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A new *Haplopteris* species from the Philippines and clarification of the status of *H. amboinensis* in China and Indochina

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ABSTRACT. A new fern species from the Philippines, *Haplopteris mindanaoensis* S.Linds. & C.W.Chen, is described and illustrated based on the results of detailed morphological comparison and molecular phylogenetic analysis. Morphologically, *Haplopteris mindanaoensis* is characterised by having obovoid (rather than funnel-shaped) soral paraphyses and deep soral grooves with asymmetrical flaps. Analysis of a combined four gene (*chlL*, *matK*, *ndhF*, and *trnL-F*) plastid data set shows that: (1) the two included samples of *Haplopteris mindanaoensis* have the same distinct haplotype; (2) *Haplopteris mindanaoensis* diverges early within the clade where most species with marginal soral grooves are placed; and (3) *Haplopteris heterophylla* C.W.Chen, Y.H.Chang & Yea C.Liu, the only other *Haplopteris* C.Presl species known to have obovoid paraphyses, is not closely related to *H. mindanaoensis*. The status of *Haplopteris amboinensis* (Fée) X.C.Zhang in China and Indochina is also clarified and a new combination, *H. ensata* (Christ) C.W.Chen & S.Linds. is made.

Keywords. Mindanao, morphology, phylogeny, paraphyses, Pteridaceae subfamily Vittarioideae, taxonomy, *Vittaria*

Introduction

Haplopteris C.Presl (Pteridaceae subfamily Vittarioideae) is a paleotropical fern genus, estimated to include some 40 species (Schuettpelz et al., 2016) mostly found in Malesia (Lindsay, 2003). While preparing a taxonomic revision of the Malesian species, the second author noticed two unusual collections from Mindanao in the Philippines (*Elmer 11361* and *11477,* both collected on Mt. Apo in 1909) that he suspected were of an undescribed species. The soral grooves of these specimens are notable due to their depth and asymmetrical construction (the upper flaps, formed by the adaxial surface of the frond, are conspicuously wider (and inconspicuously thicker) than the lower flaps). Moreover, although the soral paraphyses of both specimens are immature, they are clearly not funnel-shaped as they are in most other species in this genus. Both specimens were originally identified by Copeland (1910) as *Vittaria amboinensis* Fée (now *Haplopteris amboinensis* (Fée) X.C.Zhang), a name that has been misapplied to several Asian species (Chen et al., 2017), and were later but wrongly redetermined by him (Copeland, 1960) as *Vittaria ensiformis* Sw. (now *Haplopteris ensiformis* (Sw.) E.H.Crane).

The acquisition in 2012 of new material from Mt. Apo (*Kuo 2542*) and Mt. Kitanglad (*Kuo 3659*) that is morphologically consistent with the Elmer collections gave us the opportunity and impetus to clarify the taxonomic status of this unusual fern. We, therefore, conducted a detailed morphological comparison to material of both *Haplopteris amboinensis* and *H. ensiformis* and investigated phylogenetic relationships using four plastid DNA regions.

While surveying the usage of the name *Haplopteris* (or *Vittaria*) *amboinensis* in Asia, Chen et al. (2017) concluded that most previous records of *Haplopteris amboinensis* (or *Vittaria amboinensis*) from China and Indochina were based on the misapplication of these names and that a combination in *Haplopteris* for *Vittaria ensata* Christ was instead required. Our detailed study of *Haplopteris amboinensis*, including type material, also allowed us to further investigate whether Chen et al. (2017) were correct to suggest that *Vittaria ensata* should be applied to the Chinese and Indochinese material and whether the combination in *Haplopteris*, therefore, needs to be made.

Materials and methods

Specimens of *Haplopteris amboinensis*, *H. ensiformis* and the potentially new species from Mindanao deposited at GH, K, KYO, L, M, RB, SING, TAIF, and UC (herbarium abbreviations and acronyms follow Index Herbariorum (Thiers [continuously updated])) were examined and details of their morphology recorded. Soral paraphyses and scales from rhizome apices were transferred to slides and photographed under a light microscope (Leica, DMR, Wetzlar, Germany) with a digital camera (EOS 7D, Canon, Tokyo, Japan). Frond fragments and spores were transferred to aluminum stubs, coated with gold, and examined with a tabletop scanning electron microscope (TM-3000, Hitachi, Ibaraki, Japan). For representative specimens, the sizes (length of equatorial axes) of 30 selected spores and the thickness of 30 rhizome scale cell walls were measured. Additionally, five intact sporangia were examined under a stereo microscope (Leica, MZ6, Wetzlar, Germany) to count the number of spores per sporangium.

The total DNA of the two new collections (*Kuo 2542* and *Kuo 3659*) was extracted from silica-dried leaf fragments using DNeasy Plant Mini Kit (Qiagen, Hilden, Germany). In order to combine our data with previously published sequences

(Chen et al., 2017), four plastid DNA regions (*chlL*, *matK*, *ndhF*, and *trnL-F*) were chosen for amplification and sequencing. PCR amplification and sequencing were performed following Chen et al. (2017). The newly generated sequences (40, in total) were deposited in GenBank (Appendix). We constructed a data matrix including all the congeneric species that had sequences of all four regions available in GenBank. The final data matrix contained 32 *Haplopteris* species. Three *Antrophyum* Kaulf. species were selected as the outgroup based on a published phylogeny (Schuettpelz et al., 2016).

The matrices for each region were aligned with AliView v1.18 (Larsson, 2014) and ambiguous areas were excluded. The loci were concatenated into a master alignment with SequenceMatrix v1.8 (Vaidya et al., 2011) because there were no well-supported conflicts between the single-marker phylogenies in our preliminary analyses. From this alignment, we inferred the optimal partitioning and substitution model scheme using PartitionFinder v2.1.1 (Lanfear et al., 2017). Phylogenetic analyses were performed under maximum likelihood (ML) with Garli v2.01 (Zwickl, 2006), using the PartitionFinder-derived partitioning scheme and substitution models. The search for the best tree was run 10 times, each from an independent random-addition sequence starting tree. Support was assessed by 500 bootstrap pseudoreplicates, also in Garli, under the same settings, but with each tree search performed from a single random-addition starting tree.

Results

The results of the morphological comparison of *Haplopteris amboinensis*, *H. ensiformis*, and the potentially new species from Mindanao are presented in Table 1 and Fig. 1. All three species have linear sori immersed in marginal grooves but the grooves of the potentially new species are much deeper than those of *Haplopteris amboinensis* and *H. ensiformis*, it has obovoid rather than funnel-shaped soral paraphyses, and it has narrower rhizome scales (Table 1).

A detailed examination of the morphology of the type specimen of *Haplopteris amboinensis* and comparisons to material identified as this species from China and Indochina confirmed the conclusions of Chen et al. (2017) that this name has been misapplied and that the material from China and Indochina instead corresponds to the type of *Vittaria ensata*.

The final concatenated dataset comprises 4005 aligned sites (880, 1038, 1218, and 870 from *chlL*, *matK*, *ndhF*, and *trnL-F*, respectively), with 8.5% missing data (2.8% gaps and 5.7% uncertain character states). The optimal partitioning scheme, as inferred by PartitionFinder, with 142 free substitution parameters, is presented in Table 2. The ML phylogeny based on the concatenated dataset is presented in Fig. 2. It is generally congruent with previously published phylogenies of *Haplopteris* (Schuettpelz et al., 2016; Chen et al., 2017). Two collections of the potentially new species from Mindanao (*Kuo 2542* and *3659*) have the same haplotype and are sister to a clade consisting of *Haplopteris dareicarpa* (Hook.) S.Linds. & C.W.Chen and

Table 1. Voucher information and morphological observations of 13 specimens.

Taxon	Voucher	Herbarium and barcode	Location	Soral position	Shape of soral paraphyses	Spore size (µm)	Rhizome cell wall thickness (µm)	Spores per sporangium
Haplopteris amboinensis (Fée) X.C.Zhang	*Labillardière s.n.*	RB458839	Indonesia, Ambon Isl.	shallowly immersed in marginal grooves	funnel-shaped	NA	21.7 ± 2.7	NA
Haplopteris mindanaoensis S.Linds. & C.W.Chen	*Clemens s.n.*	UC268251	Philippines, Mindanao	deeply immersed in marginal grooves	obovoid	55.3 ± 2.5	17.8 ± 3	64
Haplopteris mindanaoensis S.Linds. & C.W.Chen	*Copeland s.n.*	UC354000	Philippines, Mindanao	deeply immersed in marginal grooves	obovoid	NA	12.3 ± 1.3	NA
Haplopteris mindanaoensis S.Linds. & C.W.Chen	*Edano PNH771*	L3641820	Philippines, Mindanao	deeply immersed in marginal grooves	obovoid	51.2 ± 3.8	13.8 ± 1.8	NA
Haplopteris mindanaoensis S.Linds. & C.W.Chen	*Elmer 11477*	M0029158	Philippines, Mindanao	deeply immersed in marginal grooves	obovoid	NA	16.5 ± 2	NA
Haplopteris mindanaoensis S.Linds. & C.W.Chen	*Elmer 11477*	K000699811	Philippines, Mindanao	deeply immersed in marginal grooves	obovoid	NA	11.9 ± 1.5	NA
Haplopteris mindanaoensis S.Linds. & C.W.Chen	*Kuo 2542*	TAIF483879	Philippines, Mindanao	deeply immersed in marginal grooves	obovoid	NA	14.5 ± 1.4	NA
Haplopteris mindanaoensis S.Linds. & C.W.Chen	*Kuo 3659*	TAIF483897	Philippines, Mindanao	deeply immersed in marginal grooves	obovoid	51.3 ± 2.6	16 ± 1.7	64
Haplopteris mindanaoensis S.Linds. & C.W.Chen	*Williams 2467*	UC419336	Philippines, Mindanao	deeply immersed in marginal grooves	obovoid	52.8 ± 2	15 ± 1.7	64
Haplopteris ensiformis (Sw.) E.H.Crane	*Razakamalala et al. 2965*	GH6453678	Madagascar	shallowly immersed in marginal grooves	funnel-shaped	53.1 ± 4.3	17.9 ± 2.3	NA
Haplopteris ensiformis (Sw.) E.H.Crane	*Sledge 1492*	K000706544	Samoa	shallowly immersed in marginal grooves	funnel-shaped	65.3 ± 3.9	21.6 ± 3.3	NA
Haplopteris ensiformis (Sw.) E.H.Crane	*Kuo 2545*	TAIF483877	Philippines, Mindanao	shallowly immersed in marginal grooves	funnel-shaped	65 ± 4.2	22.6 ± 3.3	NA
Haplopteris ensiformis (Sw.) E.H.Crane	*Wade1473*	TAIF449092	Taiwan	shallowly immersed in marginal grooves	funnel-shaped	67.6 ± 4.9	25 ± 4.7	NA

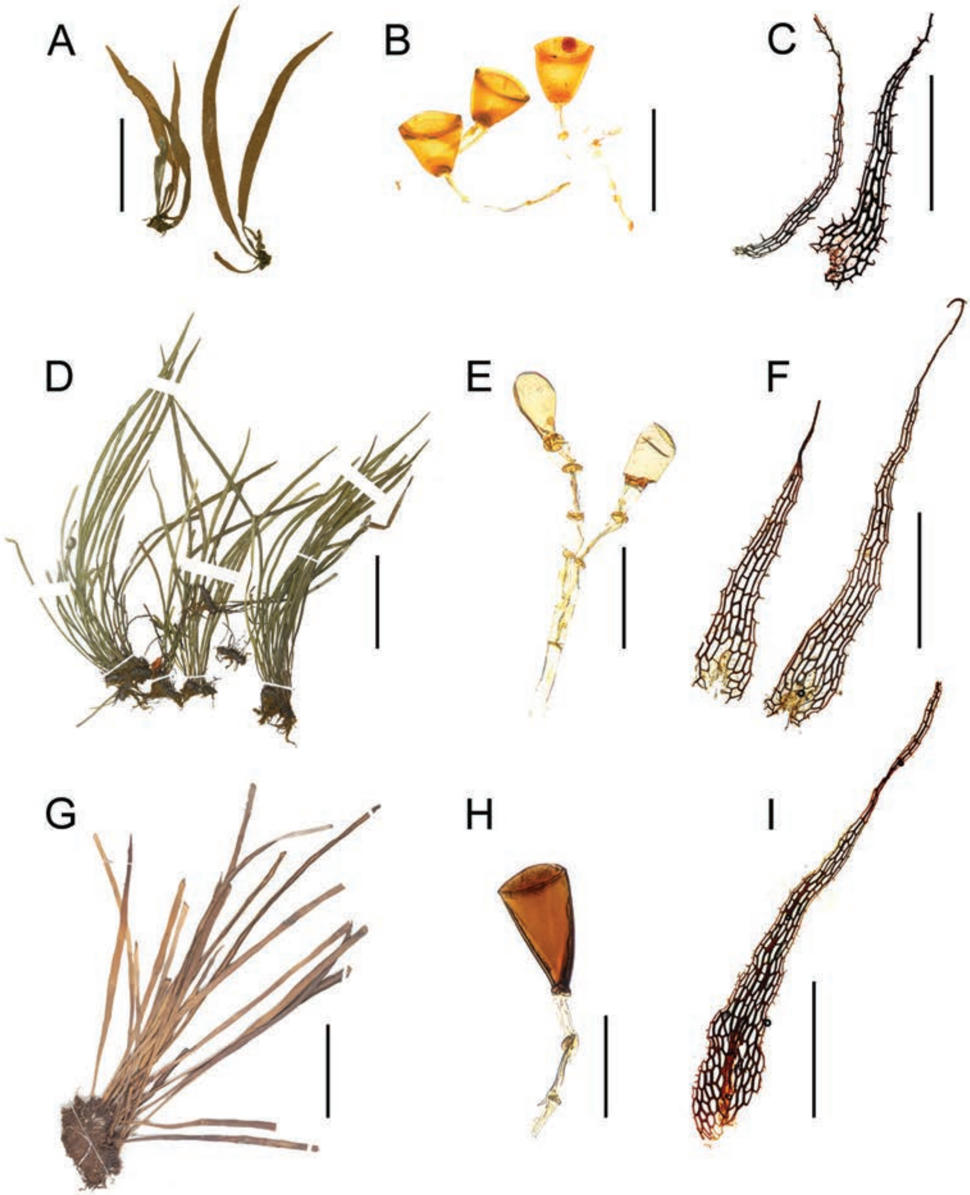

Fig. 1. Morphological comparison of frond shapes (left), soral paraphyses (middle), and rhizome scales (right) between *Haplopteris amboinensis* (Fée) X.C.Zhang (A, B, and C, from *Labillardière s.n.* (RB458839)), *H. mindanaoensis* S.Linds. & C.W.Chen (D, E, and F, from *Kuo 3659*) and *H. ensiformis* (Sw.) E.H.Crane (G, H, and I, from *Razakamalala et al. 2965*). (Scale bars: A, D, G: 5 cm; B, E, H: 100 µm; C, F, I: 1 mm) (Photos: C.-W. Chen)

Table 2. Optimal partitioning scheme and corresponding models for phylogenetic analysis.

Subset	Best model	No. of sites
chlL position 1	GTR+I+G	293
chlL position 2	K81UF+I+G	293
chlL position 3	GTR+I+G	293
matK position 1	TVM+G	346
matK position 2	TVM+G	346
matK position 3, *ndhF* position 3	GTR+G	752
ndhF position 1, *ndhF* position 2	TVM+G	812
trnL-F	TVM+G	870

another *Haplopteris* (sp. 2) from the Philippines. These three species form an early-diverging lineage within the clade where most species with marginal soral grooves are placed (Fig. 2).

Discussion

The specimens of the potentially new species from Mindanao are morphologically distinguishable from both *Haplopteris amboinensis* and *H. ensiformis* (Table 1 and Fig. 1). Furthermore, the phylogenetic analysis resolved our two samples (*Kuo 2542* and *3659*) in a unique position that is well-separated from other *Haplopteris* species (Fig. 2), providing support for its systematic uniqueness. As a result, we here describe the specimens from Mindanao as a new species, *Haplopteris mindanaoensis* S.Linds. & C.W.Chen. The obovoid paraphyses of this species are very diagnostic (funnel-shaped paraphyses are the norm in *Haplopteris*) and, as far as we know, similarly-shaped ones are only found in one other congeneric species, *H. heterophylla* C.W.Chen, Y.H.Chang & Yea C.Liu (Chen et al., 2013). *Haplopteris heterophylla*, however, differs from *H. mindanaoensis* by having sori in abaxial (rather than marginal) grooves. *Haplopteris mindanaoensis* is phylogenetically quite distant from *H. heterophylla* despite sharing the character of obovoid paraphyses, revealing yet another case of homoplasy in the genus.

By comparing the illustrations in the protologue of *Haplopteris amboinensis*, Chen et al. (2017) concluded that most previous records of *H. amboinensis* from China and Indochina are misapplied and that the name *Vittaria ensata* Christ should be used instead. Our additional observations, which, crucially, included examination of type

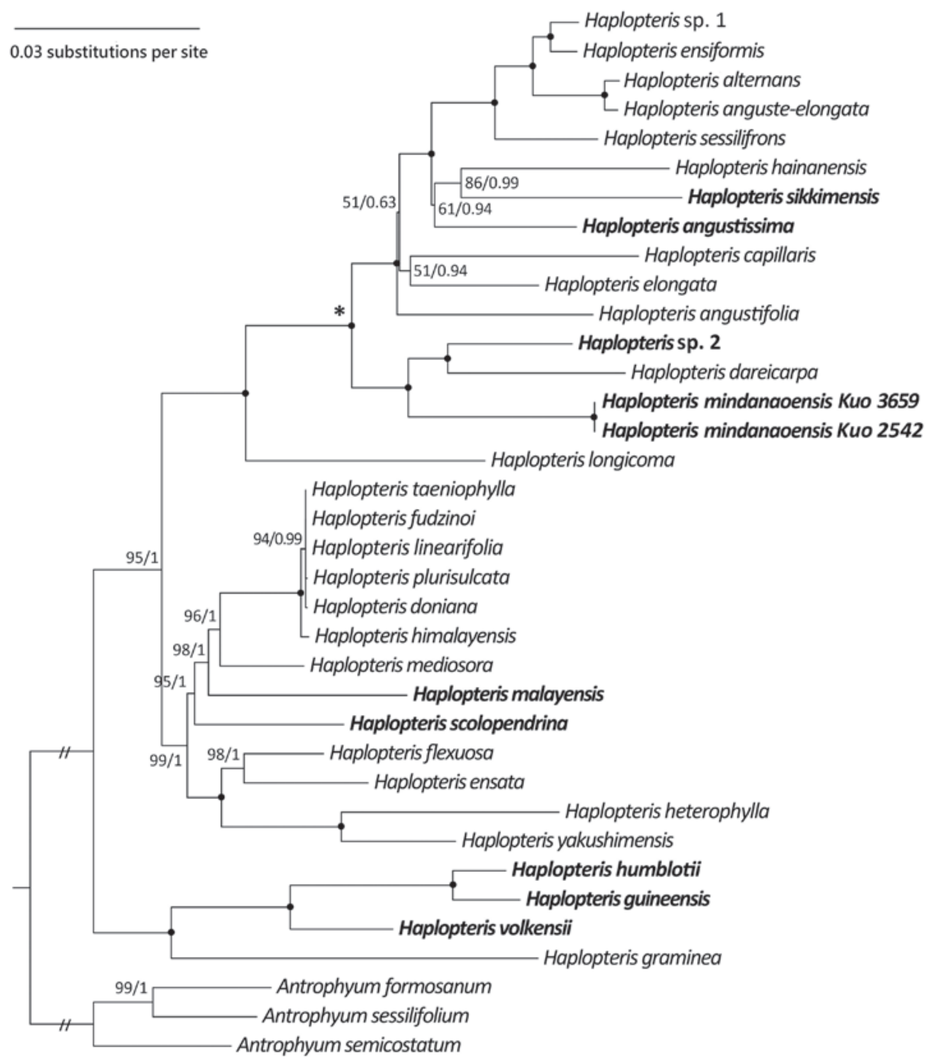

Fig. 2. Phylogram of *Haplopteris* from maximum likelihood analysis of the concatenated plastid dataset (four loci; eight data partitions). Maximum likelihood bootstrap support values and Bayesian posterior probabilities are shown for each node and solid circles at nodes indicate bootstrap = 100%, posterior probability = 1. Names in bold are those newly sequenced for this study. Outgroup branch lengths are not to scale for better visualisation of ingroup relationships. The asterisk (*) indicates the clade where most species with marginal soral grooves are placed.

specimens, support the conclusions of Chen et al. (2017). *Haplopteris amboinensis* and *Vittaria ensata* can be easily distinguished by the character of soral position. *Haplopteris amboinensis* has soral lines totally immersed in marginal grooves whereas *Vittaria ensata* has submarginal soral lines that are slightly covered by reflexed frond margins. *Vittaria ensata* requires a combination in *Haplopteris* which is provided here.

New species

Haplopteris mindanaoensis S.Linds. & C.W.Chen, **sp. nov.**
This species can be distinguished from other *Haplopteris* species by the character combination of paraphyses with obovoid, rather than funnel-shaped, terminal cells and soral lines that are deeply immersed in marginal grooves with asymmetrical flaps. **–** TYPE: Philippines, Mindanao, Mt. Kitanglad, 1,312–2,113 m, 18 December 2012, *L.-Y. Kuo 3659* (holotype PNH; isotypes CMUH [CMUH10958], SING, TAIF [TAIF483897]). (Fig. 1D-F, 3 & 4)

Epiphytic. ***Rhizome*** short-creeping, densely covered by scales, 2–3 mm diameter with scales, 0.5–1 mm diameter with scales removed; rhizome scales clathrate, linear-lanceolate, 1–4 mm long, 0.2–0.5 mm wide at the base tapering to a long, hair-like apex, reddish-brown, the margins minutely and sparsely toothed. ***Fronds*** clustered, sessile, flat for their entire length; laminae linear, 5–20 cm long, 2–3(–4.7) mm wide, widest above the middle, narrowed gradually towards both ends, c. 1 mm wide at the base, acute at apex, thin, papyraceous, glabrous throughout. ***Venation*** obscure without transmitted light, the midvein branched into three almost parallel main veins (midvein and two lateral veins) near the frond base, very sparse oblique lateral veins present, finer than the three main veins, main veins not reuniting at the frond apex. ***Soral lines*** mostly inframedial (i.e. slightly closer to the midvein than to the margin) or medial, occasionally supramedial (slightly closer to the margin than the midvein), very deeply immersed in marginal grooves, following the two main lateral veins, usually not extending to the frond apex (apical 0.6–2 cm usually sterile) and never to the fond base (basal 3–8.5 cm usually sterile); flaps of marginal grooves asymmetric, adaxial flaps 0.1–0.5 mm wider and c. 2× thicker than abaxial flaps. ***Sporangia*** glabrous, stalks short. ***Paraphyses*** uniseriate, 3–7 cells long, terminal cells obovoid, not funnel-shaped, slightly longer than wide. ***Spores*** 64 per sporangium, monolete, oblong in outline, 53 ± 3.4 µm in length, surface smooth.

Distribution. Currently only known from Mindanao in the Philippines.

Ecology/Habitat. Epiphytic on mossy tree trunks at altitudes of 1300–2100 m (possibly to 2300 m – see note below).

Etymology. This species is named after its type locality, Mindanao in the Philippines.

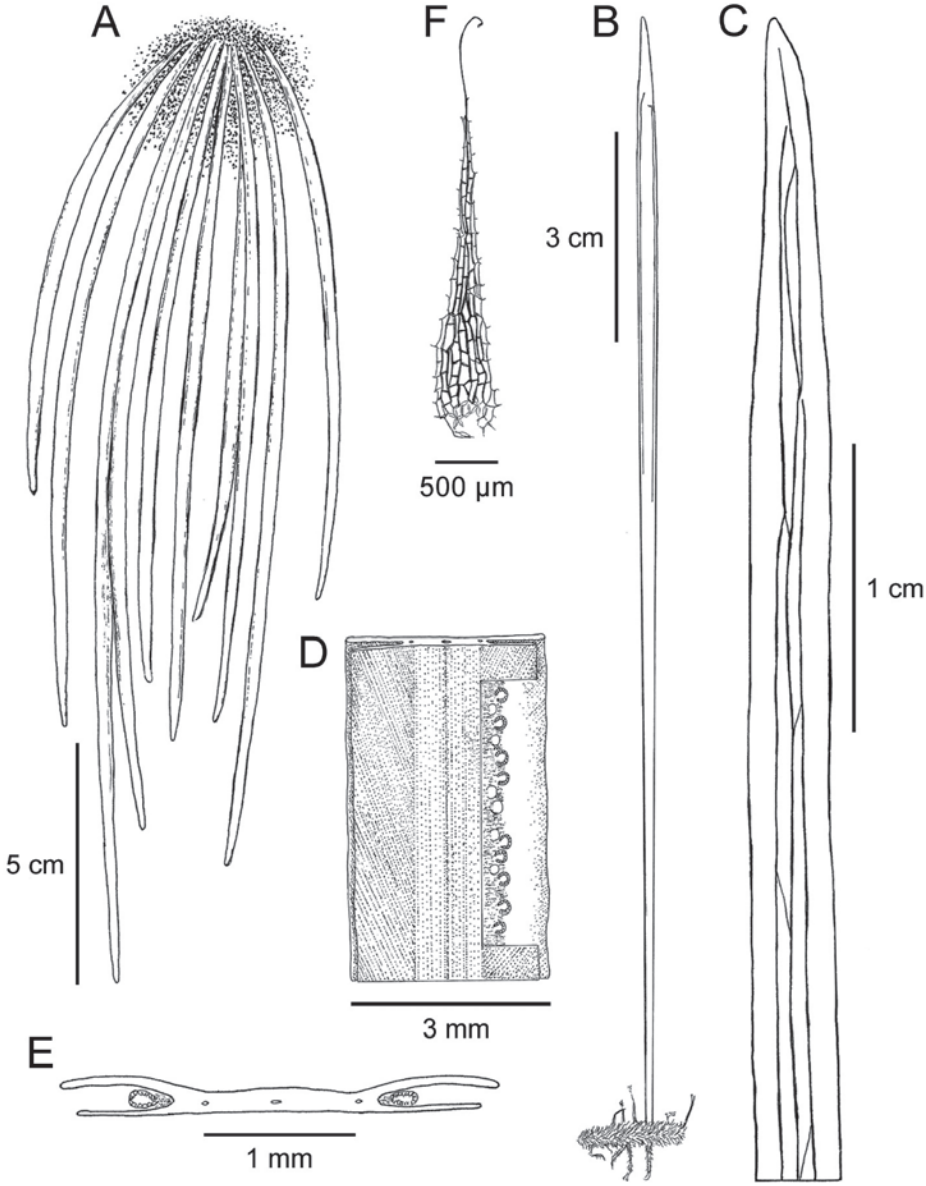

Fig. 3. *Haplopteris mindanaoensis* S.Linds. & C.W.Chen. **A.** Habit (epiphytic and pendulous). **B.** Whole frond attached to a piece of rhizome (submarginal lines depict the margins of the abaxial soral flaps and hence the general position of the linear sori). **C.** Apical 4 cm of frond showing venation pattern in cleared tissue. **D.** 5 mm long section of fertile frond (abaxial view) with 4 mm of right soral flap removed to show sporangia and paraphyses. **E.** Cross-section of fertile frond showing longer and thicker soral flaps on the adaxial surface. **F.** Rhizome scale. Drawn by Violette Chye from *Kuo 3659* (isotype, SING).

Additional specimens examined. PHILIPPINES: **Mindanao:** Mt Apo, 6500 ft [1981 m], 30 Mar 1905, *Williams 2467* (UC [UC 419336], US [US 01485992]); ibid., 2000 m, Aug 1909, *Elmer 11477* (B [B 20 0124441, B 20 0089968], E [E00126917], K [K000699811], KYO, L [L3641821], M [M0029158], P [P01414216], U [U1039065]); ibid., Jun 1924, *Clemens s.n.* (UC [UC268251]); ibid., 6 Nov 1946, *Edano PH771* (L [L3641820]); ibid., 1720–1920 m, 4 May 2012, *Kuo 2542* (TAIF [TAIF483878], [TAIF483879]); Mt Matutum, 1800 m, 1 May 1917, *Copeland s.n.* (UC [UC354000]); Locality uncertain (see note below), Aug 1909, *Elmer 11361* (E [E00126918], L [L3641822], M [M0029157]).

Note. There is some uncertainty over the collecting locality of *Elmer 11361*. The labels on the three duplicates give the collecting locality as Mt Apo, Mindanao, but do not give the altitude. Copeland (1910), however, reports that *Elmer 11361* was collected on Mt Calelan at 2300 m and implies, incorrectly, that this mountain is on Mindoro. It is actually on Mindanao close to Mt Apo. Elmer collected on both mountains in 1909.

New combination and lectotypifications

Haplopteris ensata (Christ) C.W.Chen & S.Linds., **comb. nov.** —*Vittaria ensata* Christ, J. Bot. (Morot) sér. 2, 1: 240, 274 (1908) [= J. Bot. (Morot) 21: 240, 274 (1908)]. TYPE: Vietnam, Lam Dong Province, Mt Lang Bian, 1906, *Eberhardt 169* (lectotype P [P01340816], designated here).

Vittaria lauana Ching, Lingnan Sci. J. 21(1–4): 35 (1945). — *Vittaria lauana* Ching, Acta Phytotax. Sin. 8(2): 171, pl. 24, f. 33. (1959), isonym. — TYPE: China, Hainan Island, January 1935, *Lau 5217* (lectotype PE [PE00049896], designated here; isolectotypes: IBSC [IBSC0003056], GH [00022279]).

Vittaria latifolia Ching, Acta Phytotax. Sin. 8(2): 171, pl. 24, f. 32. (1959), nom. illeg. non Benedict (1914). — *Vittaria chingii* B.S.Wang, Acta Sci. Nat. Univ. Sunyatseni 2: 51. (1961). — TYPE: China, Guangdong Province, 29 March 1932, *Huang 31969* (lectotype PE [PE00599304], designated here; isolectotype PE [PE00599303]).

Notes. Christ cited two collections for *Vittaria ensata, Eberhardt 88* and *169*. Therefore they are syntypes and a lectotypification is needed.

The name *Vittaria lauana* Ching was published twice for the same taxon 14 years apart, the second therefore being an isonym. In the second paper Ching described another species with larger fronds and rhizome scales that he named *Vittaria latifolia*. Unfortunately, he overlooked the fact that that name had already been published by Benedict for another species (now *Radiovittaria latifolia* (Benedict) E.H.Crane) and so was unavailable. Wang rectified this problem by replacing the name *Vittaria latifolia* Ching nom. illeg. with *Vittaria chingii* B.S.Wang. We regard *Vittaria lauana* and *Vittaria chingii* as synonyms of *Haplopteris ensata*.

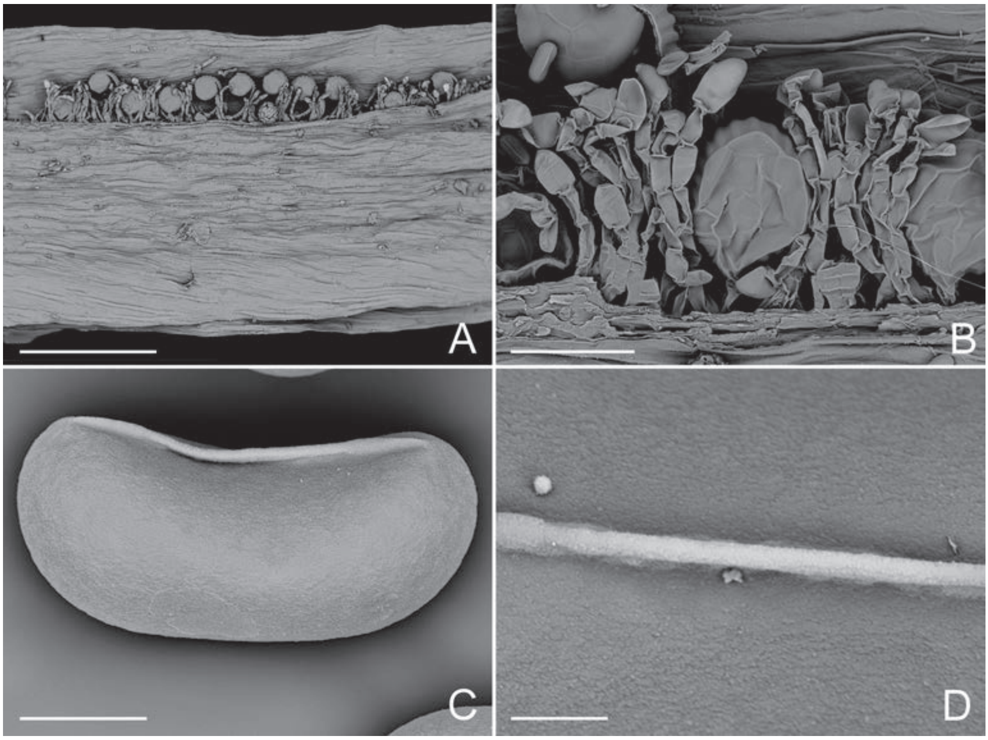

Fig. 4. SEM images of the soral paraphyses and spores of *Haplopteris mindanaoensis* S.Linds. & C.W.Chen from *Kuo 3659* (isotype, TAIF483879). **A.** Sorus showing the distribution of sporangia and paraphyses (the abaxial soral flap has been removed from one side) (scale bar 1 mm). **B.** Uniseriate paraphyses with obovoid apical cells (scale bar 150 μm). **C.** Proximal face of the spore (scale bar 15 μm). **D.** Detail of spore surface (scale bar 5 μm). (Photos: C.-W. Chen)

When publishing the name *Vittaria latifolia*, Ching designated *Huang 31969* as the type in Mandarin but did not distinguish between the duplicates. Therefore, one of these is here designated as the lectotype.

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Appendix. Voucher information and GenBank accession numbers of the specimens used in the phylogenetic analysis. GenBank numbers in bold are those newly sequenced for this study. The combination marked * will be published shortly in another paper.

Taxa	Location	Voucher	Herbarium	*chlL*	*matK*	*ndhF*	*trnL-F*
Antrophyum formosanum Hieron.	Taiwan, Taidong	*Wade1640*	TAIF	KY101178	KY101252	KY101322	KY101392
Antrophyum semicostatum Blume	Indonesia, Cibodas	*Wade1072*	TAIF	KM884685	KM884709	KM884733	KM884757
Antrophyum sessilifolium (Cav.) Spreng.	Philippines, Negros	*Wade3763*	TAIF	KY101227	KY101297	KY101367	KY101428
Haplopteris alternans (Copel.) S.Linds. & C.W.Chen	Philippines, Negros	*Wade 4000*	TAIF	KX896804	KX896840	KX896882	KX896914
Haplopteris anguste-elongata (Hayata) E.H.Crane	Taiwan, Pingdong	*Wade 1467*	TAIF	KF815947	KC812873	KC812907	KC812941
Haplopteris angustifolia (Blume) E.H.Crane	Indonesia, Java	*Wade 1917*	TAIF	KX896805	KX896841	KX896883	KC812959
Haplopteris angustissima (Holttum) S.Linds.	Malaysia, Pahang	*Wade 4825*	TAIF	**MG983937**	**MG983947**	**MG983957**	**MG983967**
Haplopteris capillaris (Copel.) comb. ined.*	Malaysia, Sabah	*Wade 4360*	TAIF	KX896825	KX896861	KX896903	KX896948
Haplopteris dareicarpa (Hook.) S.Linds. & C.W.Chen	Malaysia, Sabah	*Wade 4217*	TAIF	KX896806	KX896842	KX896884	KX896915
Haplopteris doniana (Mett. ex Hieron.) E.H.Crane	Bhutan, Trashigang	*Fraser-Jenkins 34044*	TAIF	KY101216	KY101286	KY101356	KX896916
Haplopteris elongata (Sw.) E.H.Crane	Taiwan, Hsinchu	*Wade 1542*	TAIF	KY101171	KC812885	KC812919	KC812953
Haplopteris ensata (Christ) C.W.Chen & S.Linds.	Vietnam, Lam Dong	*Wade 2588*	TAIF	KY101215	KY101285	KY101355	KY101421
Haplopteris ensiformis (Sw.) E.H.Crane	Philippines, Mindanao	*Kuo 3660*	TAIF	KY101205	KY101275	KY101345	KY101412
Haplopteris flexuosa (Fée) E.H.Crane	India, Meghalaya	*Fraser-Jenkins 33825*	TAIF	KF815952	KC812888	KC812922	KC812956
Haplopteris fudzinoi (Makino) E.H.Crane	Japan, Naraken	*Kasetani 1310*	TNS	KF815960	KF815966	KF815972	KX896920
Haplopteris graminea (Poir.) comb. ined.	Reunion, St. Philippe	*Janssen 2692*	P	KX896826	KX896862	KX896904	KC812964
Haplopteris guineensis (Desv.) E.H.Crane	Gabon, Ogooué-Maritime	*Nek 223*	MO	**MG983934**	**MG983944**	**MG983954**	**MG983964**

Appendix. Continuation.

Taxa	Location	Voucher	Herbarium	*chlL*	*matK*	*ndhF*	*trnL-F*
Haplopteris hainanensis (C.Chr.) E.H.Crane	China, Hainan	*Wu 959*	TAIF	KF815958	KC812904	KC812938	KC812972
Haplopteris heterophylla C.W.Chen, Y.H.Chang & Yea C.Liu	Taiwan, Taipei	*Wade 1711*	TAIF	KF815950	KC812886	KC812920	KC812954
Haplopteris himalayensis (Ching) E.H.Crane	Nepal, Lalitpur	*Fraser-Jenkins 30640*	TAIF	KY101198	KY101268	KY101338	KY101405
Haplopteris humblotii (Hieron.) S.Linds. & C.W.Chen	Madagascar, Toamasina	*Rasolohery 663*	MO	**KX896811**	**KX896847**	**KX896889**	**KX896926**
Haplopteris linearifolia (Ching) X.C.Zhang	China, Yunnan	*Kuo 1452*	TAIF	KY101185	KC812898	KC812932	KC812966
Haplopteris longicoma (Christ) E.H.Crane	Malaysia, Sabah	*Wade 4252*	TAIF	KX896812	KX896848	KX896890	KX896927
Haplopteris malayensis (Holttum) E.H.Crane	Malaysia, Pahang	*Wade 4412*	TAIF	**MG983936**	**MG983946**	**MG983956**	**MG983966**
Haplopteris mediosora (Hayata) X.C.Zhang	Taiwan, Nantou	*Wade 2085*	TAIF	KF815955	KC812849	KC812928	KC812962
Haplopteris mindanaoensis S.Linds. & C.W.Chen	Philippines, Mindanao	*Kuo 2542*	TAIF	**MG983929**	**MG983939**	**MG983949**	**MG983959**
Haplopteris mindanaoensis S.Linds. & C.W.Chen	Philippines, Mindanao	*Kuo 3659*	TAIF	**MG983930**	**MG983940**	**MG983950**	**MG983960**
Haplopteris plurisulcata (Ching) X.C.Zhang	China, Yunnan	*He 2013001*	TAIF	KX896814	KX896850	KX896892	KX896930
Haplopteris scolopendrina (Bory) C.Presl	Philippines, Negros	*Wade 4008*	TAIF	**MG983933**	**MG983943**	**MG983953**	**MG983963**
Haplopteris sessilifrons (Miyam. & H.Ohba) S.Linds.	Malaysia, Sabah	*Wade 4209*	TAIF	KX896816	KX896852	KX896894	KX896935
Haplopteris sikkimensis (Kuhn) E.H.Crane	Nepal, Kaski	*Fraser-Jenkins 32607*	TAIF	**MG983931**	**MG983941**	**MG983951**	**MG983961**
Haplopteris taeniophylla (Copel.) E.H.Crane	Philippines, Luzon	*FWL 974*	TAIF	KY101190	KY101261	KY101331	KC812969
Haplopteris volkensii (Hieron.) E.H.Crane	Kenya, Cherangani	*Tweedie 2708*	K	**MG983932**	**MG983942**	**MG983952**	**MG983962**
Haplopteris yakushimensis C.W.Chen & Ebihara	Japan, Yakushima	*Oka K-090106*	TNS	KF815961	KF815967	KF815973	KX896946
Haplopteris sp. 1	United States, Hawaii	*Taylor 6509*	GH	KX896834	KX896870	KX896912	KX896951
Haplopteris sp. 2	Philippines, Luzon	*Liu 9618*	TAIF	**MG983928**	**MG983938**	**MG983948**	**MG983958**