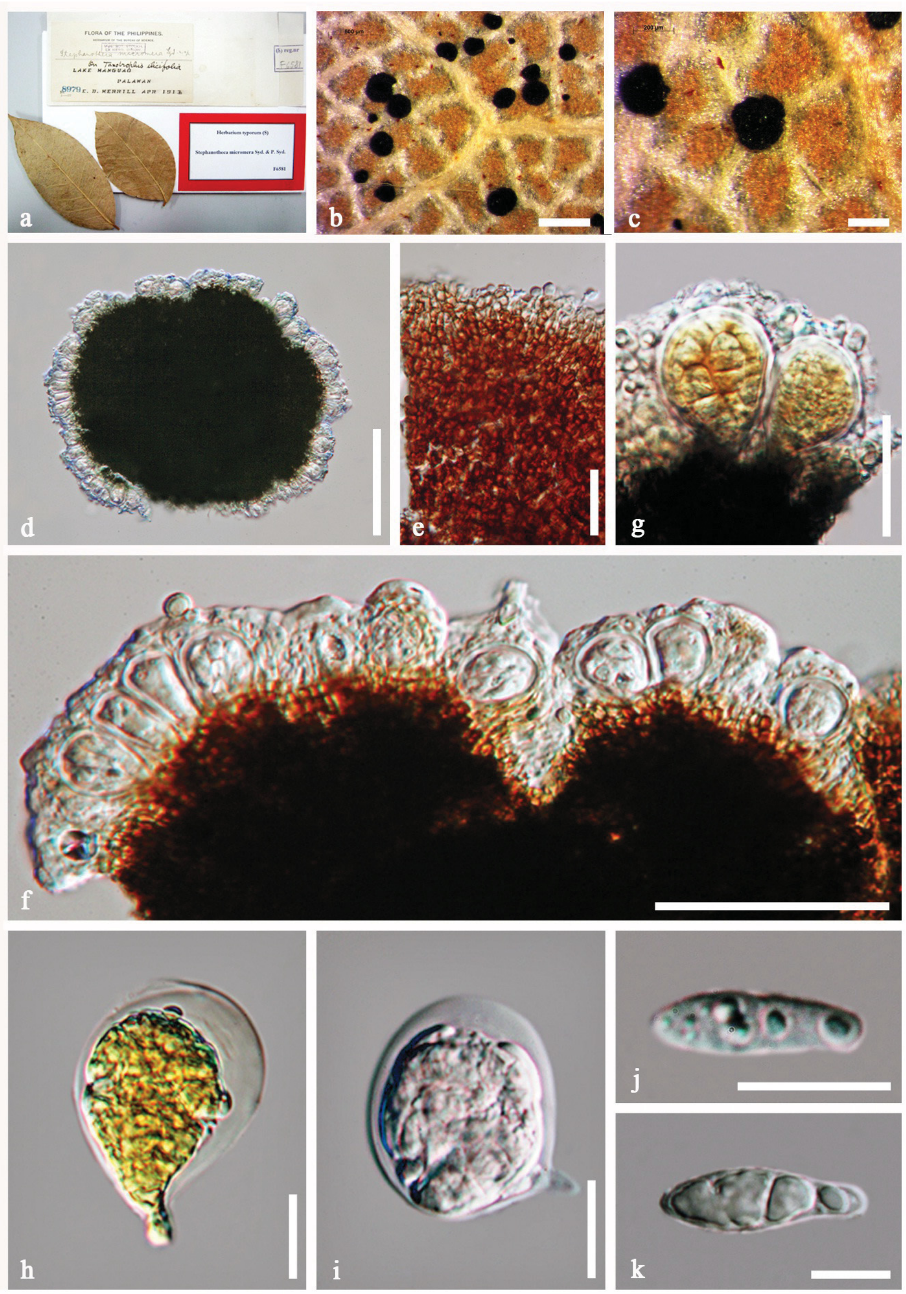

FIGURE 5. *Stephanotheca micromera* (holotype). a. Material label. b–c. Appearance of thyriothecia on host. d. Squash mount of thyriothecium. e. Cells of upper wall of thyriothecium. f. Arrangement of asci around ascomata. g–i. Asci. j–k. Immature ascospores. Scale bars: b = 500 µm, c = 200 µm, d = 100 µm, f = 50 µm, e–g = 20 µm, h–k = 10 µm.

Stephanotheca was introduced by Sydow & Sydow (1914) and has only three epithets listed in Index Fungorum (2013). *Stephanotheca* is characterized by small, black, superficial, rounded bodies with an elevated centre. This genus was originally described as Hemisphaeriaceae, but later placed in Microthyriaceae as it possesses thyriothecia (Stevens & Ryan 1939, Clements & Shear 1931). Lumbsch & Huhndorf (2007, 2010) placed *Stephanatheca* in the family Elsinoaceae. Hyde *et al.* (2013) suggested this genus could be placed in the family Asterinaceae. *Stephanotheca* forms solitary, gregarious, superficial, black thyriothecia with ovate to oblong, longitudinally radiating asci, and hyaline, one-septate ascospores. Another family which might accommodate it is

Elsinoaceae, but the asci are arranged in a single layer in thyriothecia which have a poorly developed base. Stephanothecaceae may need resurrecting to accommodate *Stephanatheca* and similar genera if sequence data becomes available. We retain the species in Asterinaceae even though it is atypical.

Myriangiaceae Nyl., Mémoires de la Société Impériale des Sciences Naturelles de Cherbourg 2: 9 (1854)

Saprobic and parasitic on bark, leaves and branches. Producing raised superficial, black ascostromata in which asci develop singly in locules that are generally scattered in ascostromata.

Hemimyriangium J. Reid & Piroz., Canadian Journal of Botany 44: 650 (1966)

Type:—*Hemimyriangium betulae* J. Reid & Piroz. , Canadian Journal of Botany 44: 651 (1966)

This taxon appears to be more similar to *Myriangium*, the type of family Myriangeaceae in having superficial ascostromata, with a single ascus in each locule, and in the arrangement of locules in the outer layer of the ascostromata and also due to its saprophytic nature. *Hemimyriangium* is referred to family Myriangiaceae in Dissanayake *et al*. (2014).

Butleria Sacc., Annales Mycologici 12: 302 (1914)

Type:—*Butleria inaghatahani* Sacc., Annales Mycologici 12: 302 (1914)

Butleria is a monotypic genus established by Saccardo (1914). von Arx & Müller (1975) referred this genus to Myriangiaceae based on ascostromata and two-celled ascospores. Barr (1979) placed this genus under Elsinoaceae. Kirk *et al.* (2001), Lumbsch & Huhndorf (2007, 2010), Li *et al.* (2011) and Hyde *et al.* (2013) have retained this genus under the family Elsinoaceae. *Butleria* has similarities with Elsinoaceae in being a parasite on leaves, but differs in having ascostromata on both sides of the leaves, with single asci with a small ocular chamber in each locule and distinct 2-celled, brown ascospores. *Butleria* shows similarity to the family Myriangiaceae in having globose, single asci in each locule, but differs in having brown ascospores. The genus has been placed in Myriangeaceae by Dissanayake *et al*. (2014).

Micularia Boedijn, Persoonia 2(1): 67 (1961)

Type:—*Micularia merremiae* Boedijn, Persoonia 2(1): 67 (1961)

Boedijn (1961) placed this genus in family Saccardiaceae, while Lumbsch & Huhndorf (2007, 2010) placed *Micularia* in the family Elsinoaceae. This placement has followed by Hyde *et al.* (2013). Even though it is a parasite on leaves, the inclusion of this genus into Elsinoaceae causes confusion, as it has only 1-septate ascospores, hairs at the apex of the ascostromata and contains a single ascus in each locule. Dissanayake *et al.* (2014) therefore placed *Micularia* in Myriangeaceae.

Brefeldiellaceae E. Müll. & Arx, in Müller & von Arx, Beiträge zur Kryptogamenflora der Schweiz 11(no. 2): 148 (1962)

Foliar epiphytes or parasites on leaves of various hosts. Thallus comprising a wide area of radiating cells with darker raised areas under which the ascomata develop and in which saccate to cylindro-clavate asci are formed (Hyde *et al.* 2013).

Saccardinula Speg., Anales de la Sociedad cientifica argentina 19: 257(1885)

Type:—*Saccardinula guaranitica* Sacc Anales de la Sociedad cientifica argentina 19: 257 (1885)

Luttrell (1973) grouped *Saccardinula* under Saccardinulaceae based on its ascostromata grouping in a radiate, superficial, cellular membrane (Li *et al.* 2011). von Arx & Müller (1975) removed this genus to Myriangiaceae and Lumbsch & Huhndorf (2007) placed *Saccardinula* in the family Elsinoaceae. Li *et al.* (2011) suggested that *Saccardinula* can be referred to either Microthyriaceae or Brefeldiellaceae, or Saccardinulaceae can be retained as a distinct family. *Saccardinula* has globose asci without paraphyses, and forms thyriothecia. Formation of asci and ascomata of *Saccardinula* are more similar to *Brefeldiella* which occurs on leaves and has a thallus comprising an area of radiating cells with ascomata (Reynolds & Gilbert 2005, Wu *et al.* 2011, Li *et al.* 2011). Hyde *et al.* (2013) placed *Saccardinula* in family Brefeldiellaceae, even though it is a less convincing member of the family as it has globose asci and muriform spores, while the thallus is less-developed.

Dothideomycetes genera *incertae sedis*

Dothideomycetes is the largest class in Ascomycota. Lumbsch & Huhndorf (2010) in Outline of Ascomycota listed over 150 genera in Dothideomycetes genera *incertae sedis* (Thambugala *et al.* 2014).

Hyalotheles Speg., Revista del Museo de La Plata 15(2): 11 (1908)

Type:—*Hyalotheles dimerosperma* Speg., Revta Mus. La Plata 15(2): 11 (1908)

Li *et al.* (2011) and Hyde *et al.* (2013) suggested that this taxon should be placed in Dothideomycetes genera *incertae sedis* because it is not a suitable candidate in Elsinoaceae apart from the oblong to ovoid sessile asci.

Chaetothyriaceae Hansf. ex M.E. Barr, Mycologia 71(5): 943 (1979)

Epiphytic or biotrophic on leaves forming mycelium appressed to the host cuticle without penetrating host tissue. Ascomata are surrounded by a thin pellicle of superficial mycelium forming black sooty mould-like areas on leaves that are easily detached from the cuticle (Chomnunti *et al.* 2012).

Beelia F. Stevens & R.W. Ryan, Bulletin of the Bernice Pauahi Bishop Museum, Honolulu, Hawaii 19: 71 (1925)

Type:—*Beelia suttoniae* F. Stevens & R.W. Ryan, Bulletin of the Bernice Pauahi Bishop Museum, Honolulu, Hawaii 19: 71 (1925)

Beelia was introduced by Stevens & Ryan (Stevens 1925) and placed *Beelia* in the family Microthyriaceae which was accepted by Petrak (1953). von Arx & Müller (1975) transferred *Beelia* to Myriangiaceae based on its dimidiate ascomata and muriform ascospores. Hawksworth *et al.* (1995) referred this genus to family Elsinoaceae where it has been listed by Kirk *et al.* (2001) and Lumbsch & Huhndorf (2007, 2010). Li *et al.* (2011) excluded this genus from Elsinoaceae as *Beelia* is a superficial biotroph on leaf surfaces which is a characteristic of the family Chaetothyriaceae. The species appears to be most similar to *Phaeosaccardinula* suggesting that this genus should be placed in Chaetothyriaceae.

Sordariomycetes genera *incertae sedis*

The Sordariomycetes is one of the largest classes in the Ascomycota and the majority of its species are characterized by perithecial ascomata and in-operculate unitunicate asci. Lumbsch & Huhndorf (2010) in Outline of Ascomycota, 119 genera were placed under Sordariomycetes genera *incertae sedis* (Zhang *et al*. 2006).

Xenodium Syd., Annales Mycologici 33(1/2): 95 (1935)

Type:—*Xenodium petrakii* Syd., Annales Mycologici 33(1/2): 95 (1935)

Parasitic on leaves. Sexual state: *Ascomata* scattered, immersed or erumpent, brown to dark brown. *Ostiole*, with paraphyses. *Peridium* comprising hyaline cells of *textura porrecta*. *Paraphyses* cylindrical to filiform. *Asci* 8-spored, unitunicate, non- fissitunicate, oblong-clavate, apically rounded, short pedicellate. *Ascospores* irregularly arranged, cylindrical to filiform, hyaline, 3-septate, hyaline and smooth walled. Asexual state: *Xenodiella*

Asexual state: ***Xenodiella*** Syd., Annales Mycologici 33(1/2): 98 (1935)

Type:—*Xenodiella petrakii* Syd., Annales Mycologici 33(1/2): 98 (1935)

Parasitic on leaves. Basal stroma globose, cells rounded, yellowish-brown. *Conidiophore cells*, simple or forked-branched, branches are always 1-celled. *Sterile hyphae* distinctively curved. *Conidia* globose or ovate-round, hyaline.

Xenodium was included in the family Elsinoaceae by Lumbsch & Huhndorf (2007, 2010). Hyde *et al.* (2013) suggested that this genus should be excluded from Dothideomycetes as it has unitunicate, non-fissitunicate asci. In this paper we suggest that this genus should be placed under Sordariomycetes genera *incertae sedis*.

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