

POLYPODIACEAE

POLYPODIUM ENSIFORME, THE CORRECT NAME FOR MICROSORUM ENSIFORME (POLYPODIOIDEAE)

INTRODUCTION

In southern Africa four fern species are generally ascribed to the tribe Microsoreae of the family Polypodiaceae. Sim (1895, 1915) included them all in the genus *Polypodium* L. but Schelpe (1969a & b, 1970) placed *P. punctatum* L. and *P. pappei* Mett. ex Kuhn in *Microsorium* L. (as *Microsorium*) and *P. ensiforme* Thunb. and *P. scolopendria* Burm.f. in *Phymatodes* C.Presl. *Phymatodes*, however, is an illegitimate name and was replaced by *Phymatosorus* Pic.Serm. who placed both these species in that genus (Pichi Sermolli 1973). In an unpublished checklist of southern African pteridophytes, pending the *Flora of southern Africa*, Schelpe followed Copeland (1947) by including *Phymatosorus* (as *Phymatodes*) in *Microsorium*. This view was followed by Jacobsen (1983), Schelpe & Anthony (1986) and Burrows (1990). In her revision of the genus *Microsorium* (Bosman 1991), only *M. punctatum* (L.) Copel. was retained in the genus. The other species were either placed in *Phymatosorus* or suggested as belonging to the genus *Neocheiropteris* Christ. Although recognising their close affinity, all three of these genera are widely accepted (Ching 1933; De Vol & Kuo 1980; Tryon & Lugardon 1990; Hennipman *et al.* 1990; Bosman 1991). Nootboom (1997), however, placed the last-named genera in synonymy under *Microsorium*. He also, quite erroneously, placed *M. ensiforme* (Thunb.) Schelpe in synonymy under *M. scolopendria* (Burm.f.) Copel.

In view of these varied opinions it was thought necessary to review the southern African taxa ascribed to this group of ferns.

MATERIAL AND METHODS

Sections of rhizomes and fronds were obtained from plants cultivated at Kirstenbosch National Botanic Garden. Samples were also taken from specimens housed in the Compton Herbarium from both the NBG and SAM collections. Leaf clearings were prepared using household bleach. Illustrations were prepared using a drawing tube fitted to an Olympus CH-2 light microscope.

DISCUSSION AND CONCLUSION

Microsorium was placed in the subfamily Microsorioideae of the Polypodiaceae (Nayar 1970) but this generic assemblage was amended and the redefined group reduced to tribal level (Tu 1981). The group is currently defined as terrestrial, epilithic or epiphytic plants with a creeping, dorsoventrally flattened rhizome that bears basally attached or peltate, clathrate paleae. The lamina is simple or pinnately dissected with entire or sinuate margins. The venation forms a complex reticulum with free, simple or branched, recurrent and excurrent veinlets in the areoles. The veinlets mostly terminate in a

hydathode. Sori are irregularly scattered or they are variously arranged but always occur at a plexus of connectives or at a plexus of distinct soral veins and connectives (Figure 8A). Paraphyses are mostly simple and uniseriate but peltate paraphyses occur in a few species. The spores have plain, irregularly rugate or tuberculate surfaces often with small papillae and globules. The ultrastructure of the exospore is described by Hennipman & Roos (1983).

Many of the characters that define the Microsoreae are not unique to the group but also occur in other groups within the Polypodioideae. As a result, the definition and circumscription of monophyletic groups within the subfamily is varied and still much debated. The microsorioid ferns, however, are widely accepted as a group of ferns with a common descent (Copeland 1947; Nayar 1970; Hetterscheid & Hennipman 1984; Bosman 1991; Nootboom 1997). Perhaps the most diagnostic feature of the Microsoreae is its venation pattern and soral innervation that has been studied in great detail by Hetterscheid & Hennipman (1984) and Bosman (1991).

The venation pattern and soral innervation of *M. pappei*, *M. punctatum* and *M. scolopendrium* are typically that of microsorioid ferns. In *M. ensiforme*, however, the veins form costal areoles and to a lesser degree smaller areoles near the margin (Figure 8E, F). The costal areoles are very prominent and contain an excurrent, simple or branched, free veinlet. In some instances this anadromous vein anastomoses with a tertiary vein to form a narrow rectangular secondary areole. Apart from the soral veins, free veinlets are rarely formed in any of the areoles, but excurrent ones do form along the margin. Some veins may end in an inconspicuous enlarged vein ending, while others do not. The sori are superficial, adaxially pustulate, circular, and up to 5 mm diam. They are positioned in a single row on either side of the primary vein and/or costa at a plexus of a distinct branched excurrent soral veinlet. A single sorus occurs within each costal areole (Figure 8F). This venation pattern and type of soral innervation does not occur in any of the known *Microsorium* species nor does the pattern correspond with that of the Microsoreae as currently defined. It is therefore suggested that *M. ensiforme* be removed from the Microsoreae and placed in the Polypodeae.

Generic delimitation within the Polypodeae, especially the *Polypodium-Microgramma-Pleopeltis* complex is problematical (De la Sota 1973; Mitsuta 1984). The last-mentioned two genera are often treated as subgenera of *Polypodium* (Stolze 1981; Proctor 1989) whereas others, although realising their close affinity, treat them as distinct (Copeland 1947; Holttum 1954; Tryon & Tryon 1982). Hennipman *et al.* (1990) treat these genera as tentative groups of *Polypodium*. The close affinity of these genera is emphasised by the occurrence of natural hybrids between *Polypodium* and *Pleopeltis* (Anthony & Schelpe 1985; Mickel & Beitel 1987) and *Polypodium* and *Microgramma* (Gómez 1975). Ribulose-1, 5 biphosphate carboxylase (RbcL) data, however, support the



FIGURE 8.—Indumentum, venation, soral innervation and paraphyses in A, *Microsorium punctatum*; E, F, H, Hh, *Polypodium ensiforme*; G, L, Ll, M, N, P, *vulgare*; C, D, I, li, J, Jj, K, *Pleopeltis macrocarpa* and B, O, Oo, P, Q, *Microgramma lycopodioides*. A–G, venation and soral innervation; H, Hh, I, li, L, Ll, O, Oo, rhizome paleae; M, N, P, K, lamina indumentum; J, Jj, Q, paraphyses. A, Roux 603 (NBG); B, Van Jaarsveld 2158 (NBG); C, D, Roux 2770 (NBG); E, F, H, Hh, Roux 1997 (NBG); G, Roux 2336 (NBG); I, li, J, Jj, Roux 439 (NBG); K, Roux 2274 (NBG); L, Ll, M, N, Matthews 1032 (NBG); O, Oo, P, Roux 665 (NBG); Q, Buitendag 533 (NBG). Scale bars: A–G, 5 mm; H, I, L, O, 0.25 mm; Hh–Jj, Ll, Oo, 0.2 mm; J, K, N, 0.1 mm; M, 0.25 mm; P, 0.25 mm; Q, 0.2 mm.

TABLE 1.—Comparative morphology of *Polypodium ensiforme*, *Polypodium*, *Pleopeltis* and *Microgramma*

	<i>Polypodium ensiforme</i> (Figure 8E, F, H, Hh)	<i>Polypodium</i> (Figure 8G, L, LI, M, N)	<i>Pleopeltis</i> (Figure 8C, D, I, II, J, Jj, K)	<i>Microgramma</i> (Figure 8B, O, Oo, P, Q)
Rhizome paleae	basally attached centrally clathrate	basally attached/peltate non-clathrate/centrally clathrate/clathrate	peltate non-clathrate/clathrate	peltate non-clathrate/clathrate
Lamina	non-comose pinnatifid monomorphic serrate	non-comose simple/variously pinnately dissect monomorphic/subdimorphic entire/serrate/crenate	comose/non-comose simple/pinnately dissect subdimorphic/dimorphic entire	non-comose simple subdimorphic/dimorphic entire
Lamina indumentum adaxial	glabrous	glabrous/uniseriate 2-celled hairs	uniseriate 2-celled hairs & peltate clathrate paleae	glabrous
abaxial	glabrous	glabrous/uniseriate 2-celled hairs	uniseriate 2-celled hairs & peltate clathrate paleae	glabrous/filamentous paleae
Lamina hairs	—	epodioid	podiod	—
Venation	areolate goniophlebiod	areolate/not free/goniophlebiod	reticulate reticulate	areolate/reticulate goniophlebiod/reticulate
Hydathodes	absent/present	absent/present	absent	absent
Stomata	anomo-/polocytic	anomo-/polocytic	polocytic	polo-/coplocytic
Sori	single row areole layered	single row/ storeyed areole layered	single row not areole layered	single row areole layered/not
Soral innervation	single free forked vein from secondary vein	free anadromous vein branch/ single simple free vein from secondary vein or from connectives/two (rarely three) simple free veins from connectives	vein plexus	vein plexus/simple free vein from secondary vein/two or three free veins from connectives
Paraphyses	simple uniseriate hairs	absent/simple uniseriate hairs/ peltate clathrate paleae	absent/peltate clathrate paleae	uniseriate (often glandular) hairs/narrow paleae
Spores	verrucate	verrucate/tuberculate/papillate/ globulate	verrucate/sparsely globulate	papillate/coarsely verrucate/ tuberculate

boundary between *Polypodium* and *Pleopeltis* (Haufler & Ranker 1995).

In the Polypodeae, as in the Microsoreae, the characters that define generic boundaries are mostly shared. The position of *M. ensiforme*, henceforth referred to as *Polypodium ensiforme*, in the *Polypodium-Pleopeltis-Microgramma* assemblage is therefore not clear. Table 1 summarises some of the most important morphological characters of *P. ensiforme* and that of the *Polypodium-Pleopeltis-Microgramma* assemblage.

Based on the data provided in Table 1, it is evident that *P. ensiforme* indeed belongs to *Polypodium* rather than *Pleopeltis* or *Microgramma*, as their characteristics are all identical. The inclusion of *P. ensiforme* in *Goniophlebium* C.Presl as suggested by Fée (1852) and defined by Rödl-Linder (1990) is not supported by the venation pattern, spore morphology and distribution of that genus.

Tribus Polypodeae

***Polypodium ensiforme* Thunb.**, *Prodromus plantarum capensium*: 172 (1800); Sim: 272 (1915). *Margitaria ensiformis* (Thunb.) C.Presl: 188 (1836). *Phlebo-dium ensiformis* (Thunb.) J.Sm.: 59 (1841). *Goniophlebium ensiforme* (Thunb.) Fée: 255 (1852). *Phymatodes ensiformis* (Thunb.) Schelpe: 135 (1969b); Jacobsen: 316 (1983). *Phymatosorus ensiformis* (Thunb.) Pic.Serm.: 459 (1973). *Microsorium ensiforme* (Thunb.) Schelpe: 151 (1982); Schelpe: 165, t. 51, fig. 2, 2a (1986); Burrows: 202, t. 46, fig. 205 (1990), as '*Microsorium*'. Type: Grootvadersbosch, Thunberg s.n. (UPS-THUNB24492, holo.).

Tribus Microsoreae

***Microsorium pappei* (Mett. ex Kuhn) Ching** in Bulletin of the Fan Memorial Institute of Biology, Botany 4: 295 (1933); Jacobsen: 313 (1983); Schelpe: 163, t. 51, fig. 1, 1a (1986); Burrows: 199, t. 46, fig. 202 (1990). *Polypodium pappei* Mett. ex Kuhn: 150 (1868); Sim: 277, t. 141, fig. 1 (1915). Types: Prom. bon. spei. Caffraria, Rawson s.n. (BM, ?isosyn.); Natalia, Sander-son s.n. (K, ?isosyn.).

***Microsorium punctatum* (L.) Copel.** in University of California Publications in Botany 16: 111 (1929); Jacobsen: 312 (1983); Schelpe: 163 (1986); Burrows: 199, t. 46, fig. 203 (1990), as '*Microsorium*'. *Acrostichum punctatum* L.: 1524 (1763). *Polypodium punctatum* (L.) Sw.: 21 (1802), non Thunb. (1784); Sim: 165, t. 145, fig. 2 (1915). *Pleopeltis punctata* (L.) Bedd.: 22 (1876). Type: China, Fothergill s.n. (Lost).

***Microsorium scolopendria* (Burm.f.) Copel.** in University of California Publications in Botany 16: 112 (1929); Jacobsen: 314 (1983); Schelpe: 165 (1986); Burrows: 200, t. 46, fig. 204 (1990), as '*Microsorium scolopendrium*'. *Polypodium scolopendrium* Burm.f.: 232 (1768). *Phymatodes scolopendria* (Burm.f.) Ching: 63

(1933). *Phymatosorus scolopendria* (Burm.f.) Pic.Serm.: 460 (1973). Type: India, *Herb. Burmann* (G, holo.). *Polypodium phymatodes* L.: 306, 307 (1771), nom. illeg.; Sim: 273, t. 138 (1915). Type: Habitat in India orientali, sine coll. s.n. (LINN 1251.6, holo.).

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ASTERACEAE

A NOTE ON THE GENUS *PHILYROPHYLLUM*

Anderberg (1991) in his generic revision of the tribe Gnaphalieae (Asteraceae), described the capitula of the genus *Philyrophyllum* O.Hoffm. as epaleate. However, Hoffmann (1890) and Merxmüller (1967) described them as being paleate. Material from herbarium specimens housed in PRE was dissected to investigate this matter and it became clear that the capitula are in fact paleate. Anderberg agreed on these results (pers. comm.). The key to the genera presented by Anderberg (1991) is still a problem, as the genus *Philyrophyllum* is keyed out under the group containing epaleate capitula. The key and the description of the genus will be corrected in the *Seed plants of southern Africa* (in prep.).

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RUBIACEAE

A NEW SPECIES OF *PAVETTA* FROM THE SOUTPANSBERG, SOUTH AFRICA

Pavetta tshikondeni N.Hahn, sp. nov., *P. catophyllae* K.Schum. affinis sed lobis calycis ensiformibus non triangularibus et floribus fructibusque in cymis laxioribus dispositis differt; fortasse *P. gracillimae* S.Moore affinis, species sylvarum oriente meridieque regionis Zimbabwe dictae habitu tenniore lobisque calycis anguste triangularibus non ensiformibus.

TYPE.—Northern Province, 2231 (Messina): Makhuya Park, World's View, 22° 30' 24.1" S and 31° 01' 59.6" E (WGS 84 mapping datum), (–CA), 300 m, 27-01-1997, (in flower), N. Hahn 1367 (K, holo.; PRE, Herb. Sout., iso.).

Multistemmed shrub up to 2 m tall. *Bark* pale to dark grey, smooth. *Branches* when young, covered with a white indumentum, becoming glabrous with age. *Leaves* opposite, obovate to spatulate, up to 78 × 22 mm, apex obtuse to rounded, base attenuate to obtuse, upper surface pale green and sparsely hairy, lower surface grey-

green and hairy, bacterial nodules randomly scattered on leaf lamina, domatia absent, principal lateral veins 5–8 pairs; petiole up to 2 mm long (Figure 9). *Inflorescences* of terminal cymes, borne on slender lateral branches up to 700 mm long; peduncle hairy; pedicels 0–3 mm long, hairy (Figure 10). *Flowers* white, 4-merous. *Calyx* lobes ensiform, fused at base, up to 9.0 × 0.5 mm, hairy. *Corolla* sparsely hairy on both surfaces; tube up to 15 mm long; lobes 6 × 2 mm, apices obtuse to acute. *Anthers* exserted, 4–5 mm long. *Style* 25–30 mm long. *Disc* glabrous. *Hypanthium* (part fused with inferior ovary) up to 1.5 mm long. *Fruit* a fleshy berry, spherical, up to 5 mm diam., turning black when ripe; calyx lobes persistent, forming a crown at apex.

Distribution and habitat

Pavetta tshikondeni is associated with *Androstachys* woodland on soils derived from Karoo Supergroup