

## SHORTER NOTES

**An *Adiantopsis* Hybrid from Northeastern Argentina and Vicinity.**—During a recent collecting trip to the Parque Nacional Iguazú, Misiones, Argentina, an unusual specimen of *Adiantopsis* was collected (*Hickey 01-63 et al.*, MU; Fig. 1). The single plant was found growing with *A. radiata* (L.) Fée on steep, moist, wooded slopes along the walkway leading to Iguazú Falls. Its leaves were pedate with inequilateral basal pinnae and extended basal basiscopic pinnules (Fig. 1). In Tryon & Tryon (*Ferns and Allied Plants with Special Reference to Tropical America*, 1982), this plant keyed to *A. pedata* (Hook.) T. Moore, a species listed as endemic to the Greater Antilles. Comparisons of the Argentinian collection with Caribbean material showed no obvious morphological differences between the two (Fig. 1). Herbarium loans (BM, MO, MU, UC, SI) revealed additional collections of this unusual *A. pedata*-like plant dating back to 1907, and ranging into adjacent areas of Brazil and Paraguay. Among these collections, *Biganzoli et al. 168* (SI) was identified by M. Ponce as *A. pedata* as was *Rojas 10451* (BM) by Peña-Chocarro. *Hahn 2013* (MO, UC) was annotated by A. R. Smith as *Adiantopsis chlorophylla* × *radiata*.

Evidence from spores supports Smith's contention for a hybrid origin of the South American plants. Spores of *Adiantopsis pedata* from the Greater Antilles number 64 per sporangium and are uniform in shape and size. In contrast, the material from South America shows a variable number of spores (52 to 76 per sporangium), most of which are misshapen, suggestive of a hybrid origin. These South American collections, therefore, represent the first known hybrids in *Adiantopsis*.

The enlarged basal basiscopic pinnules, reduced leaf dissection, and shape of the ultimate segments argue strongly for *Adiantopsis radiata* as one of the parents. The second parent, contributing the pinnate frond architecture, is probably a member of the taxonomically difficult *A. chlorophylla* (Sw.) Fée complex. Potential taxa include *A. chlorophylla*, *A. per fasciculata* Sehnem, and *A. occulta* Sehnem. Hypotheses including *A. per fasciculata* and *A. occulta* as the second parent are supported by their erect rhizomes and densely crowded stipes, characters quite evident in the hybrid. The creeping rhizomes and more distantly attached stipes of *A. chlorophylla* argue against its involvement, although it is possible that *A. radiata* may have individually conferred these traits to the hybrid. Preliminary analyses of spore morphology support *A. per fasciculata* as the second parent. The spores of this species and the hybrid possess elongate, bent spines, characters not seen in the other species. Ancillary support for parentage is derived from geography. *Adiantopsis radiata* and *A. chlorophylla* are both widely distributed and often sympatric in the American tropics. In contrast, the hybrid is restricted to Argentina, Brazil and Paraguay and its absence throughout the range of co-occurrence argues against a widespread *A. chlorophylla* as the second parent.

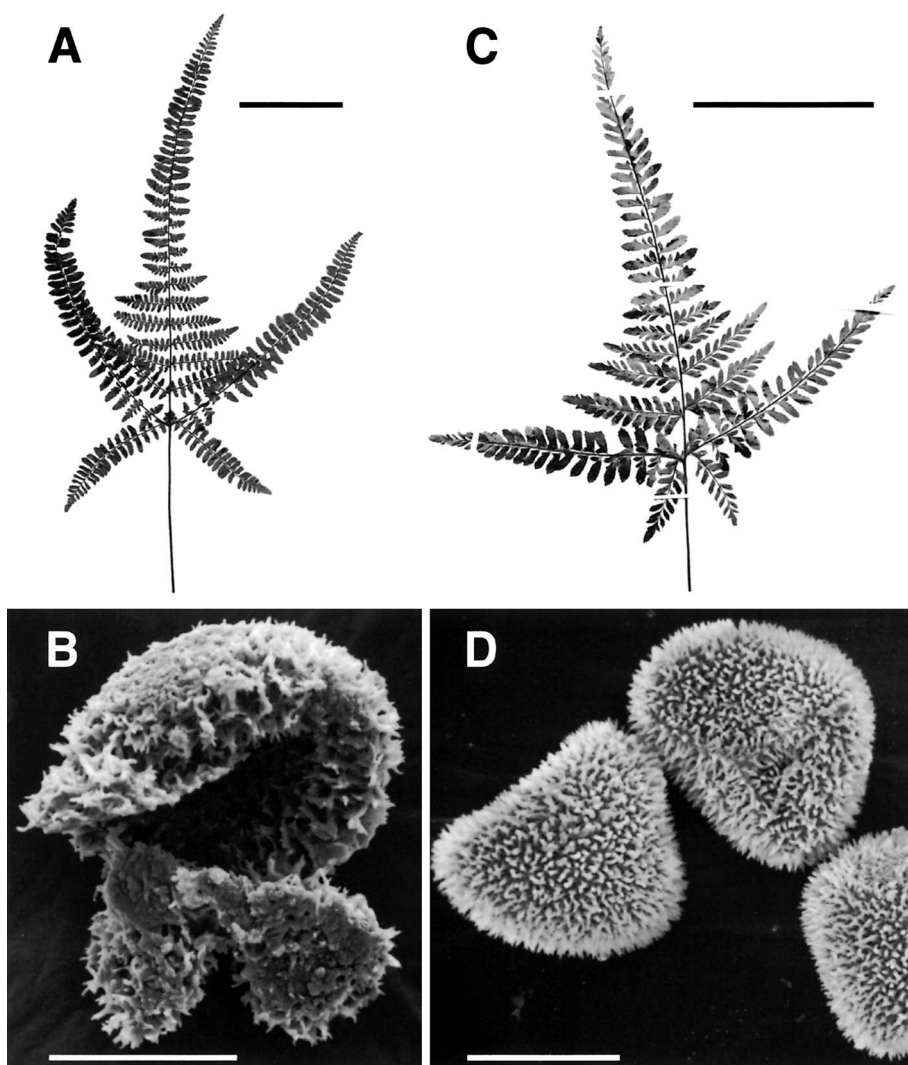


FIG. 1. Fronds and spores of *Adiantopsis*  $\times$  *australopedata* and *A. pedata*. A. *A. \times australopedata* from Misiones, Argentina (*Hickey 01-63 et al*, MU), bar = 5 cm. B. Aborted spores of *A. \times australopedata* (*W. H. Hahn 2013*, UC), bar = 25  $\mu$ m. C. *A. pedata* from Jamaica (*Proctor 35655*, US), bar = 5 cm. D. Normal spores of *A. pedata* (*Proctor 35655*, US), bar = 25  $\mu$ m.

Both *A. perfasciculata* and *A. occulta*, however, have ranges nearly identical to that of the hybrid and both have the expected frond architecture predicted for the second parent. Considering the ranges of the hybrid and its putative parents, it is surprising that there has been no reference to the hybrid in Rosentock (*Hedwigia* 46:57–167. 1907), the various floristic treatments by Sehnen (*Pesquisas* 3:495–576, 5f. 1959; *Pesquisas* 13:1–42, 10f. 1961 in

P. R. Reitz (ed.), *Flora Illustrada Catarinense, I Parte. Pteridáceas*, 244 pp. 1972), or in Peña-Chocarro *et al.* (Fern Gaz. 15:221–259. 1999).

***Adiantopsis* × *australopedata*** Hickey, Barker, et Ponce, *hybr. nov.* **Fig. 1.** A & B. Type.—Paraguay, Depto. Cordillera, Caacupe, semideciduous forest to 20 m tall on fairly steep slope, *Enterolobium*, *Parapiptadenia* dominants, soil sandy with some red clay, 25° 20' S, 57° 10' W, 9 Feb 1984, *Hahn 2013* (holotype MO, sheets 1 and 2; isotype UC ).

Laminae pedatae; pinnae supernae bipinnatae; pinnae basales tripinnatae, praebens pinnulas basales basiscopicas elongatas magnopere. Ab *A. pedata* sporis abortivus differt.

PARATYPES.—**Brazil:** Rio Grande do Sul, transiens in *Ad. pedata*, Cameste do Peiraes, 1907, *Jürgens 173a* (UC). **Paraguay:** in altplnitie et declivibus “Sierra de Amambay”, May 1907/1908, *Rojas 10451* (BM); Colonia Independencia Villarica, 13.11.1945, *Teague 453* (BM). **Argentina:** Misiones, Dep. Iguazú, Parque Nacional Iguazu, *Hickey 01-63*, *Taylor*, *Strittmatter & Guaglianone* (MU). Dep. Cainguás, Predio de la Universidad Nacional de La Plata, valle de arroyo Cuña Pirú, 2do. campo con “Urunday”, 27° 07' S–54° 58' W, sotobosque, *Biganzoli*, *Peralta*, *Giallorenzo & Moreno 168* (SI).

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**Leaf Flavonoids in the Genus *Gleichenia* (Gleicheniaceae).**—As part of a continuing chemotaxonomic study of flavonoids in genera of the Gleicheniaceae by Umi Kalsom (Blumea 40: 211–215. 1995), our attention has turned to *Gleichenia*, which contains some five species and two varieties. Apart from the genus *Dicranopteris*, the family has not been extensively investigated and the results of a general flavonoid survey will be presented later. This paper describes the identification of some of the major flavonoids found in the genus *Gleichenia*. From the viewpoint of flavonoid chemistry, the only major survey of *Gleichenia* has been that of Wallace *et al.* (Amer. J. Bot. 70: 207–211. 1983) who found flavonol 3-*O*-glycosides to be major components in methanolic leaf extracts of 8 species. In addition, some species appear to accumulate traces of chalcone *O*-glycosides and/or aurone *O*-glycosides.

The purpose of the present research was to determine whether or not other members of the Gleicheniaceae have flavonoid profiles similar to the

gleicheniaceous ferns previously studied. For this, the flavonoid profiles of *Gleichenia hirta* Bl., *G. microphylla* R. Br., *G. longissima* Bl. and *G. blotiana* C. Chr. as interpreted by Piggot (*Ferns of Malaysia in Colour*, Tropical Press, Sdn Bhd., Kuala Lumpur, 1998) were determined and compared with those of *Gleichenia* by Wallace and Markham (Amer. J. Bot. 65: 965–969 1978). Leaves from freshly dried plant material collected from various habitats in Peninsular Malaysia were analysed. Voucher specimens of the ferns (collection number: UKY 326-329) have been deposited in the herbarium of the Department of Biology of the Universiti Putra Malaysia. Standard chromatographic procedures (Harborne, J. B. 1967, *Comparative Biochemistry of the Flavonoids*, Academic Press, London; Markham, K. R. 1982, *Techniques of flavonoid Identification*, Academic Press, London) were used for examining flavonoids present in direct and acid hydrolysed leaf extracts; the common aglycones were identified by means of  $R_f$  values and color reaction in UV light when compared with standard markers. In acid-hydrolyzed extracts, the flavones were recognized by their distinct, dark yellow spots on paper chromatograms in UV light. When fumed with ammonia vapor they became bright yellow. The flavonols appeared yellow in UV light before and after fuming with ammonia. For complete identification of flavonoid glycosides, samples were separated in one-dimensional chromatograms of direct extracts and then the pure flavonoids were identified by UV spectral analysis using standard procedures of Mabry and coworkers (*The Systematic Identification of the Flavonoids*, Springer-Verlag, New York, 1970). In addition to spectral techniques, flavonoids were identified by PC (Whatman No. 1) co-chromatography of the glycosides and products of enzyme and acid hydrolyses in  $\eta$ -butanol-acetic acid-water (BAW, 4:1:5) and 50% glacial acetic acid (50% HOAc). The aglycones were identified by TLC (Merck) co-chromatography in BAW, forestal (concentrated hydrochloric acid-acetic acid-water, 3:30:10) and 30% HOAc, whereas the sugars were identified by PC co-chromatography in BAW, *h*-butanol-ethanol-water (BEW, 4:1:2.2) and toluene- $\eta$ -butanol-pyridine-water (TBPW, 5:1:3:3).

Twelve compounds were obtained in a more or less pure state by means of preparative chromatography. All species produce kaempferol and quercetin, while genkwanin and luteolin were present in *G. blotiana* C. Chr. and *G. hirta* Bl. and acacetin in *G. microphylla* R. Br. This is the first report of acacetin and genkwanin in *Gleichenia*. Acacetin was isolated as the 7-glucoside. The flavonols of *Gleichenia* leaves were found to be present as 3-glucosides, 3-rhamnoside, 3-rutinoside, 3,4'-diglucosides, 7-glucosides and 7-arabinoside. Quercetin-3-glucoside was identified as a major flavonoid component of all species studied. Quercetin-3-rhamnoside and quercetin-3,4'-diglucoside were isolated from *G. longissima* and *G. blotiana*. In addition, *G. blotiana* accumulates kaempferol-3-methyl ether-7-arabinoside, rhamnocitrin-3-glucoside and kaempferide-7-arabinoside. Kaempferol-3-rutinoside and kaempferol-7-glucoside were found in all species except *G. hirta*, which does not appear to accumulate the kaempferol derivative. The glucosides were observed as minor constituents. Two compounds which are generally rare in ferns, orientin and

vitexin, occur in *G. microphylla*. Previously, Wallace and coworkers (Amer. J. Bot. 70:207–211. 1983) studied the species of *Gleichenia* from Hawaii and found different flavonoid patterns. They found quercetin-3-rutinoside, quercetin-3-glucoside and kaempferol-3-glucoside, but they found kaempferol-3-rutinoside as well. Furthermore, quercetin-3-rutinoside was identified as a major flavonoid component of all species except *G. intermedia*, *Dicranopteris pectinata* and *Sticherus cunninghamii* (it was a minor component in the latter). Quercetin-3-glucoside and kaempferol-3-glucoside were observed as minor constituents of the two species studied. Thus, our findings are not consistent with the flavonoid profiles of the species analyzed by Wallace and co-workers (Amer. J. Bot. 70:207–211. 1983). From a chemotaxonomic viewpoint, the occurrence of kaempferol and quercetin in all species indicates a close relationship among them. However, the presence of acacetin-7-glucoside, vitexin and orientin in *G. microphylla* is of interest, since these compounds have not been found in this family before.

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