The ‘minor confusion’ around Parquetina nigrescens (Periplocaceae)

H.J.T. Venter* and R.L. Verhoeven

Department of Botany and Genetics, University of the Orange Free State, P.O. Box 339, Bloemfontein, 9300 Republic of South Africa

Received 5 June 1995, revised 10 October 1995

A correction of the taxonomy of Parquetina nigrescens (Afr.) Bullock with its synonyms Periploca nigrescens Afr. and Omphalogonus calophyllus Baill. is presented. Our investigation reveals that Periploca nigrescens and Omphalogonus calophyllus are two distinct taxa, as their floral morphology differs conspicuously. The name, Parquetina nigrescens, therefore is an incorrect combination. A taxonomic revision of Periploca nigrescens and Omphalogonus calophyllus completes this account.

Keywords: Omphalogonus, Parquetina, Periplocaceae, Periploca nigrescens, taxonomy.

*To whom correspondence should be addressed.

Introduction

Afrelius established Periploca nigrescens in 1817. This name was universally accepted by various taxonomists, such as Schumann (1896), Hiern (1898), N.E. Brown (1902), De Wildeman (1906, 1911), Chevalier (1920), Hutchinson & Dalziel (1931) and Robyns (1947). Baillon erected Parquetina gabonica in 1889 and in 1902 N.E. Brown placed this name in synonymy with Periploca nigrescens. Baillon (1890) also coined Omphalogonus calophyllus, a name accepted by Schumann (1895), N.E. Brown (1902), Chevalier (1920) and Brenan (1949).

Bullock in 1961 combined Periploca nigrescens, Parquetina gabonica and Omphalogonus calophyllus as Parquetina nigrescens (Afr.) Bullock. It is unclear how Bullock could have come to this conclusion on evidence from the floral morphology of the two taxa. Our own investigation revealed major differences between the flowers of Periploca nigrescens and Omphalogonus calophyllus. Periploca nigrescens has the typical rotate Periploca flower with indistinct shallow corolla tube and exserted gynostegium. Omphalogonus calophyllus, in contrast, has flowers with a well-developed campanulate corolla tube, within which the gynostegium is enclosed.

Periploca nigrescens and Omphalogonus calophyllus belong to two distinct groups of taxa in the Periplocaceae. The first group’s flowers are rotate, having shallow, saucer-shaped corolla tubes from which the gynostegia are exserted. The second group has flowers with distinct campanulate to tubular corolla tubes within which the gynostegia are enclosed. Periploca nigrescens accordingly belongs to the first group and Omphalogonus calophyllus to the second group.

Instead of clearing up a ‘minor confusion’ Bullock (1961) created a major confusion. An important factor that probably, at least partly, led to Bullock’s confusion, is the conspicuously similar vegetative appearance of the two species and the fact that both species’ twigs, leaves, peduncles and flowers are black when dry. Their leaves are so similar in shape, texture and appearance that it is difficult, sometimes impossible, to identify sterile material with total certainty to any one of the two species.

N.E. Brown (1902) was most definitely correct in his recognition of Parquetina gabonica as Periploca nigrescens and in his maintaining Omphalogonus calophyllus as a distinct taxon. Bullock’s (1961) allegation that N.E. Brown (1902) was at fault is therefore unfounded. Bullock’s ‘evidence of sexual dimorphy’ is possibly the result of confusion caused by the large conspicuous anthers of Periploca nigrescens and the small, less-conspicuous anthers of Omphalogonus calophyllus.

Material and Methods

Herbarium specimens from the herbaria of BM, BR, COL, K, L, LISC, MO, P, PRE, SRGH and WAG were studied. External morphology was examined with an Olympus stereo-microscope. Pollen was collected from the above-mentioned specimens and acetylated according to the method of Erdtman (1960), mounted in glycerine jelly and sealed with paraffin wax. Samples were examined with a Zeiss microscope (LM). Measurements of tetrad size were, whenever possible, based on a minimum of 15 tetrads per specimen. For the scanning electron microscope (SEM), pollen was acetylated, air-dried on stubs, coated with gold and examined. A Jeol JSM 6400 electron microscope was used.

Account

Pollen morphology

Omphalogonus calophyllus: Its pollen grains are united in tetrads with these grains arranged decussately and only a small proportion rhomboidally (Figure 1a & b). The decussate tetrads are (31.5-40.5) 35.9 x 34.7 (27.9-39.6) mm. Three to four pores occur per grain, the pore size being 0.7-2.2 mm. These pores are sometimes covered by a thin layer of exine material. The exine is smooth.

Periploca nigrescens: The pollen grains of this species are united in tetrads with these grains arranged rhomboidally or decussately (Figure 2a-d). Both types are common. The rhomboidal tetrads measure (59.4-93.6) 72.7 x 63 (49.5-85.5) mm. The de-cussate tetrad size amounts to (58.5-87.3) 67.7 x 62.8 (46.8-84.6) mm. Four to six pores occur per grain, the size of the pores being 2.2-5.1 mm. The pores are sometimes covered by a thin layer of exine material. The exine is smooth. The pollen of Periploca nigrescens is similar to that found in the other species of Periploca, although its grains are larger than in most of the species (Verhoeven & Venter 1994).

Omphalogonus calophyllus is easily distinguishable from Periploca nigrescens by the smaller size of its pollen grains and dominance of its decussate tetrads.

Key to Omphalogonus calophyllus and Periploca nigrescens

1a. Corolla lobes spreading, 6-7 mm long, inner surface conspicuously papillate and uniformly pink to deep violet. Gynostegium and corona lobes enclosed within the corolla tube.
Corona lobes channelled radiating processes of 2 mm long .......

Corolla lobes reflexed, 10–12 mm long, inner surface velvety and violet at base turning brown towards tip. Gynostegium and corona exerted from the corolla mouth. Corona lobes 5–7 mm long, linear to filiform and segmented towards their apices .......

Periploca nigrescens

Omphalagonus calophyllus

Omphalagonus calophyllus Baill, in Bulletin Mensuel de la Société Linnéenne de Paris 2: 812 (1890), 300 (1891); K. Schum.: 221 (1895); N. E. Br.: 256 (1902); A. Chev.: 430 (1920); Brenan: 67 (1949). Type: Tanzania, Zanzibar, Boivin 1008A (P, holotype).

Enumeration of the two species

Figure 1 SEM (a) and LM (b) micrographs of a decussate tetrad of Omphalagonus calophyllus [Gillett 15213 (K)]. Scale bar: 10 μm.

Figure 2 SEM (a & b) and LM (c & d) micrographs of tetrads of Periploca nigrescens [Bunting 31 (MO)]. a & c: Rhomboidal tetrads; b & d: decussate tetrads. Scale bar: 10 μm.
O. nigrifrons N.E. Br.: 279 (1912), Hutch. & Dalz.: 53 (1931).
Type: Southern Nigeria, N.W. Thomas 1011 (K, holotype).

Periploca calophylla (Balta.) Roberty: 1429 (1953).

Parquetina nigrescens (Aiz.) Bullock: 205 (1961). pm parte exsp. typ.

*Corona*, large and spreading with copious white latex. *Roots* unknown. *Stems*: woody, twining, up to 20 × 0.1 mm, bark glabrous, pale brown, verrucose and flaky. *Leaves*: opposite, simple, glabrous; petiole (15–45–65 mm long; blade glossy to dull green above, very pale green below, 90–115–(35–)55–85 (–105) mm, broadly ovate, base cordate, apex obtuse to rounded and cuspitate, margin entire, veins pale green above, dark green below, 7–14 secondary veins per side, thickly coriaceous. *Infructescences*: axillary, cymose with monochasial branches, 10–30-flowered, glabrous, primary peduncles (10–)20–27 mm long, secondary 4–10(–)20 mm long; bracts 2 × 1 mm, acicular. *Flowers*: bisexual, actinomorphic, pendent, pedicels 4–5 mm long; buds sub-glabrous with apex rounded. *Sepals*: sub-ovaricate, 2–3 mm, glabrous, green, margin entire, with paired, suborbicular collars at their inner bases. *Corolla*: outside glabrous; tube 5–5.5 mm long, campanulate with gynostegium enclosed, inside of mouth papillate; lobes broadly elliptic to broadly ovate, spreading, 6–7 × 6–7 mm, fleshy coriaceous, inside pink, maroon, dark red or violet to deep violet and papillate, apex rounded. *Corona*: lobes 5, antisepalous, borne in lower half of corolla tube, 2 mm long, each lobe fused to the corolla tube's inner face for ca. 1.5 mm and radiating into tube's cavity, radiating processes channelled, upper part bisegmented, the outer segment subulate to rounded, the inner segment convolutely hood-shaped, violet to maroon. *Interstaminal discs* antisepalous, sub-orbicular, concentrically arranged around the style. *Stamens*: 15 antisepalous, arising directly below corona lobes, ca. 1 mm long, green; filaments free, terete, ca. 0.5 mm long, glabrous; anthers fused to stigmatic head, narrowly hastate-ovate, ca. 0.5 mm long, pubescent to rarely glabrous on back. *Ovaries*: 2, free, semi-inferior, sub-hemispherical, 1.8–2.0 mm long; style terete, ca. 0.75 mm long; stigmatic head pentangular, apex obtuse; pollen carriers spatulate, 1–1.1 mm long, receptacle broadly ovate, stipite terete, viscidium elliptic. *Follicles* paired, horizontal, very narrowly deltoid-ellipsoidal to deltoid ovoid, 2-edged, apex obtuse, 110–245 × 20–35 mm, glabrous. *Seed* narrowly elliptic to obliquely narrowly elliptic, dark brown, 6–8 × 2 mm, surface reticulate and warty; coma 30–40 mm long, dirty white. (Figure 3). *Uses*: The cortical fibres of *O. calophylla* are fleshy and very strong. Its roots are used as aphrodisiac in Tanzania.

*Geographical distribution and ecology: O. calophylla* occurs in tropical Africa from Gambia, Guinea Bissau, Ghana, Ivory Coast and Nigeria in the west to Kenya and Tanzania in the east (Figure 4). This species was collected in wet forest (mist, riverine and marshy forests), and in coastal thicket of *Albizia petersoniana*, Grewia sp. and *Croton megacarpodes*. Its flowers are offensive smelling and are visited by flies.

*Specimens examined*

*Benin*: —12N09E: Ackley, (AC), Lejoly 824/01 (BR, K).

*Central African Republic*: —05N02E: Bambal region (–DA), Tisserant 2248 (P).

*Ghana*: —05N00W: Nungua Agricultural Station (–CA), Moreton A1471 (K); Kwabenyan (–CA), Deaw S29I (MO); Aburi (–CC), Chevalier 13847 (P).

*Guinea*: —08N09W: Macenta and Nzerekore (–CB), Schnell 4560 (P).

*Guinea Bissau*: —11N15W: Cubissobo, Pobresa (–DC), Santo 2379 (BR, K).

*Ivy Coast*: —05N04W: Lamto Reserve, Tiassale (–DA), Gautier-Beguin 386 (MO).

*Kenya*: —00S39E: Between Garissa and Buma on Tana River (–DD), Balfour 1995 (MO).

*Malawi*: —12N16W: Capech (–AC), Santo 266 (BR, K).

*Polhill*: —05N06W: 34 km from Samburu camp with that of Galpin (–DA), W. Polhill 532 (K).

*Senegal*: —12N16W: Bignona, Koubalan (–CD), Berhart 6779 (P); Fort Kaloumey (–CD), Berhart 7186 (P).
Figure 3 *Omphalognus calophyllus*. A. Stem with leaves and flowers. B. Bud. C. Flower opened revealing the channelled corona lobes, the hairy stamens and the pistil. D. Pollen carriers. [A. Geerling & Bokdam 488 (MO), B-D. Enii R815 (SRGH)].
Sudan: —05N31E: Lado, Ye River (–BA), Sillito 452 (K, P).
—06N28E: Yambio, Zande District (–AD), Wyld 1 (BM).

Tanzania: —03S35E: Mbulu District, Lake Manyara National Park (–DB), Greenway & Kauri 12073 (K).
—03S37E: Usambaras, Kiswani (–BB), Greenway 6699 (K, PRE).

—04S38E: Lushoto District, Mombo (–CD), Hervson, Persson & Petterson 87418 (K).
—05S35E: Pangani District, Bushiri Estate (–BD), Faulkner 562 (BR, K).
—05S38E: Korogwe (–AB), Aichhold 989 (K); 11 km south of Pangani (–BD), Harris & Harris 3443 (K).
—06S37E: Morogoro District, Mavisini (–DC), Wigg 975 (K).

—06S9E: Zanzibar (–AA), Boivin 1008a (P, type of Ompalagonus calophyllus), Vaughan 1086 (K), Sacleux 838 (P); Zanzibar, Chikwani (–AA), Faulkner 2705 (K), 2783 (K).
—07S36E: Bridge west of Malolo (–BC), Carter, Abdallah & Newton 2365 (K).
—08S35E: Makuwyi District, Ubanda (–BC), Korischer 902 (K).

—10S39E: Lindi District, 32 km on Mnzamoja-Mtwara Road (–BB), Bidgood, Abdallah & Vollesen 1762 (K).

Togo: —06N00E: Lome (–BC), Warnecke 216 (BM, BR, K, L).
—07N01E: 10 km west of Atakpané on road to Ounabè (–CA); Hiepko & Schultzze 223 (K, P); SW of Bodjendi Sada (–CB), Pasch 8957 (K).

**Periploca nigrescens** Aftelius, Stiprum Guineae. 1: 2 (1817); K.Schum.: 232 (1896); Hierm: 681 (1898); N.E.Br.: 258 (1902); De Wild.: 83 (1906), 370 (1911); A. Chev.: 430 (1920); Hutch. & Dalz.: 52 (1931); Rohyns: 85 (1947). Type: Locality unknown, Anon s.n. (BM, holotype).

**P. afzelii** G. Don: 163 (1837). Type: Sierra Leone, collector unknown. (No type located). Synonymy according to the description of G. Don (1837).

**P. preussii** K.Schum.: 117 (1893), 216, fig. 64 (1895). Type: Cameroon: between Mokonye and Kumba Ninge, Preuss 151 (B1, holotype, no isotype located). Synonymy according to the description of Schumann (1893) and (1895).

**Parquetina gabonensis** Bail.: 806 (1889), 294 (1891); K. Schum.: 218 (1895). Type: Gabon, locality unknown, Duperquet 1864, no. 1 (P, holotype).

**Periploca gabonensis** (Bail.) A. Chev.: 251 (1951).

**Parquetina nigrescens** (Afz.) Bullock: 205 (1961).

Liana: with copious white latex in roots, stems and leaves. Roots: tuberous. Stems: woody, twining, 10 m or more long; bark on older stems rough, scaly, brown, on twigs green to purple. Leaves: opposite, simple, glabrous; petiole 20–50(–95) mm long, purplish; blade shiny, bright green above, pale green below, (75–)125–140(–160) × (30–)45–75(–110) mm, mostly elliptic, also broadly oval to narrowly ovate, base cordate, apex rounded to obtuse and cuspidate, seldom acuminate, margin entire, veins pale green to purplish below, secondary veins 8–12 per side, papery to thickly coriaceous. Inflorescences: axillary, cymose with monochasial branches, 15–30-flowered, glabrous, pale green, primary peduncles 20–40 mm long, secondary 10 mm long, bracts 1–2 × 0.5–1 mm, acuminate to narrowly ovate. Flowers: bisexual, actinomorphic, pentameres, pedicels 2–5 mm long, buds ovoid with apex acute. Sepals: broadly oval to ovate, 1.5–2 × 2 mm, glabrous, margin entire, with paired (triangular) or single (semi-orbicular) collets at their inner bases. Corolla: rotate, pale green, creamy green or white outside, glabrous; tube 2–4 mm long, halfway reflexed, with gynostegium exserted; lobes elliptic to ovate, reflexed, 10–12 × 4–5 mm, fleshy coriaceous, outside creamy green, inside velvety and deep crimson, deep violet or black-violet at base turning brown to dark brown towards tip, apex rounded. Corona: lobes 5, antisepalous, borne from corolla mouth, 5–7 mm long, greenish-white, pale green or pale yellow, filiform to linear, 2–4 segmented above middle, rarely undivided, upper two segments tortuous. Stamens: antisepalous, arising directly below corona lobes, 5–6 mm long, green to brown with white hisrtue hairs on filaments and backs of anthers; filaments free, terete, 1–1.5 mm long; anthers fused to stigmatic head, narrowly ovate, 3–4 mm long. Ovaries: 2, free, semi-inferior, sub-hemispherical, ca. 1.5 mm long; style terete, 1.5–2 mm long; stigmatic head pentangular with apex flattened, 3 mm long; pollen carriers spathulate, 2.5–3 mm long, receptacle broadly oval, stipe terete and viscidium triangular. Follicles: paired, horizontal, linear-ovoid, 2-edged, apex acute to attenuate, 120–210 × 12–20 mm, glabrous. Seed elliptic, 3.3–3.5 × 1.5 mm, brown, testa warty; coma white, 24–25 mm long. (Figure 5).

**Vernacular names:** Cameroun: njambel, abaankol; Nigeria: oha mili; Sierra Leone: kpooyangolei (Mendk), koke ndowe, dibewu, fubabou; Zaire: bosambala (Turumbu), kamanja (Legu), loliki (Kundu), lubumba (Kumbe), ndungu (Ngwaka).

**Uses:** *P. nigrescens* is used as antidote against worms. Its latex is used for skin troubles.

**Distribution and ecology:** This species is distributed from Sierra Leone and Guinea in the west, eastwards to the eastern border of Zaire (Figure 6). Although a large collection of herbarium specimens exist of *P. nigrescens*, little can be learnt about this species’ ecology and habitat from the specimen labels. It has been collected in maritime thickets, on ant hills and in gallery forest, where the species may be common. When considering the distribution pattern of *P. nigrescens* through tropical Africa the deduction can be made that it is a member of tropical forest and savannah.
Figure 5  *Periploca nigrescens*. A. Stems with leaves and flowers. B. Bud. C. Flower opened revealing the reflexed corolla lobes, the segmented filiform corona lobes, the hairy stamens and the pistil. D. Pollen carriers. [A. *Casier 478* (MO), B–D. *Bos 2492* (WAG)].
Figure 6 Known geographical distribution of *Periplioca nigrescens*.

Specimens studied

Angola: -05S12E: Cahinda, Landana (–AA), Gossweiler 8054 (BM, COI, K).
-09S14E: Golengo Alto District, Mussenga (–BB), Welwitsch 4232 (BM, COI, K, MO), 4225 (BM); Cassualala-Dondo (–CB), Teixeira 10559 (LSC).

Cameroon: -02N09E: 3 km south of Kribi (–DD), Bos 5255 (WAG).
-02N10E: 17.5 km from Kribi (–CC), Bos 3447 (BR, MO, K, P, WAG).
-02N13E: Between Adjip and Akonete, south of Ebolowa (–CC), Koufani 19 (P).
-03N1E: Bipende (–AA), Gruker 337 (MO), Zenker 35 (BM, MO).
-03N11E: 30 km from Yaounde on Douala road (–CD), Thomas, D. 6318 (BR).
-04N08E: Near Bessingi (–DD), Thomas, D. 6759 (MO).
-04N13E: Ndjangane, 13 km south of Ebaka (–CD), Leewenberg 7406 (BR, K, MO, WAG).
-04N14E: Bertoua, 6 km on road to Batouri (–AD), Breteler 1659 (BR, WAG).

Central African Republic: -04N18E: Bangui (–BC), Chevallier 10929 (BR).
-07N21E: Oubangui-Chari (–AA), Le Testu 4375 (BM, BR).

Equatorial Guinea: -03N08E: Bioko, Malabo–Riaba (–DD), Carvalho 2886 (BR, K).

Gabon: -00N09E: Como River, 120 km from Gabon (–BB), Bates 465 (BM, K); Libreville–Kango (–BC), Breteler & Lemmens 8387 (BR); Munda, Libange Farm (–DA), Ssyana 406 (K).
-00S12E: 33 km along road from Lastoursville to Moanda (–DD), Breteler & de Wilde 765 (BR, WAG).
-01S11E: Ngounie (–CB), McPherson 13998 (BR, K).
-02S13E: 60 km SSW of Moanda (–AA), Breteler 6909 (BR, WAG).

Locality unknown, Duparquet 1864, no. 1 (P, type of *Parquerina gabonica*).

Ghana: -04N01W: Ejiam, Ashanti (–DD), Vigne 1123 (K).
-04N02W: Axim (–CC), Irvine 2364 (K, MO).
-05N01W: Asuani (–AC), Irvine 1562 (K).
-05N02W: Ankobra Junction (–AC), Irvine 1079 (K).
-06N02W: 3 km east of Bibiani (–AD), Adams 1951 (K).

Guinea: -07N09W: Nzérékoré District, Tonota (–AD), Adam 3969 (MO).
-08N09W: Massadou, 32 km south of Macenta (–AD), Collenette 26 (K).
-09N13W: Conakry (–DA), d'Alletzette 4709 (L).
-10N12W: Kindia (–BB), Jacques-Felix 1803 (K).

Ivory Coast: -04N07W: Bérézy (–CA), Oldeman 627 (BR, K, WAG).
-05N03W: 9 km from Yalassé Mé-Kodiosous road (–DD), Leeuwenberg 61 (K).
-05N04W: Andouin, 14 km west of Abidjan (–AC), Yapo Forest (–CC), Bamps 186 (BR).
-06N03W: Comoe River, near Mbuaso (–AD), J. de Wilde 532a (BR, MB); Mbuaso, 50 km east of Adzopé (–BC), Oldeman 205 (BR, K, MO, WAG).
-06N04W: 1 km south of Tiémédékro (–DA), Garnier PG/UB 143 (K).
-07N05W: Bamoro Station (–CC), Garnier PG/UB111 (K).

Libera: -04N07W: Webo District, Nyaake (–DC), Baldwin 6141 (K).
-05N08W: Sinoe Basin (–BC), Johnston s.n., anno 1904 (K).
-06N08W: Tchien District, Zwedru (–AA), Baldwin 7037 (K);
Tapeta area, along road to Ganta (–BD), Box 2642 (BR, K, WAG).
-06N09W: Salala District, Totota (–DD), Baldwin 13220 (K, MO).
-06N10W: Dukwia River (–BA), Cooper 453 (BM, K); Mt Barely (–BC), Bunting 31 (BM, MO); Gola National Forest, near Yoma (–DD), J. de Wilde & Voorhoeve 3838 (BR, K, WAG).
-07N08W: Ganta (–BB), Harley 195 (K); Nimba (–BC), Adam 23512 (MO); District Yékéka, Granfield (–DA), Adam 27533 (MO).
-07N09W: Gbargna (–AB), Linder 529 (K); Daniel 84 (BR, COI, K, MO), Blickenstaff 41 (BR, BR, COI, K, MO); Zorzor (–CD), Box 2110 (BR, K, WAG).
-07N10W: Lofa County, Gbargna–Zorzor Road (–AD), Bos 2492 (K, WAG).

Nigeria: -04N07E: New Calabar (–AC), Holland 127 (K).
-04N08E: Old Calabar (–CD), Thomas, N. W. 43 (K).
-05N05E: Ikum near Osodegbe (–GB), Holland 261 (K).
-05N07E: Ezi (–DD), Thomas, N. W. 2329 (K).
-05N08E: Oban (–BC), Talbot 2016 (BM, MO); Oban Forest Reserve near Orem Village (–DA), Latilo & Oguntaya FH170547 (K); Ntchibhot (–DB), Onyeachusim & Latilo FH154079 (K).
-06N04E: Omo Forest Reserve (–CD), Lowe 4527 (K).
-06N05E: Uloolu (–AB), Thomas, N. W. 2292 (K); Aghbdi near Sapoba (–BB), Meikle 547 (K).
-06N06E: Omiach Oloko (–BC), Thomas, W. N. 1835 (K).
-06N07E: Obom Eke Village, Isiuvo District (–CD), Eniwiegbon FH163117 (K).
-07N03E: Ibadan (–BA), Newberry 49 (K).
-07N04E: Shasha Forest Reserve, Ijebu Province (–BA), Ross 77 (MO).
-07N05E: Onoghofo Forest Reserve, Central Ishan (–CD), Eumagoeji & Oguntaya FH177744 (K).
-09N08E: Kontagora (–BA), Daitiel 50 (K).

Sierra Leone: -07N11W: Nyala (–BA), Deighton 729 (K).
-07N12W: York (–CB), Deighton 5329 (K); Bagroo River (–DA), Anon 845 (K).
-08N11W: Ronetica (–BD), Thomas 5282 (K).
-08N12W: Kasewe (–AC), Morton SL860 (K); Samu Country.
Kakor (–BB) Scott Elliot 4206 (K); Yonibana (–CA), Thomas 4730 (K).
The financial support from the Foundation for Research Development, Pretoria, and the University of the Orange Free State is gratefully acknowledged. A word of sincere thanks goes to Mrs Tessa Clausen for the drawings of the two species discussed in this article. We also thank the herbaria mentioned under Material and Methods for the loan of their specimens used in this investigation.

References

AFZEIUS, A. 1817. Stirpium in Guinea, Vol. 1. Zeipel et Palmblad, Upsala.

BAILLON, M. 1889. Sur le groupe des Tacazzeées. Bull. Soc. Linn. Paris 2: 805–808.

BAILLON, M. 1890. Le Pentanura du Yunnan. Bull. Soc. Linn. Paris 2: 812.

BAILLON, M. 1891. Periploca. Hist. Pl. 10: 293–304.

BRENAN, J.P.M. 1949. List of the forest trees and shrubs of the British Empire, No. 5, Tanganyika. Imperial Forestry Institute, Oxford.

BROWN, N. E. 1902. Asclepiadaceae. In: Flora of tropical Africa, ed. W.T. Thistle-Dyer. Lovell Reeve, London.

BULLOCK, A.A. 1951. Parqueina nigrescens. Kew Bull. 15: 205–206.

CHEVALIER, A. 1920. Periploca nigrescens. Expl. Bot. Afr. Occ. Franc. 1: 430.

CHEVALIER, A. 1951. Parqueina gabonica. Revue Bot. appl. Agric. trop. 31: 251.

DE WILDEMAN, E.A.J. 1906. Periploca nigrescens. Not. Pl. Ut. Congo 2: 83, tab. 5.

DE WILDEMAN, E.A.J. 1911. Periploca nigrescens. Pl. Thonn. Cong. Ser. 2: 370.

DON, G. 1837. A general system of gardening and botany, Vol. 4. Rivington, London.

ERDTMAN, G. 1960. The acetolysis method: a revised description. Svensk. bot. Tidskr. 54: 561–564.

HIERN, W.P. 1898. Periploca nigrescens. Catalogue of the African plants, Vol. 1. Trustees, London.

HUTCHINSON J. & DALZIEL, J.M. 1931. Asclepiadaceae. Flora of west tropical Africa, Vol. 2. Crown Agents, London.

ROBERTY, G. 1953. Periploca calophylla. Bull. Inst. Franc. Afr. Noire 15: 1429.

ROBYNS, W. 1947. Asclepiadaceae. Flore des Spermatophytes du Parc National Albert 2: 85. Institut des Parcs Nationaux du Congo Belge, Brussels.

SCHUMANN, K. 1893. Periploca. In: Engler, Bot. Jb. 17: 117

SCHUMANN, K. 1895. Asclepiadaceae. In: Natürliche Pflanzenfamilien, ed. Engler & Prantl, vol. IV, part 2.

SCHUMANN, K. 1896. Periploca. In: Engler, Bot. Jb. 23: 232.

VERHOEVEN, R.L. & VENTER, H.J.T. 1994. Pollen morphology of Periploca (Periplocoae). S. Afr. J. Bot. 60: 198–202.