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RESEARCH NOTE

Taxonomic and Nomenclatural Notes on Philippine Ferns. VI. *Asplenium lepturus* and *A. contiguum* (Polypodiales, Aspleniaceae), One or Two Species?

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The present study clarifies the existing confusion between the Southeast Asian–Malesian *Asplenium lepturus* and the Hawaiian *A. contiguum*. The geographical range of both species is reported. Eleven (11) European and North American herbaria were visited by the author, and virtual collections of eight more herbaria were consulted. A morphological comparison of the size, shape, color, and dissection of the rhizome, scales, fronds, pinnae, apical segment, and sori was studied using light and dissecting microscopes. *A. lepturus* and *A. contiguum* are different species that can be distinguished by the size of the frond of fully developed plants, their different scales, the dentation of the pinna margin, the shape and length of the pinna apex, and sori position. *A. lepturus* is reported as a new Hawaiian species different from *A. contiguum*. *A. lepturus* is found in the Hawaiian Archipelago, south China, Laos, Vietnam, Philippines, and Sulawesi. *A. contiguum* is endemic in the Hawaiian Archipelago.

Keywords: Hawaii endemics, marginal teeth, pinna margin, SE Asian pteridophytes

INTRODUCTION

Asplenium contiguum (Kaulfuss 1824) was described from a specimen collected by Adalbert von Chamisso (*Chamisso s.n.*, P) in Oahu, Hawaii, and Presl described *A. lepturus* (Presl 1849) from a plant collected by Hugh Cuming (*Cuming 211*) in the old Province of Tayabas, now Quezon Province, in southern Luzon, Philippines. The taxonomy of *A. contiguum* and *A. lepturus* has been confused since Presl (1849) noticed their similarities in his original description of *A. lepturus*. Fée (1850–1852) mentioned neither of these species. Moore (1857) accepted *A. contiguum*, and placed *A. lepturus* among its synonyms. Mettenius (1859) recognized both species emphasizing differences in pinna length and other details of the pinna. Hooker (1860) listed *A. lepturus* as a variety of *A. contiguum* and mentioned *A. filiforme* Kaulf. (1824) to be an intermediate between the two. Copeland (1905) recognized *A. contiguum* and remarked that *A. lepturus* differs from it in the shape of the frond and the pinna lobes formed by incisions. Christ (1906) accepted *A. lepturus* without mentioning *A. contiguum*. Christensen (1905) listed *A. lepturus* as a synonym of *A. contiguum*, but later (Christensen 1934) separated them. In his revision of Hawaiian pteridophytes, Christensen (1925) pointed out that "very similar forms occur in Malaya and East Africa." Copeland (1960) reduced *A. lepturus* to *A. contiguum* because "[he] could not distinguish them." Regardless of Christensen's (1905, 1934) change of opinion, the confusion between *A. lepturus* and *A. contiguum* persists among SE Asian and American botanists. The present study will attempt to clarify the species status of *A. lepturus*, *A. contiguum*, and the geographical range of both species.

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MATERIALS AND METHODS

The specimens of *A. lepturus* and *A. contiguum* deposited at Botanischer Garten und Botanisches Museum Berlin, Berlin, Germany (B); Natural History Museum, London, England, UK (BM); Royal Botanic Garden Edinburgh, Scotland, UK (E); Royal Botanic Gardens, Kew, England, UK (K); Naturalis Biodiversity Centre, Leiden, Netherlands (L); The New York Botanical Garden, Bronx, New York, United States (NY); Muséum national d'Histoire naturelle, Paris, France (P); Charles University, Prague, Czechia (PRC); Swedish Museum of Natural History, Stockholm, Sweden (S); Smithsonian Institution, Washington, DC, United States (US), and Naturhistorisches Museum Wien, Vienna, Austria (W) were examined as well as their digital images. The collections at Herbarium Pacificum, Department of Natural Sciences, Bishop Museum, Honolulu, HW, United States (BISH); Field Museum of Natural History, Chicago, IL, United States (F); Harvard University, Cambridge, MA, United States (GH); Missouri Botanical Garden, Saint Louis, MO, United States (MO); Miami University, Oxford, OH, United States (MU); University of Michigan, Ann Arbor, MI, United States (MICH); The Conservatoire et Jardin botaniques de la Ville de Genève, Geneva, Switzerland (G), and Herbarium, Academy of Natural Sciences, Philadelphia, PA, United States (PH) were consulted using the JStor Plants and herbarium digital databases. The habit, indument, size, shape, color, length, width, and dissection of roots, rhizome, fronds, pinnae, apical segment, and sori were studied using light and dissecting microscopes. Notes on the habitat and distribution of the species were taken from the labels of the herbarium specimens. A comparison of the types was made to assess their morphological similarities and differences. The herbarium acronyms in the Index Herbariorum (Thiers 2023) and nomenclature guidelines in the International Code of Nomenclature for algae, fungi, and plants (Turland *et al.*, ICN, Shenzhen Code, 2018) were followed. Journal and author abbreviations follow International Plant Name Index (IPNI 2022) guidelines. The Global Biodiversity Information Facility (GBIF 2022) and the World Plants. Synonymic Checklist and Distribution of the World Flora (Hassler 2022) were consulted extensively. The Creative Common licenses of the owner's herbaria for the use of images were validated. The botanical terminology used is that of Lellinger (2002).

TAXONOMIC TREATMENT

Family Aspleniaceae Newman 1840: 6.
Subfamily Asplenioideae Link 1841: 73.
Genus *Asplenium* L 1753: 1078.

Asplenium lepturus C.Presl, Epimeliae Botanicae 72, 73. 1849.

Rhizome scales dark reddish-brown. Fronds (47.7)53–76(116.5) cm long. Stipe and rachis glabrous or rarely with reddish-brown normally clathrate unbranched scales, hairs absent or rarely present at the base of the stipe. Pinna falcate, margin finely and irregularly serrate near the pinna base, middle, and distal portion with sinuses 5–7 mm wide, with prominent teeth at regular intervals, teeth 2–6 mm long, with two or three small acute apical teeth; pinna apex long caudate. Sori parallel or oblique to the costa.

Specimens labeled *Cuming 211* have traditionally been considered isotypes of *A. lepturus*, and herbarium sheets are so labeled. They have been found in nine herbaria so far (B, BM, E, GH, K, MICH, P, PRC, US). There are two varieties or species with the collector's name and number *Cuming 211*: the typical variety of *A. lepturus*, and the forma *filiforme*, usually labeled as variety (Salgado 2022). These two varieties are considered duplicates of the same gathering as the *Shenzhen Code* (Turland *et al.* 2018) defines it (Art. 8.2, 8.3). These isotype specimens, however, represent an admixture of the two morphological variations. The absence of the date and specific locality where these specimens were collected – Luzon, Philippines – is not detailed enough to know their precise provenance. The following specimens represent the forma *filiforme* and not the typical *A. lepturus*, as described by Presl (1849). Their barcodes are B20 0017192, K000451012, P00642967, and US00135099. *Cuming 211* (MICH1190073) consists of two fronds that came from BM, "*ex Herbario Musei Britannici*" with a note "*... contiguum ß filiforme*". These fronds do not agree with the type of *A. contiguum*.

Asplenium lepturus C.Presl, Epimeliae Botanicae 72, 73. 1849. Lectotype here designated: Philippines, Luzon, *Cuming 211,* (PRC, no barcode present; isolectotypes: K000451011, K000451013, BM001045202, GH00020553, E00210804).

Note: there is one specimen of *A. lepturus* in PRC. This specimen was probably used by Presl in the description of the new species. Presl did not designate a type specimen for *A. lepturus*. Accordingly, I select it as lectotype, here designated, of *A. lepturus*, the specimen deposited at PRC, with the handwritten notes on the herbarium sheet: "211," "Luzon," "*Asplenium lepturus* J. Smith [unintelligible words] Hook. Jour. Bot. III 408 [unintelligible words] 72," "*In Insula Luzon legit Cuming*." There was no barcode on this herbarium sheet at the time of the visit to the PRC. This plant, however, is not the best specimen to represent the typical *A. lepturus*. An epitype is selected here to assist in the critical and precise identification of the above lectotype, "*Asplenium lepturus* J. Smith, Luzon, *Cuming 211*" found in the Royal Botanic Gardens, Kew, England, identified with the barcode [K000451010]. *Asplenium lepturus* C.Presl, Epimeliae Botanicae 72, 73. 1849. Epitype here designated: Philippines, Luzon, *Cuming 211* (K000451010). The specimen K000451010 is selected

here because of its good condition, and it shows the important morphological frond characteristics described by Presl (Figure 1) and agrees with the PRC plant (Holttum 1968).

Asplenium contiguum Kaulf., Enumeratio Filicum 172. 1824. Rhizome scales black. Fronds (29.5)36–63(70.4) cm long. Stipe and rachis glabrous or with scattered black thickly clathrate branched scales, hairs present or not. Pinna straight, margin notched or dentate throughout, narrow sinuses, teeth acute, < 1 mm long when present, evenly distributed along the entire length of the pinna, prominent marginal teeth never present; pinna apex acute to acuminate or short caudate. Sori imbricate and oblique to the costa.

The plant of *A. contiguum* collected by Chamisso was mixed in P with other specimens from Hawaii and remained forgotten. The description by Kaulfuss (1824)

Figure 1. Epitype of *Asplenium lepturus*. Philippines, Luzon, *Cuming 211* (K000451010).

is not detailed enough to critically evaluate collected plants. Kaulfuss did not mention any specimen nor gave details of the locality, except for the word "O-Wahu." The unavailability of specimens collected by Chamisso led to the misidentification of many Hawaiian plants and some SE Asian specimens. The confusion and disagreement among pteridologists were widespread.

Asplenium contiguum Kaulf., Enumeratio Filicum 172. 1824. Lectotype here designated: United States, State of Hawaii, Island of Oahu, "habitat in insula Sandvicenti, O-Wahu," *Chamisso s.n*. (P00642985).

Note: P [P00642985] is the only specimen of *A. contiguum* found to this date collected by Chamisso in Hawaii. Chamisso is identified on the original label as the collector (Figure 2).

DISCUSSION

Asplenium contiguum is a name that has been used in Hawaii for plants that vary greatly in their morphology. Some plants do not belong to *A. contiguum* and

Figure 2. Lectotype of *Asplenium contiguum*. Oahu, Hawaii, United States. *Chamisso s.n*. (P00642985).

Table 1. Comparison of diagnostic characters.

	Asplenium lepturus	***Asplenium contiguum***
Rhizome scales	Dark reddish-brown	Black
Pinna shape	Falcate	Straight
Pinna margin	Finely and irregularly serrate near the pinna base, middle and distal portion with sinuses 5–7 mm wide	Notched on dentate throughout, narrow sinuses
Pinna marginal teeth	Prominent teeth at regular intervals, 2–6 mm long, with two or three small acute apical teeth	Teeth evenly distributed along the entire length of the pinna, < 1 mm long when present, acute, promiment marginal teeth never present
Pinna apex	Long caudate	Acute to acuminate or short caudate
Sori position	Parallel or oblique to the costa	Imbricate and oblique to the costa

represent one or more separate species; others are *A. filiforme* (Kaulfuss 1824) often considered a variety of *A. contiguum* (Hillebrand 1888); some mature, well-developed specimens, match *A. lepturus* (*Cuming 211*) found in SE Asia; finally, others match the description by Kaulfuss (1824) of *A. contiguum* (*Chamisso s.n.*, P). This mixture of plants named *A. contiguum* is the root of the confusion between *A. contiguum* and *A. lepturus*. The lack of access to the holotype of *A. contiguum* has been a major problem in determining the identity and presence of both species in SE Asia and Hawaii. The finding by Salgado in P, in 2008, of a specimen of *A. contiguum* collected by Chamisso (*Chamisso s.n.*, P00642985) in Oahu, Hawaii, has provided the opportunity to compare the original material of both species. Now that the Chamisso specimen has been located, it became imperative to designate a lectotype for *A. contiguum*.

Asplenium lepturus and *A. contiguum* (Figures 1 and 2) can be distinguished by the size of the frond of fully developed plants, their different scales, shape of the pinnae, dentation of the pinna, shape and length of the pinna apex, and soral position. The most obvious differences between them are the pinna margin sinuses and dentation (see Table 1). In *A. lepturus*, the proximal two-thirds of the pinna margin is cut into wide angular sinuses forming unique-looking marginal teeth originating at an oblique angle, 2–6 mm long, and up to 1 mm wide, with 2–3 small acute apical teeth. The pinna margin of *A. contiguum* is shallowly dentate or notched and lacks the characteristic marginal teeth found in *A. lepturus*. The pinna of *A. lepturus* is falcate and long caudate, whereas that of *A. contiguum* is straight, acute, or acuminate but not long caudate. The frond apical segment is long, lobes narrowly decurrent along the rachis, with sharp pointed teeth in *A. lepturus*; in *A. contiguum*, the frond apical segment has decurrent, rounded lobes, forming a wider band along the rachis, but this is a variable feature. The original material of *A. lepturus* probably used by Presl, is in PRC (Holttum 1968). On the herbarium sheet, there is a handwritten note by Holttum, dated 1967: "This has been considered synonymous with *Asplenium contiguum* from Hawaii, but I consider the Philippine plants distinct and Presl's name should stand." In his commentary on the fern types found in the K. B. Presl herbarium, Holttum (1968) repeats the above-handwritten comment, adding that this specimen agrees with the one at K, selected here as the epitype. The comparison of the types supports Holttum's opinion, and the two species should remain separate (Figures 1 and 2). *A. lepturus* has a consistent morphology in SE Asia. Plants are similar in their adult form and habitat. The typical Asian *A. lepturus* with its falcate pinnae, long acuminate pinna apex, widely spaced long marginal teeth, and the frond apical segment is indistinguishable from some Hawaiian plants identified in error as *A. contiguum* (Figure 3). *A. lepturus* grows at high elevation, mostly above 1200 m. *A. contiguum* is found at middle to high elevations at 500–1300 m. Both species grow in wet, tropical forests. It is the opinion of the author that *A. lepturus* exists in Hawaii, and it is a species distinct from *A. contiguum* collected by Chamisso, as the comparison of the types shows. The typical *A. contiguum* has not been found in Asia. Some Asian specimens labeled *A. contiguum* are misidentified and belong under *A. lepturus* or other species.

CONCLUSION

Asplenium lepturus and *A. contiguum* are distinct species, and both names should remain separate and not in synonymy. *A. lepturus* is found in the Hawaiian Archipelago, south China, Laos, Vietnam, Philippines, and Sulawesi. *A. contiguum* is endemic in the Hawaiian Archipelago, and has not been found in Asia. The name *A. contiguum* has often been misapplied to Hawaiian and SE Asian plants that are different from the *A. contiguum* collected by Chamisso and described by Kaulfuss.

Figure 3. *Asplenium lepturus* collected on the Island of Molokai, Hawaiian Archipelago, United States, *R.I.Walker 3998* (UC1730069).

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STATEMENT ON CONFLICT OF INTEREST

Author statement: there is no conflict of interest associated with this paper.

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