A NEW TODEA FROM NEW GUINEA WITH REMARKS ON THE GENERIC DELIMITATION IN RECENT OSMUNDACEAE (FILICES)

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INTRODUCTION

The identification of some thousands of ferns from New Guinea by the late Dr A. H. G. Alston (1940) resulted in the description of but comparatively few new species. His conclusion, that the fern flora of New Guinea 'is now fairly well known' may be right in a general way, but continuous collecting performed after his paper was published proved the existence of many more novelties. One of these is a new species of *Todea*, a representative of the *Osmundaceae*, a primitive family of ferns, which dates back to the Palaeozoicum (Hirmer, 1938).

A recent study by Hewitson (1962) about the comparative morphology of the living *Osmundaceae* inspired me to make some remarks on the delimitation of the other recent genera.

I. DESCRIPTION OF A NEW SPECIES

Todea papuana Hennipm., *spec. nov.* — **Fig. 1.**

A *Todea barbara* (L.) Moore, cui valde affinis, differt rhizomate erecto brevi (ut in *Osmunda* invenitur), frondibus c. 75 cm tantum longis, textura crassiore, pinnulis basalibus fertilibus ovato-triangularibus, 10—20 mm longis, basi c. 6 mm latis, i.e. 2—4-plo longioribus quam latis. *Todea barbara* rhizomate (sub)arborescente frondibus maioribus texturaque coriacea, pinnulis basalibus fertilibus lineari-lanceolatis, plus quam 4-plo longioribus quam latis, quam in *Todea papuana* semper angustioribus plerumque longioribus instructa.

NEW GUINEA. Terr. of New Guinea. Morobe Dist.: Edie Creek, steep, grassy bank above creek, 2135 m, 23-9-1964, *Sayers NGF 21247* (A, BRI, CANB, K; L, type; LAE).

Rhizome terrestrial, erect, short, about 6 cm wide (persistent stipular regions included). *Petioles* tufted, *c.* 30 cm long, shorter than the lamina, near the base *c.* 9, near the apex 3—4 mm thick, brownish, when young covered with brownish, woolly hairs, glabrous when mature. *Stipular region c.* 5 cm long, narrowed towards the base, with 2 firm, brown lateral wings which are strongly prolonged in the upper part. A cross-section half-way up the stipular region shows a central cilinder of brownish sclerenchyma, in which an arch-shaped leaf-trace surrounded by ground tissue with many irregularly scattered, blackish sclerenchyma strands on both sides of the trace, the brownish wing with many flabellately arranged strands of the same type. *Lamina* 35—45 by 20—25 cm, widest below or about the middle, bipinnate, texture thick, when living pale green above (Sayers' field note), brown when dried, glabrous on both sides. *Veining* open,

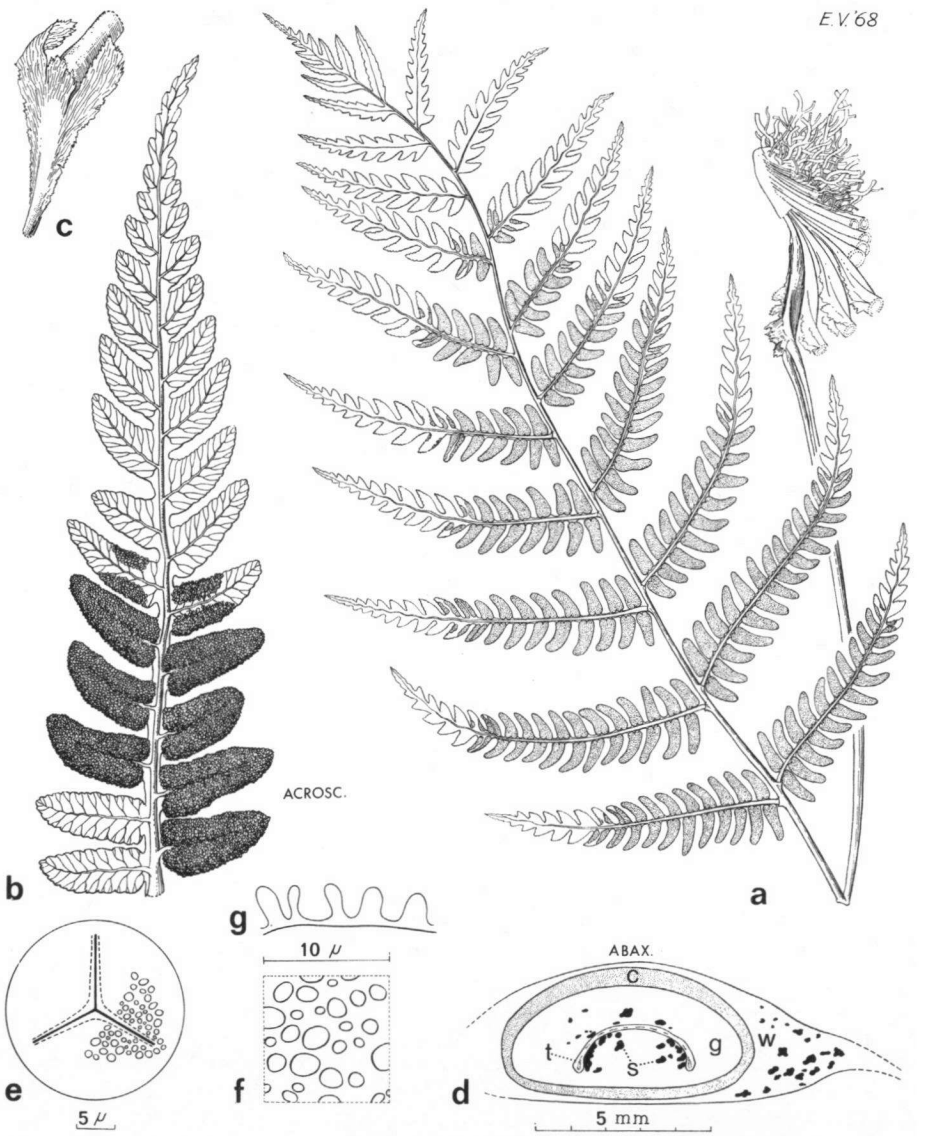

Fig. 1. *Todea papuana*. — a. Habit, × ½; b. detail of pinna with the sporangia of two of the lower pinnules removed, × 1; c. detail of stipular region, × ½; d. cross-section about half-way up the stipular region (c = cilinder of brownish sclerenchyma, g = ground tissue, s = blackish sclerenchyma strands, t = leaf-trace, w = wing); e. spore, proximal view (only part of the projections drawn); f. surface view of projections; g. id., lateral view. (From the type.)

costa and costule raised on both sides, lateral veinlets immersed, up to two times branched, reaching the margin, visible in dried material. *Pinnae* with the apical part pinnatifid, 20—22 pro leaf, up to 55 mm apart, middle pinnae 110—130 by 25—35 mm, widest below the middle, articulated to the rhachis, stalk of basal pinnae up to 5 mm long. *Pinnules* closely placed, basal ones 10—20 by *c.* 6 mm, widest near the base, often somewhat falcate, wholly adnate or slightly constricted especially at the basiscopic side, margin subentire (near the base) to crenate, apex acute to obtuse. *Terminal segment c.* 5 cm long, triangular, pinnatifid. *Sporangia* acrostichoid, on the lower surface of the veinlets of conform pinnae, the apical part of pinnae and lamina devoid of sporangia, without the stalk 350—550 μ long, stalk 150—250 μ long, annulus situated in the upper part of the sporangium. *Spores* trilete, whitish, outline in proximal view *c.* circular, 40—55 μ, with many small projections all over the outer surface except the scars.

Note. The spores are variable in shape, sometimes looking even deformed. According to Hires (1965) this is also found in fresh, unmounted spores of other *Osmundaceae*.

II. REMARKS ON THE DELIMITATION OF THE GENERA OF LIVING OSMUNDACEAE

The presence of fossil *Osmundaceae*, particularly abundant in the Rhaetic and Jurassic and strongly resembling the living ones (Walton, 1958) led Kidston and Gwynne-Vaughan (1907) and Hewitson (1962) to a detailed study of their morphology. The first two authors concentrated mainly on the fossil *Osmundaceae*, but pictured anatomical features of seven living species as well. Hewitson's detailed study was based on nearly all the living species. He concluded that of the anatomical characters studied 'only one, that of the sclerenchyma disposition in the leaf bases, appears to be reliable enough to characterize species, subgenera and genera'. Hewitson therefore proposed this character to be included in species descriptions. He also stated that 'morphological and anatomical observations support the naturalness of three subgenera in the genus *Osmunda* and suggest that *Leptopteris* could be included within the genus *Todea*'.

So the disposition of the sclerenchyma in the leaf base of *Todea papuana* had to be compared with that found in *T. barbara*, *Leptopteris*, and *Osmunda*. This was easy as Hewitson's fig. 7 gives fine drawings of this pattern in almost all the species he examined.

Cross-sections of *T. papuana* made about half-way up the stipular region of dried material softened in polyvinyl lacto-phenol (its properties were discussed by van Brummelen, 1967), have already been described and figured above (Fig. 1d). Sections made near the base were devoid of the blackish sclerenchyma strands inside the cilinder of brownish sclerenchyma; outside the cilinder, in the tissue of the wing, only a few strands were found. On the other hand, sections made in the upper part of the region just below the geniculation, showed many more sclerenchyma strands than there were to be seen in sections made about half-way. Besides, also a few-celled thick layer of these blackish sclerenchyma cells covered the abaxial side of the central cilinder. The presence and the pattern of distribution of the dark sclerenchyma strands thus show considerable variation depending on the place where the sections are made. Hewitson does not indicate the place of sectioning, but I assume they were made about half-way.

In comparing the disposition of the sclerenchyma in *Todea papuana* with that found in *T. barbara* (see Hewitson's fig. 7J) we notice that in *T. barbara* strongly developed sclerenchyma on the adaxial side of the trace is lacking. According to Hewitson this is also the difference between *T. barbara* and *Osmunda* subgenus *Plenasium*. This difference between the pattern of *T. barbara* and that of *T. papuana* and *Osmunda* subgenus *Plenasium* is in fact very slight. Moreover, it seems to me of no importance, as the drawing of

T. barbara given by Kidston and Gwynne-Vaughan (l.c., pl. VI fig. 7) does show strongly developed sclerenchyma on the adaxial side of the trace. The disposition of the sclerenchyma in the stipular region is too variable to be of much importance in distinguishing *Todea* and *Osmunda* subgenus *Plenasium*.

In *Leptopteris*, however, the situation is somewhat different (Hewitson's fig. 7K—M). It differs from *Todea* 'in lacking sclerenchyma inside of the ring and by having a band of sclerenchyma on the adaxial side of the leaf trace.'

It is also Hewitson's opinion that anatomy alone cannot be decisive for uniting *Leptopteris* and *Todea*. His suggestion was in fact based on the 'gross morphology' of the fronds.

In my opinion, however, there are gross-morphological characters which are notably different between these two genera. *Leptopteris* has thin leaves of filmy habit without stomata and with but few scattered sporangia. Furthermore, the annulus is situated near the stalk of the sporangium. *Todea* has coriaceous or thick leaves with many sporangia crowded together (as in *Osmunda*). The annulus is situated in the upper part of the sporangium.

From the data given by Hewitson in his very informative paper, supplemented by those found in *Todea papuana*, it seems probable to me that *Todea* and *Osmunda* are mutually more closely related than either of these with *Leptopteris*. Nevertheless, I fully agree with those pteridologists who recognize these three genera (Copeland, 1947; Holttum, 1949). In case one would prefer to accept two genera, it seems to me more proper to unite *Todea* with *Osmunda* (Thunberg, 1800; Brown, 1810) than to unite *Todea* with *Leptopteris* (Hooker, 1842; Allen, 1961; and suggested by Hewitson).

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