

# Nomenclatural changes and additions to the genus *Ophioglossum* in Africa (Ophioglossaceae: Pteridophyta)

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**Keywords:** Africa, new combination, new species, *Ophioglossum*, Pteridophyta, taxonomy

## ABSTRACT

Recent research has necessitated a review of the nomenclature of the genus *Ophioglossum* in Africa. This paper establishes a new species, *O. caroticaule* J. E. Burrows, a new subspecies, *O. vulgatum* L. subsp. **africanum** Pocock ex J. E. Burrows, and a change in status, *O. latifolium* (Prantl) J.E. Burrows (basionym: *O. gomezianum* var. *latifolium* Prantl). Lectotypification is provided for *O. gracillimum* Welw. ex Hook. & Bak., *O. lusoáfricanum* Welw. ex Prantl, *O. latifolium* (Prantl) J.E. Burrows, and *O. rubellum* Welw. ex A. Braun. Nomenclatural problems in *O. lancifolium* Presl are discussed.

## UITTREKSEL

Onlangse navorsing het 'n hersiening van die nomenklatuur van die genus *Ophioglossum* in Afrika noodsaaklik gemaak. 'n Nuwe spesie, *O. caroticaule* J.E. Burrows, 'n nuwe subspesie, *O. vulgatum*, L. subsp. **africanum** Pocock ex J.E. Burrows, en 'n verandering in status, *O. latifolium* (Prantl) J.E. Burrows (basioniem: *O. gomezianum* var. *latifolium* Prantl), word in hierdie artikel beskryf. Lektotipifikasie word verskaf vir *O. gracillimum* Welw. ex Hook. & Bak., *O. lusoáfricanum* Welw. ex Prantl, *O. latifolium* (Prantl) J.E. Burrows, en *O. rubellum* Welw. ex A. Braun. Nomenklatoriese probleme in *O. lancifolium* word bespreek.

## INTRODUCTION

The genus *Ophioglossum* L. has received no taxonomic attention in Africa since Clausen's (1938) confusing monograph of the genus. The simple morphological structure of the plants together with apparently considerable intraspecific variation has caused compilers of African regional floras to either follow Clausen's nomenclature or assume a conservative stance by maintaining broadly circumscribed species which, in the light of recent studies, are often composed of two or more clearly distinct taxa.

The most important development since Clausen's work is the publication by Wagner & Wagner (1983) of their 'genus communities' concept, based upon work on the genus *Botrychium* Swartz (Ophioglossaceae) in North America. This concept made use of the fact that *Botrychium* (like *Ophioglossum*) frequently grows together in multiple species communities and, when this occurs, one is able to make rational comparisons between taxa occurring within a community, particularly if these differences are maintained in communities found elsewhere under different edaphic and climatic conditions. This concept has provided taxonomists with a valuable additional tool with which to distinguish between environmentally-induced variation and differences that are genetically controlled.

During recent studies, the senior author has discovered an unique area in northwestern Zimbabwe which supports 11 species of *Ophioglossum*. Additional genus communi-

ties have since been located in both Zimbabwe and South Africa which have made a better delimitation and definition of the southern African species of *Ophioglossum* possible. However, these studies have resulted in the need to revise the nomenclature of several of the taxa occurring on the African subcontinent.

## DISCUSSION

In 1983, the senior author collected nine species of *Ophioglossum* growing within an area of about six square kilometres in the Sengwa Wildlife Research Area of northwestern Zimbabwe. Subsequent collecting at Sengwa has yielded a further two species, bringing the total to eleven, a situation not recorded to date elsewhere in the world for the genus *Ophioglossum*. Additional genus communities have been discovered by the senior author on Ngomakurira, northeastern Zimbabwe (6 species), Elim Hospital, eastern Zimbabwe (4 species), Treur River, eastern Transvaal (5 species) and several communities composed of two or three species each. These localities occur on various substrates (sandstone, granite, quartzite and dolomite) and under varying climatic conditions, and the consistent differences displayed between members of these genus communities have allowed for clearer definitions to be established between taxa.

However, the specific concepts within the African members of *Ophioglossum* entrenched by Tardieu-Blot (1953, 1964) and Schelpe (1970, 1977) do not adequately cover the number of taxa that are evident from genus community studies. This was noted by Dr Mary Pocock of Grahamstown who spent much time studying the South African species of *Ophioglossum*. She recorded her concepts in a manuscript which unfortunately was never pub-

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lished. The author's studies corroborate some of Pocock's species concepts and one of her taxa is published below.

Spore morphology is a valuable taxonomic tool within the southern African species of *Ophioglossum* even though it cannot be readily employed for rapid determinations in herbaria.

### 1. The *Ophioglossum lancifolium* aggregate

#### Key to species

- 1a Trophophore linear with a length:width ratio >10:1; trophophore frequently falcate . . . . . *O. gracillimum*  
 1b Trophophore narrowly lanceolate to narrowly elliptic with a length:width ratio <10:1; trophophore not falcate:  
 2a Old rhizomes strongly linear, with a length:width ratio >6:1; spore wall lumina distinct, muri clearly reticulate . . . . . *O. lusoaffricanum*  
 2b Old rhizomes short or ellipsoid, with a length:width ratio <6:1; spore wall lumina reduced to conical pits:  
 3a Trophophore linear-elliptic, length:width ratio >6:1; rhizome ellipsoid . . . . . *O. caroticaule*  
 3b Trophophore elliptic, length:width ratio <6:1; rhizome linear . . . . . sp. aff. *O. lancifolium*

1.1. *Ophioglossum caroticaule* J.E. Burrows, sp. nov., ab *O. gracillimum* sporis aletis et trophophoris majoribus et latoribus differt; etiam *O. lusoafricano* similis sed rhizomate brevi et latiore, trophophoro apiculato et sporis lumina parva et conica ostendentibus differt.

TYPUS.—Zimbabwe: Gokwe Dist., Sengwa Wildlife Research Area, Leguaan Vlei, 880 m, 11-2-1991, J.E. & S.M. Burrows 5153 (K, holo.; PRE, SRGH, iso.). Figures 1; 2A, B.

*Rhizome* 4–14 × 2.0–3.5 mm (ratio 2.6:1), ellipsoid, with wiry, semi-descending roots which are rarely proliferous. *Stipe* 18–40 mm long, ± 0.5 of its length subterranean, dead stipes sometimes slightly persistent. *Trophophore* usually solitary, erect, 14–39 × 2.5–5.0 mm (ratio 7.2:1), very narrowly elliptic, sterile trophophore flat, fertile trophophore shallowly folded, apex sharply apiculate, venation linear, epidermal cell walls sinuous, stomata anomocytic. *Sporophore* 40–60 mm long, bearing (6–)12–15(–19) pairs of sporangia. *Spores* alete, 43–49 µm in equatorial diameter, muri thick, ± 3 µm wide, continuous and somewhat undulate, lumina conical, 1.5–2.3 µm wide, proximal surface concave, pitted (Figure 2A, B).

This taxon was included under *O. lancifolium* s.l. which comprises three or more species in Africa. It closely resembles *O. lusoaffricanum* but is clearly differentiated from it by the spores with their conical lumina, and the short, ellipsoid rhizome. The apex of the trophophore is generally sharply apiculate compared to the acute apex of *O. lusoaffricanum*. *O. gracillimum* is separated from *O. caroticaule* by its trilete and smaller spores, 27–38 µm in equatorial diameter (Figure 2D, E), and its much narrower and slightly falcate trophophore.

*Ophioglossum caroticaule* appears, from the few known collections, to be a species of shallow, sandy or humic loams which are seasonally moist or wet, growing among sparse, short grasses in subtropical deciduous

woodland or on open sheetrock on seasonally wet vegetation islands. It is a gregarious species and, in all populations so far seen in the field, grows with either *O. lusoaffricanum*, *O. gomezianum* Welw. ex A. Br., *O. rubellum* Welw. ex A. Br. or *O. costatum* R. Br.

#### Specimens examined

(Localities identified in terms of grid reference system—see Edwards & Leistner 1971.)

ETHIOPIA.—0539: Sidamo, Bitata, 20 km from Negele on road to Menghist, 1 450 m, 24-5-1983, Gilbert, Ensermu & Vollesen 7762 (K).

KENYA.—0237: K4 Machakos, Nairobi-Mombasa Road, 7.4 km towards Nairobi from Hunter's Lodge, 960 m, 6-1-1972, Faden & Faden 72/18 (K, MO).

ZAMBIA.—0831: Abercorn Dist., old road to Cascalawa, 16-2-1960, Richards 12480 (K).

ZIMBABWE.—1828 (Gokwe): Gokwe Dist., Sengwa Wildlife Research Area, Leguaan Vlei, 13-2-1983, Burrows 3016 (J.E.B. Herb.); 11-2-1991, Burrows & Burrows 5153 (K, holo., PRE, SRGH). 2027 (Plumtree): Matopo Hills, Bulalima-Mangwe, Embakwe, (–DD), 10-5-1942, Feiertag s.n. (BM, SRGH). 2028 (Bulawayo): Matopo Hills, Bulalima-Mangwe, Greystone, (–CA), 1-5-1939, Feiertag s.n. (BM, SRGH).

#### SOUTH AFRICA

TRANSVAAL.—2429 (Zebediela): Potgietersrus, Percy Fyfe Nature Reserve, (–AA), 1 500 m, 22-2-1971, Huntley 2013 (PRE). 2430 (Pilgrim's Rest): Bourke's Luck, Goedgeloof Plantations, Treur River, (–DB), 1 200 m, 27-12-1990, Burrows 5113 (J.E.B. Herb.).

1.2. *Ophioglossum gracillimum* Welw. ex Hook. & Bak., Synopsis filicum: 445 (1868); Burrows: 40 (1990); Johns: 8 (1991). Type: Angola, Pungo Andongo, near Catete, Jan. 1857, Welwitsch 36 (BM, lecto!; K!, LISU, iso.).



FIGURE 1.—*Ophioglossum caroticaule*, Burrows 3016, Sengwa Research Area, Zimbabwe.



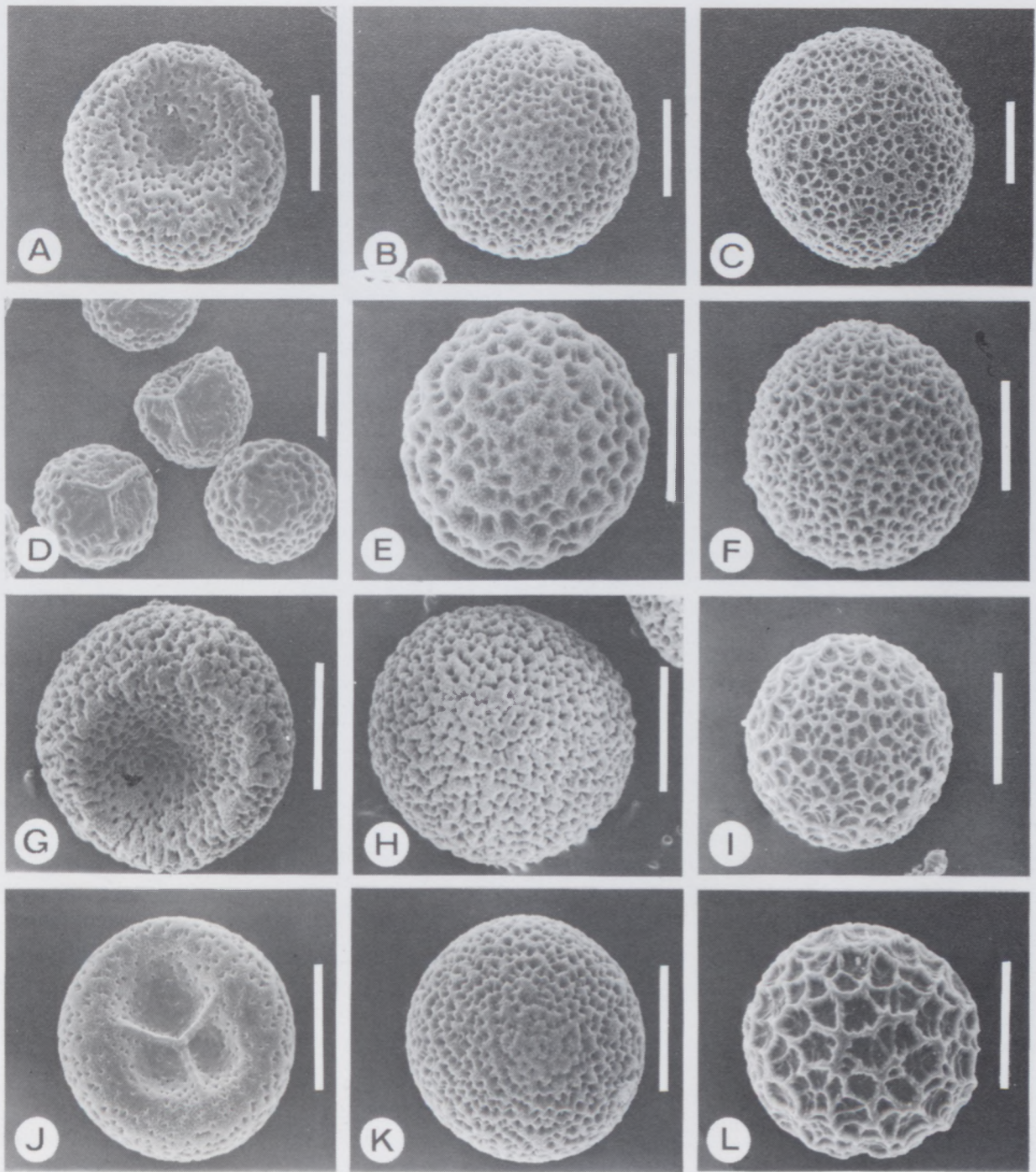


FIGURE 2.—Spores of *Ophioglossum*. *O. caroticaule*, J.E. & S.M. Burrows 5153: A, proximal, B, distal. *O. lusoaffricanum*: C, J.E. & S.M. Burrows 5147, distal; F, Burrows 4949, distal. *O. gracillimum*, J.E. & S.M. Burrows 5138: D, proximal, E, distal. *O. sp. aff. lancifolium*, J.E. & S.M. Burrows 5158: G, proximal, H, distal. *O. vulgatum* subsp. *africanum*, J.E. & S.M. Burrows 5122: I, proximal, K, distal. *O. convexum*, J.E. & S.M. Burrows 5213: L, distal. Scale bars: 20  $\mu$ m.

*O. lusitanicum* L. var. *gracillimum* Welw. ex A. Br.: 177 (1868).

*O. gramineum* Willd., sensu Schelpe: 34 (1977).

Although the collection *Welwitsch 36* is repeatedly quoted as the type material of this species, no single element has been selected from what are, by Welwitsch's own admission (on the BM sheet), several different collections, albeit from the same area or locality. After his initial gathering in January 1857, to which he allocated the number 36, Welwitsch apparently re-collected this species on three occasions. Subsequent collections made in February were then numbered 36a, 36b and 36c and the BM sheet bears plants from all four gatherings. Since the January

collection (No. 36) is the first collection, and is typical of the species, the group of seven central plants immediately above the brown label on the sheet housed in BM, is hereby selected as the lectotypic element for the name of the species, with isotypic specimens in K and LISU.

The practice of placing Welwitsch's species under the superficially similar Australo-Asian species *O. gramineum* (Prantl 1883; Carruthers 1901; Clausen 1938; Tardieu-Blot 1953, 1964; Schelpe 1977) is, in my opinion, unfounded and *O. gracillimum* is hereby maintained as a clearly defined species confined to Africa.



*Distribution:* Ghana, Tanzania, Angola, Zimbabwe, South Africa (Transvaal).

1.3. ***Ophioglossum lusoaffricanum* Welw. ex Prantl** in *Berichte der Deutschen Botanischen Gesellschaft* 1: 351 (1883); Pichi Sermolli: 641 (1954); Faden: 25 (1974). Type: Angola, Pungo Andongo, *Welwitsch 34* (B, holo. [destroyed]; BM!, neo.; K!, LISU, iso.).

Soon after the publication of Welwitsch's epithet, the taxon was sunk into *O. gramineum* Willd. by Clausen (1938) who then, in July 1939, annotated Welwitsch's sheet of *O. lusoaffricanum* in Kew as *O. lancifolium* Presl. In southern Africa, Schelpe (1970) and Schelpe & Anthony (1986) have retained the epithet *O. lancifolium* for all species of *Ophioglossum* with a narrowly elliptic to lanceolate trophophore which is held clear of the ground on a distinct stipe. Recent studies have shown that there are three distinct taxa that display these general characters within south-central Africa. *O. caroticaule* (described above) appears to be rare. The most common species is a taxon with a rather variable trophophore shape and size but with two characters which clearly differentiate it from what is believed to be typical *O. lancifolium*: spore sculpturing (Figure 1A & B) and rhizome shape. This common taxon matches perfectly Welwitsch's *O. lusoaffricanum*, a fact also recognized by Pichi Sermolli (1954) and Faden (1974). What is thought to be true *O. lancifolium* is recorded from central Africa but is not recorded from south of the 20°S line of latitude, being apparently confined to the Zambezi phytogeographical region (White 1983).

In his type description, Prantl (1884) quotes a specimen in Berlin as the type collection. Since all Berlin's *Ophioglossum* material was destroyed during World War 2, a neotype must be selected.

All the sheets seen of *Welwitsch 34* in K and BM comprise more than one gathering. Although probably all of the same species, in a genus with species so poorly differentiated as *Ophioglossum*, it is essential that a single gathering is selected as the type to avoid taxonomic ambiguity. Therefore the top collection on the sheet in BM, composed of nine plants collected in January 1857, is hereby selected as the neotype of *O. lusoaffricanum*.

*O. lusoaffricanum* displays a confusing trait whereby the first emerging trophophore from a root sucker is frequently ovate to orbicular and appressed to the ground, thereby resembling *O. convexum* J. E. Burrows. These small, ovate forms may sometimes produce fertile spikes, giving the impression that there are two topographic species. However the spore pattern of the two species is quite different (Figure 2C, F, I, L) with *O. convexum* being consistently trilete and *O. lusoaffricanum* being alete or trilete, or rarely monolete. The spore sculpturing of *O. convexum* is variable which may indicate hybrid activity in some forms.

1.4. ***Ophioglossum lancifolium* Presl**, *Supplementum tentaminis pteridographiae* (1845). Type: Mauritius, *Du Petit-Thouars s.n.* (PR, holo., P!, iso.?).

*O. lancifolium* is a name that has been widely applied to any species of *Ophioglossum* in tropical Africa that

bears a narrow trophophore well clear of the ground (Schelpe 1970; Tardieu-Blot 1953; Jacobsen 1983). Although plants which roughly correspond to Thouars' plants have been collected in central Africa, the status of *O. lancifolium* cannot be verified on the African mainland until good topotypic material is located from Mauritius. The extant specimens in Paris collected by Du Petit-Thouars from Mauritius are extremely poor and inadequate for a sound comparison. Specimens from mainland Africa share the same trophophore shape, the same rhizome form and (possibly) the same spore ornamentation (Figure 2G, H). However it is vital that live plants are seen and collected from Mauritius before the African taxon can be equated with the type of *O. lancifolium*. Unfortunately Lorence, in his survey of the pteridophytes of Mauritius (1978), records against *O. lancifolium*: 'not seen recently'.

The distribution of the African taxon currently attributable to *O. lancifolium*: Angola, Namibia, Botswana, Zambia, Zimbabwe.

2. ***Ophioglossum latifolium* (Prantl) J.E. Burrows**, stat. nov.

*O. gomezianum* Welw. ex A. Br. var. *latifolium* Prantl in *Jahrbuch des Königlichen Botanischen Gartens und des Botanischen Museums zu Berlin* 3: 307-333 (1884). Type: Angola, Pungo Andongo, near Catete, Feb. 1857, *Welwitsch 32* (K, lecto!., the right-hand specimen here designated; BM!, LISU, iso.).

*O. latifolium* most closely resembles *O. rubellum* Welw. ex A. Br. (with which it is most frequently confused) but differs in its much larger size, its more slender rhizome with wider-spreading proliferous roots, the lack of orange pigmentation in the pedicel and trophophore, and its completely different spore ornamentation.

Up to now we have thought that this taxon could be a hybrid since three spore samples examined have all had malformed or undeveloped spores. This fact is also noted by Prantl in his original description where he states 'spora degenerae'. However, apparently normal spores have been found in some collections which, together with this species' wide distribution, suggests that it is probably a stabilised hybrid with a very low percentage of viable spores produced. This is borne out by the populations seen being extremely localised and of obvious clonal origin. Nonetheless, there is no reason not to consider it a good species.

There seems to be no valid reason to assume that *O. latifolium* is allied to *O. gomezianum* since it shares very few characters with the latter species. Most noticeably, it lacks the suborbicular or ellipsoid rhizome that is typical of *O. gomezianum*, whereas its consistently broader trophophores which are held almost flat on the ground, clearly separate it from *O. gomezianum*, and the taxon is therefore elevated to species level.

Although no holotype was designated by Prantl in his description, Schelpe (1977) illegitimately quotes the Kew collection as the holotype. The Kew sheet comprises two collections and the right-hand collection on the Kew sheet is hereby selected as the lectotype of the name *O. latifol-*



*ium*. Ballard's determination of that collection as *O. costatum* is incorrect.

**Distribution:** Sierra Leone, Nigeria, Kenya, Zaïre, Angola, Zambia, Zimbabwe.

**3. *Ophioglossum vulgatum* L. subsp. *africanum* Pockock ex J.E. Burrows**, subsp. nov., ab *O. vulgato* subsp. *vulgato* sporis glabrioribus reticulo murorum tenuiore aequabiliore luminisque fovearum conicis  $\pm$  1.0–1.5  $\mu$ m latis diminutis differt.

**TYPUS.**—2929 (Underberg): South Africa, Natal, Bergville Dist., Cathedral Peak Forest Research Station, Catchment 9, (–AB), 1 905 m, 9-1-1951, *Killick 1267* (NU, holo.; PRE, iso.).

The epithet *vulgatum* has been generally applied to southern African species of *Ophioglossum* that are morphologically very similar to the north temperate *O. vulgatum* L. During a recent study of the genus in Africa, numerous SEM photographs have been made of spores of the southern African taxon, which has revealed a striking difference in spore morphology between the northern and southern hemisphere taxa. The spore morphology of *O. vulgatum* has been well documented in Europe (Paul 1987; Ferrarini *et al.* 1986) and Asia (Kurita 1981; Nakamura & Shibasaki 1959; Pant & Misra 1975). All these studies reveal spore ornamentation characterised by a very irregular and coarse reticulum of muri rising up to shallow points resulting in a distinctly jagged profile.

In contrast, all the spores of the southern African taxon examined have a relatively uniform and fine reticulum which, in profile, is smooth (Figure 2J, K), lacking the jagged reticulum of the northern hemisphere taxon. Spore size, however, does not differ greatly [southern Africa: (27–)33–45(–60)  $\mu$ m; Europe/Asia: (28–)34–40(–47)  $\mu$ m] although the southern African material tends to be slightly larger.

Pockock, in her unpublished manuscript on southern African *Ophioglossum*, describes the southern African material of *O. vulgatum* as a subspecies of the typical material, based, as she puts it, 'largely upon geographical considerations'. This, in itself, is not sufficient grounds for taxonomic distinction; however, the additional information now available on spore morphology supports this separation, and the southern African material (none of the specimens examined for spore pattern have shown any resemblance to the northern hemisphere subspecies) is now regarded as a separate subspecies. Spores of *O. vulgatum* from East Africa have not yet been examined.

#### *Selected specimens examined*

Note: specimens of which spores have been examined by SEM are marked with an asterisk \*.

**ZIMBABWE.**—1731 (Harare): Domboshawa, (–CA), 26-3-1983, *Burrows 3037* (SRGH, J.E.B. Herb.). 1828 (Gokwe): Gokwe Dist., Sengwa Wildlife Research Area, Froggy Pond, (–AA), 10-2-1991, *Burrows & Burrows 5144\** (K, MICH, NU, PRE, SRGH, TI); Leguaan Vlei, (–AA), 11-2-1991, *Burrows & Burrows 5155\** (J.E.B. Herb., TI). 1832 (Mutare): Nyanga National Park, (–BD), 16-1-1951, *Chase 3758\** (BM, BOL, SRGH). 1932 (Melsetter): Chimanimani Mts. Bundi Plain, (–DD), 26-10-1959, *Goodier & Phipps 280* (BM, PRE, SRGH).

**TRANSVAAL.**—2230 (Messina): Funduzi, (–CD), 21-1-1931, *Bremekamp & Schweickerdt 321* (PRE). 2328 (Baltimore): Blouberg, (–BB), 11-1-1955, *Codd & Dyer 8979* (PRE). 2430 (Pilgrim's Rest): Graskop, The Pinnacle, (–DD), 2-1-1961, *Braithwaite 203\** (BOL). 2530 (Lydenburg): 0.25 km N of Sabie, (–BB), 30-12-1990, *Burrows & Burrows 5122\** (K, MICH, PRE, TI); Kaapsehoop village, (–DB), 19-12-1990, *Burrows & Burrows 5093\** (K, MICH, PRE, TI).

**NATAL.**—2730 (Vryheid): Utrecht, (–AD), 3-11-1985, *Devenish 1884* (PRE). 2929 (Underberg): Fort Nottingham Commonage, (–BD), 30-10-1987, *Goldblatt & Manning 8510* (MO, PRE). 2930 (Pietermaritzburg): New Hanover/Mapumulo, Kingcliffe, (–BD), 5-1-1965, *Moll 1519* (PRE). 3029 (Kokstad): Alfred Dist., Weza, southern slopes of Ingeli Mtn, (–DA), 2-1-1966, *Strey 6395* (BR, K, NU, PRE).

**4. *Ophioglossum rubellum* Welw. ex A. Br.** in Kuhn, *Filices africanae*: 179 (1868); Hook. & Bak.: 445 (1868); Prantl: 321 (1884); Clausen: 152 (1938); Tardieu-Blot: 23 (1953); Faden: 25 (1974); Schelpe: 33 (1977); Johns: 10 (1991). Type: Angola, Pungo Andongo, near Catete, *Welwitsch 33* (K, lecto.; BM!, LISU, iso.).

As with most of Welwitsch's collections of *Ophioglossum*, his No. 33, the type of *O. rubellum*, is composed of a number of collections gathered at different localities in the Pungo Andongo District during January and February 1857. The sheet in BM and one of the two sheets in K both consist of more than one gathering. Clausen, in 1946, annotated the one sheet in K as 'Type', although he never published a lectotypification. There are, however, two (apparently) different collections on the Kew sheet. In order to avoid confusion, the group of four plants mounted above Welwitsch's printed label at the bottom of the sheet at Kew (already annotated as the type by Clausen) is hereby selected as the lectotypic element for the name of the species.

**Distribution:** Guinea (?), Sierra Leone, Ghana, Nigeria, Central African Republic, Ethiopia, Uganda, Kenya, Tanzania, Gabon, Angola, Zambia, Zimbabwe, South Africa (Transvaal).

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