

# NOTES FROM THE ROYAL BOTANIC GARDEN EDINBURGH

VOLUME XXIX · NO. 1 · 1969

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## BOWKERIA AND ANASTRABE:

Two woody South African Scrophulariaceae

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Anyone who has seen shrubs of white-flowered *Bowkeria* in the eastern Cape and Natal would be surprised to pick up *Flora Capensis* (Thiselton-Dyer 1904, p.219) and find that he was expected to distinguish four different species; still more so to learn that a fifth (*B. natalensis*) has been added since. His surprise would be justified, for only one species has any reality in nature. The existence of others in the literature has two underlying causes: omissions in Harvey's (1859) original description and illustration of *B. triphylla*, and the lack of herbarium material adequate to display the considerable variability of which the species is capable.

Harvey omitted to describe or illustrate the stamens in any detail. The arrangement of these didynamous stamens is interesting. They arise at the top of the short, narrow basal part of the corolla tube and stand erect, pressed against the back wall of the corolla with their thickened bases embracing the top of the ovary. The filaments of the antecious pair are twisted at the base through a half spiral which brings the anthers round to face the front of the flower as do those of the posticous pair. The toothing of the filament follows upon its being twisted, so the tooth is always there, though the degree to which it is developed is an idiosyncrasy of the individual.

Harvey's original specimen of *B. triphylla* (TCD) shows this feature clearly. Fresh material of *Bowkeria* from the eastern Cape and several different localities in Natal all had filaments precisely like those of *B. triphylla*. Indeed, they are arranged in the same way in *B. cymosa* and *B. citrina* too (see fig. 1, B, C and D) as well as in *Anastrabe integerrima*, which seemed to me sufficient reason for extending the study to include this genus.

Little was known about *B. citrina*, a species with yellow flowers described by J. Thode nearly fifty years ago from a single collection he had made in the foothills of the Drakensberg in northern Natal. We travelled along the rutted earth road that links the tiny hamlet of Paulpietersburg in Natal with Wakkerstroom in the Transvaal, able to see but unable to reach the forest that clothes the face of the Drakensberg and fingers down the mountain

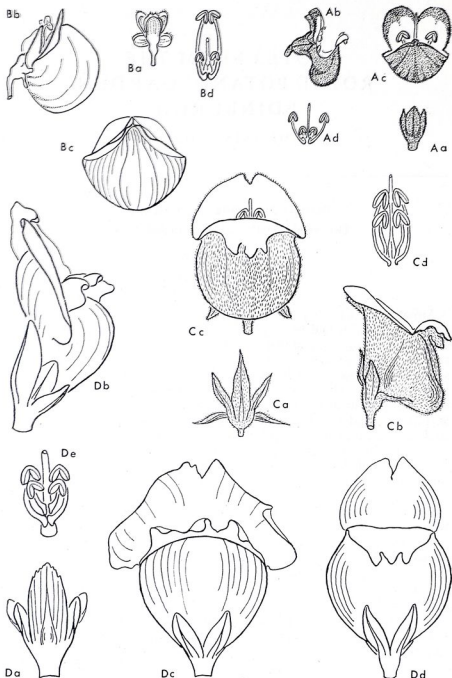


FIG. 1. A. *Anastrabe integerrima*: a, calyx from the back; b, flower, side view; c, flower, front view; d, stamens embracing top of ovary. (Hilliard 4824). B. *Bowkeria cymosa*: a, calyx, from the back; b, flower, side view; c, flower, front view; d, stamens and gynoecium (Cult. Hilliard, origin unknown). C. *Bowkeria citrina*: a, calyx, from the back; b, flower, side view; c, flower, front view; d, stamens & gynoecium. (Hilliard 4784). D. *Bowkeria verticillata*: a, calyx, from the back; b, flower, side view; c, flower, front view; d, flower, front view; e, stamens embracing top of ovary. (b & c, coll. F. B. Wright: Natal, Estcourt distr., Kamberg, "Gladstone's Nose"; d, coll. M. Bokelmann: Eastern Cape, Hogsbank). All X 2.

slopes along every watercourse, certain habitat of *Bowkeria*, which is never found far from streamsides or forest margins. Then below a little cliff on the banks of the Pemvaan river, one of the tributary streams of the Pongola river, which rises hereabouts, we found a single specimen. We were probably skirting the edge of terrain suitable for the species, for Dr. Killick has since found that it is common in the Madhlangampisiberg, a range of hills close to the Drakensberg in the Wakkerstroom district of the Transvaal.

The first specimen of *Bowkeria* to excite botanical interest was collected by Ecklon and Zeyher on the "Winterberge, Kaffirland" and in the absence of flowers they described it with some doubt as a species of *Trichocladus* (Ecklon & Zeyher, 1836, p.356). It was not until 1859 that Harvey described the genus *Bowkeria*, which he did not associate with *Trichocladus verticillatus* Ecklon & Zeyher. We now have to adopt the oldest epithet, *verticillatus*, in conjunction with Harvey's generic name. This name honours Henry Bowker Esq. and his sister, Mrs. F. W. Barber, both of whom lived on what was then the eastern frontier of the Cape and contributed much to a knowledge of the plants of that area. (Harvey also published in a footnote an extract from one of Mrs. Barber's letters, which, while describing her pleasure in botany, is also a vivid commentary on the hardships and dangers of pioneering).

Harvey (1859) related *Bowkeria* to *Halleria* and *Scrophularia* while its pouched lower lip reminded him of *Calceolaria*. He did not mention *Anastrabe*. Diels (1898, p.120) first suggested that the separation of *Anastrabe* and *Bowkeria* might not hold when he noticed the similarity between the flowers of his new *B. calceolarioides* (a synonym of *B. cymosa*) and those of *Anastrabe*.

The general shape of the corolla is the same in *Anastrabe* and *Bowkeria*, but the pouch is partly of the tube, partly of the lower lip in *Anastrabe* and *Bowkeria cymosa*, wholly of the tube in *B. verticillata* and *B. citrina*. The flowers of *B. verticillata* and *B. cymosa* are waxy-white and viscid, those of *B. citrina* and *Anastrabe* yellow and pubescent, but all have a similar patterning of reddish or purple spots or streaks on the inside of the pouch and glands in the same place.

It has already been remarked that the structure of the stamens is the same in the two genera. That of the gynoecia is too. They are alike in gross morphology and in details of placentation. Attendant upon this is the similarity in appearance and dehiscence of the capsules and in the cell structure of the testa.

The taxonomic evidence presented here seems wholly against keeping the two genera separate. But *Anastrabe* does differ in the valvate aestivation of the calyx and in its stellate indumentum. Moreover, the leaves are opposite in *Anastrabe*, generally ternate in *Bowkeria*. Both names have been in use for over a hundred years. It could well be more confusing than helpful to unite them.

The most striking differences between the two genera are tabulated below. The number of primary veins in the leaf and the angle at which they ascend is somewhat variable and there is no sharp discontinuity between the genera in this character, but on average there are more primary veins in *Anastrabe* than in *Bowkeria* and they ascend less sharply. The diagnostic characters are italicised.

**Anastrabe**

1. *Leaves opposite.*
2. Main primary veins usually 12-17, occasionally as few as 10.
3. Primary veins ascending at an angle of about 40°-70°.
4. *Stellate hairs* on undersurface of leaf, twigs, inflorescence branches, calyx and corolla.
5. *Calyx 5-fid, the lobes valvate.*

**Bowkeria**

1. *Leaves almost always ternate.*
2. Main primary veins usually 6-9, up to 12 in *B. cymosa* and very occasionally in *B. verticillata*.
3. Primary veins ascending at an angle of about 20°-40° in *B. verticillata* and *B. citrina*, 25°-50° in *B. cymosa*.
4. *Hairs*, if present, *simple* sometimes gland-tipped.
5. *Calyx 5-partite, the lobes imbricate.*

All three species of *Bowkeria* are well-shaped shrubs or small trees found along watercourses and on forest margins or occasionally as a constituent of the forest understorey. In the Natal Drakensberg, it is usual to see *B. verticillata* growing along the foot of the Cave sandstone cliffs wherever there is shade and moisture. *Anastrabe* is a small tree, occasionally a shrub, growing in the coast forest or in drier open woodland, or, like *Bowkeria*, on the forest margin and along streamsides. It also favours sandstone cliffs above forested gorges and escarpments. All flower from about December to June.

*Bowkeria* ranges from the eastern Cape through Natal and the neighbouring mountainous parts of Lesotho (Basutoland) and the Orange Free State to the mountains of Swaziland and the eastern Transvaal. *B. verticillata*, the most variable species, is found as far south as the Great Winterberge near Queenstown and extends northwards through the cooler, more elevated parts of the eastern Cape and Natal and into the Orange Free State and Lesotho in the Witziesshoek area beyond Van Reenen Pass. *B. citrina* is known only from the foothills of the Drakensberg in the extreme north of Natal and from the neighbouring Wakkerstroom area of the Transvaal. *B. cymosa* grows in the mountainous parts of Swaziland and the eastern Transvaal as far north as Woodbush. The three species thus replace one another in a neat linear series without any overlap. *Anastrabe* is more coastal in its distribution than *Bowkeria*, ranging from East London through the Transkei to Natal, paralleling the distribution of *B. verticillata*. There is one record of its having been found in the Lebombo Mts., Moçambique. The areas of *B. verticillata* and *Anastrabe* meet near Weenen and in Qudeni Forest, Zululand. Otherwise the areas of the genera too are discrete. (See fig. 2.).

**Anastrabe** [E. Mey. ex] Benth. in Hook., Comp. Bot. Mag. 2:54 (1836); Benth. in De Candolle, Prod. 10:334 (1846); Harvey, Gen. S. Afr. Fl. Pl. ed. 2:265 (1868); Benth. & Hook f., Gen. Pl. 2:937 (1876); Wettstein in Engler & Prantl, Pflanzenfam. 4(3b):64 (1897); Hiern in Thiselton-Dyer, Fl. Cap. 4, 2:217 (1904); Sim, The forests and forest flora of the colony of the Cape of Good Hope: 283, pl. 155, fig. 2 (1907); Phillips, Gen. S. Afr. Fl. Pl. ed. 2:669 (1951).

Type: *A. integerrima* [E. Mey. ex] Benth.

*Leaves* opposite or subopposite. *Inflorescences* cymose, many-flowered, solitary in the upper leaf axils. *Bracts* in pairs at each branching of the inflorescence and subtending the pedicels. *Calyx* lobes 5, about equalling the tube in length, the posticous one slightly the larger, valvate, persistent. *Corolla* bilabiate, the tube greatly inflated on the anticous side above a very short more or less cylindric basal part and together with the inflated lower lip forming a deep pouch; upper lip erect, deeply 2-lobed, exterior in bud; lower lip shortly 3-fid; mouth open. *Stamens* 4, ascending, the anticous pair longer than the posticous pair, all included; filaments arising at the top of the narrow basal part of the corolla tube, their bases embracing the top of the ovary, slightly curved, much thickened at the base, the anticous pair twisted (and thereby toothed) at the base, which brings the anthers round to face the front of the flower above those of the posticous pair; anther thecae divergent, confluent at maturity; staminode present. *Ovary* conic, small, 2-celled, the placentae T-shaped in cross-section, the whole surface ovuliferous; style relatively long and slender, slightly bent over at the tip, long persistent; stigma small. *Fruit* a woody, ovoid, septicidal capsule surrounded by the persistent calyx. *Seeds* numerous, fusiform, testa deeply reticulate through loss of the outer walls of the cells; embryo straight, embedded in endosperm.

An endemic, monotypic genus confined to the more coastal parts of the eastern Cape and Natal, with one record from Moçambique.

*A. integerrima* [E. Mey. ex] Benth. in Hook., Comp. Bot. Mag. 2:54 (1836); Wood, Natal plants 1:66, pl. 81 (1899); Hiern in Thiselton-Dyer, Fl. Cap. 4, 2:218 (1904); Henkel, Woody plants of Natal and Zululand: 125 (1934). Type: *Drège*, Amaponda country.

Syn.: *A. serrulata* [E. Mey. ex] Benth. in Hook., Comp. Bot. Mag. 2:54 (1836). *Drège*, Amaponda country.

*A. integerrima* var. *serrulata* [E. Mey. ex Benth.] Hiern in Thiselton-Dyer, Fl. Cap. 4, 2:218 (1904).

Small tree to a height of about 9 m, occasionally a shrub; branches terete, conspicuously lenticellate, glabrescent, young twigs slightly flattened and together with the petioles, the lower leaf surface and all parts of the inflorescence densely stellate pubescent. *Leaves* broadly lanceolate, sometimes obovate, up to about 8 × 3 cm, occasionally larger in coppice growth and shade specimens, coriaceous, discolorous, dark green, glossy and sometimes rugose above, generally whitish below with felted stellate hairs that are sometimes partly deciduous, dotted with yellow glands above and below, apex acute, mucronate, base narrowly or broadly cuneate, margin entire or serrulate; petiole 3–5 mm long. *Inflorescences* many-flowered, up to about 3 cm long; pedicels about 3 mm long. *Bracts* small. *Calyx* coriaceous, strongly ribbed, stellate pubescent and gland-dotted; tube broadly campanulate, 2.5–3 mm long, lobes deltoid, about 2 mm long. *Corolla* about 8 mm long and as broad, coriaceous, pouch strongly ribbed, slightly dorsoventrally compressed, yellow spotted and streaked scarlet inside and with a scarlet blotch above the point of insertion of the anticous filaments, densely stellate-pubescent and gland-dotted outside and on the inside of the lobes, otherwise glabrous, strongly glandular inside the anticous face. *Stamens*: anticous filaments about 4 mm long, exerted at anthesis, the posticous

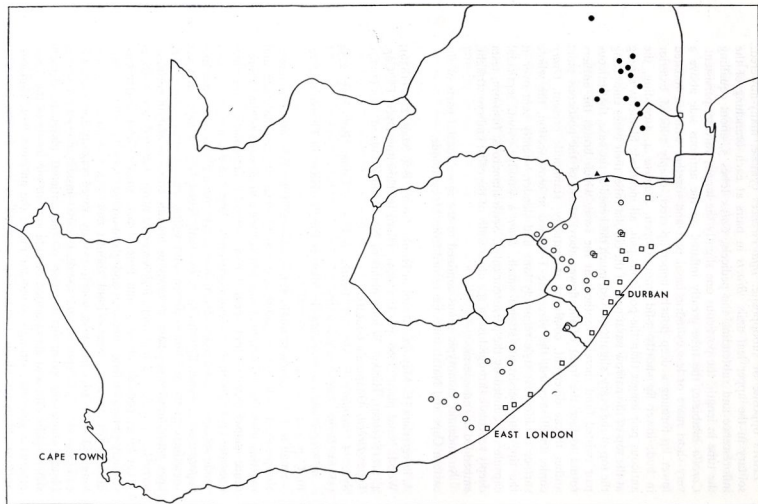


FIG. 2. Map of South Africa showing distribution of ○ *Bowkeria verticillata*; ▲ *B. citrina*; ● *B. cymosa*; and □ *Anastrabe integerrima*.

about 1 mm and much thickened; anther lobes 1.5 mm long. Ovary 2.5 mm long, about 1.5 mm broad, with conspicuous vertical ridges, stellate-pubescent and gland-dotted; style about 2.5 mm long, exceeding the posticous stamens, the stigma lying immediately below the anthers of the anticous stamens. Capsule about 6 mm long.

No purpose is served by maintaining the variety *serrulata* because there is no discontinuity in the type of leaf margin. All intergradations between entire and serrate margins are found. Leaves with entire or serrate margins can occur on the same twig, as for example in *Strey* 5925 (NH) from Evungu kloof, Port Shepstone district, Natal and *Pegler* 369 (GRA) from Kentani, E Cape.

CAPE. East London, Buffalo river, *Flanagan* 1770 (PRE). Kentani, *Pegler* 369 (GRA, PRE). Willowvale dist., above Qora river crossing, 10 miles from sea, *Wells* 3588 (GRA, PRE). Elliotdale dist., Bashee river mouth, The Haven, *Gordon-Gray* 1265 (NU). E Pondoland, Egossa, *Sim* 2397 (GRA, NU, PRE). NATAL. Port Shepstone dist., Izotsha Falls view site, *Hilliard* 4034 (NU). Umzinto dist., Scottburgh, *Bayer* 724 (NU); Umgaye, Friedenau, *Rudatis* 849 (PRE). Umlazi dist., Amanzimtoti, *Wood* 2801 (NH). Durban dist., Durban, Umgeni, *Wood* 12577 (NH). Pinetown dist., New Germany, *Indian collector* s.n., NH 17589; Krantzklouf Nature Reserve, *Moll* 3296 (PRE). Pietermaritzburg dist., Table Mt., *Killick* 93 (NU, PRE). Inanda dist., Inanda, *Wood* 449 (NH). Lower Tugela dist., New Guelderland, *Stewart* 89 (NH, PRE). Mapumulo dist., 2 miles Mapumulo-Kranskop, *Moll* 2936 (PRE). Kranskop dist., Kranskop, Ntunjambili, *West* 1996 (NH). Weenen dist., Weenen Townlands, *Pentz* 346 (NH, PRE). Eshowe dist., Umlalazi valley near Melmoth road bridge, *Lawn* 1756 (NH). Mtunzini dist., Ngoye forest, *Strey* 4942 (NH, PRE). Nkandla dist., Nkandla forest, *Edwards* 1329 (NU); Qudeni, *Edwards* 1118 (NU). Ngotshe dist., Ngome bush, *Gerstner* 1895 (PRE).

MOÇAMBIQUE. Portuguese East Africa, Lebombos, *Sim* 20512 (PRE).

*Bowkeria* Harv., Thes. Cap. 1:24, t. 37 (1859) et Gen. S. Afr. Fl. Pl. ed. 2:264 (1868); Benth. & Hook., Gen. Pl. 2:937 (1876); Wettstein in Engl. & Prantl, Pflanzenfam. 4, 3b:64 (1897); Hiern in Thiselton-Dyer, Fl. Cap. 4, 2:218 (1904); Sim, The forests and forest flora of the colony of the Cape of Good Hope: 282, pl. 118, fig. 2 (1907); Phillips, Gen. S. Afr. Fl. Pl. ed. 2:669 (1951).

Type: *B. verticillata* (Eckl. & Zéyh.) Schinz through its synonym *B. triphylla* Harv.

Much-branched shrubs, occasionally small trees, up to about 4 m high, aromatic. Leaves usually ternate, very occasionally opposite, lanceolate, elliptic or ovate, usually pubescent and always dotted above and below with sessile glands that are usually also present on the young twigs, the inflorescence branches and the calyx. Inflorescences cymose, solitary in the upper leaf axils, 1- to many-flowered. Bracts in pairs at each branching of the inflorescence and subtending the pedicels. Calyx divided almost to the base into 5 segments, the posticous one usually larger than the others, imbricate, persistent. Corolla bilabiate, strongly pouched on the anticous side; mouth



slit-like, the lips pressed together or slightly gaping; limb oblique, upper lip erect, bilobed, exterior in bud, lower lip trilobed. *Stamens* 4, ascending and pressed against the posticous wall of the corolla, the antious pair longer than the posticous ones; filaments arising at the mouth of the narrow basal part of the tube, their bases embracing the top of the ovary, rather thick, slightly curved, swollen at the base, the antious pair twisted at the base and there appearing toothed: all the anthers thus face outwards; anther thecae divergent, confluent at maturity; staminode present. *Ovary* cylindric or conic, small, 2-celled, sometimes 3-celled in *B. verticillata*, the placentae T-shaped in cross-section, the whole surface ovuliferous; style relatively long and slender, slightly bent over at the tip, long persistent; stigma small. *Fruit* a woody, ovoid, septicidal capsule surrounded by the persistent calyx. *Seeds* numerous, fusiform, testa deeply reticulate through loss of the outer walls of the cells, embryo straight, embedded in copious endosperm.

*Key to the species* (Note: the key can be used on either flowering or fruiting specimens; both the persistent calyx and the corolla are diagnostic).

- 1 Flowers less than 1 cm long, the cymes usually many-flowered. Capsule 5-6 mm long. Posticous calyx segment about 3 mm long . 3. *B. cymosa*
- + Flowers generally at least 1.5 cm long, the cymes 1-7-flowered. Capsule about 1 cm long. Posticous calyx segment at least 5 mm long . 2
- 2 Corolla white, glabrous, viscid; calyx viscid, the segments coriaceous, rugose, margin flat, apex usually obtuse, sometimes acute, often mucronate . 1. *B. verticillata*
- + Corolla canary yellow, pubescent; calyx not viscid, the segments thin-textured, margin often undulate, apex very acute to acuminate 2. *B. citrina*

1. *B. verticillata* (Eckl. & Zeyh.) Schinz in Bull. Herb. Boiss. ser. 2, 6:828 (1906); Druce in Rep. Bot. Exch. Cl. Brit. Isles, 1916:610 (1917) as comb. nov.

Type: Cape, Winterberge, *Ecklon and Zeyher* 2271 (SAM).

Syn.: *Trichocladus verticillatus* Eckl. & Zeyh., Enum. Pl. Afr. Austr.:356 (1836).

*Bowkeria triphylla* Harv. in Harv., Thes. Cap. 1:24, t. 37 (1859); Hiern in Thiselton-Dyer, Fl. Cap. 4, 2:220 (1904); De Wild., Ic. Sel. Hort. Then. 2:143, t. 74 (1901); Sim, The forests & forest flora of the Colony of the Cape of Good Hope:282 (1907); Henkel, Woody Pl. of Natal and Zululand: 176 (1934). Type: Cape, on the eastern frontier, *Mrs. Barber* s.n. (TCD!).

*B. gerrardiana* [Harv. ex] Hiern in Thiselton-Dyer, Fl. Cap. 4, 2:220 (1904); Skan in Curtis, Bot. Mag. t. 8021 (1905); Henkel, Woody Plants of Natal and Zululand:175 (1934); R.H.S. Dict. Gard. 1:304 (1956). Syntypes: Natal, near York, *Gerrard & M'Ken* 2025; upper Umkomaas river, *Adlam* (K!); Blinkwater near York, *Wood* 883; Shafton, Howick, *Mrs. Hutton* 75 (GRA!), 94 (GRA!, PRE!), 201; without precise locality, *Mrs. K. Saunders*.

*B. triphylla* var. *subglabra* O. Kuntze, Rev. Gen. Pl. 3 (2):230 (1898). Type: Cape, Kingwilliamstown dist., Pirie wood, *Kuntze* (K!).

*B. triphylla* var. *pubescens* O. Kuntze, Rev. Gen. Pl. 3, 2:230 (1898). Type: Natal, Van Reenen's Pass, *Kuntze* (K!, PRE!)



*B. velutina* [Harv. ex] Hiern in Thiselton-Dyer, Fl. Cap. 4, 2:219 (1904). Type: Natal, Ndwandwe div., at Emnyati, *Gerrard* 1212 (K!).

*B. simpliciflora* MacOwan in Journ. Linn. Soc. Bot. 25:390 (1890), *nom. illegit.*; Hiern in Thiselton-Dyer, Fl. Cap. 4, 2:219 (1904); Sim, The forests & forest flora of the Colony of the Cape of Good Hope: 282 (1907).

*B. simplicifolia* sphalm. *B. simpliciflora* in Index Kewensis supp. i (1906).

*B. natalensis* Schinz in Bull. Herb. Boiss. ser. 2, 6:828 (1906). Type: E. Cape (sphalm. Natal), Mt. Insizwa, *Schlechter* 6511 (GRA!, Z!).

Shrub or small tree, very variable in indumentum: the young twigs, leaves peduncles and pedicels glabrous to velutinous, some or all or none of the hairs gland-tipped; epidermis dotted with sessile, colourless glands; older branches glabrous to glabrescent with prominent lenticels. Leaves sessile or very shortly petioled; blade lanceolate to elliptic,  $3-15 \times 1-5.5$  cm, apex acute to acuminate, base attenuate to subcordate, margin entire to serrate particularly in the upper half, upper surface often rugose. Inflorescences 1-7-flowered; peduncles 1.5-5 cm long; pedicels 2-3 mm long. Bracts lanceolate to cordate, about  $4-12 \times 1.5-8$  mm. Calyx segments elliptic-oblong,  $5-10 \times 3-6$  mm, the posticous segment larger than the others, apex obtuse to acute, often mucronate, sometimes emarginate, coriaceous, rugose, viscid, glabrous outside or pubescent, the pubescence largely confined to the very prominent midvein which becomes glabrous with age, gland-dotted. Corolla about 1.5-2 cm long, glabrous, viscid, waxy-white, the pouch spotted violet inside and glandular there; tube bellied on the anticus side above a short, narrow, cylindric base; mouth closed or slightly gaping; upper lip erect, conspicuous, its spread ranging from 1-2.5 cm; lower lip short, reflexed, resting upon the pouch. Stamens: anticus filaments about 7 mm long, the posticous slightly shorter, all included; anticus pair of anthers lying immediately above the posticous pair, lobes about 2.5 mm long. Ovary about 3 mm long, 1.5 mm broad, 2- or 3-celled, occasionally even on one plant, gland-dotted; style 5-8 mm long, lying behind the stamens and slightly exceeding them. Capsule about 1 cm long.

CAPE. Kingwilliamstown dist., Buffalo river mts., *MacOwan* s.n. (K); Pirie forest, *legit.* *Dodd* in herb. *Galpin* 8409 (GRA, PRE). Keiskammahoek dist., Ghulu Kop, *Wells* 3092 (GRA, PRE). Victoria East dist., Hogsback, *Acocks* 11088 (K). Cathcart-Stockenstrom dist. boundary, Gaika's Kop, *Mrs. Barber* (K). Stockenstrom dist., Katberg, *Dyer* 371 (K, PRE). Engcobo dist., Engcobo Mt., *Flanagan* 2695 (K, PRE); between Cala and Ngamakwe, Kwaiman cutting, *Pegler* 1746 (K, PRE). Umtata dist., Baziya, *Baur* 206 (K). Tsolo dist., Ntywenka pass, *Acocks* 12172 (PRE). Mt. Ayliff dist., near Sugar Bush post office, *Acocks* 22117 (K, PRE). Umzimkulu dist., Insikeni forest, *Kotze* 517 (PRE).

NATAL. Alfred dist., Ngeli slopes, *Strey* 6295 (NH, NU, PRE). Richmond dist., near Richmond, Waterfall, *Thode* A 1218 (NH, PRE). Polela dist., top of Mahwaqua Mt., *Evans* 237 (NH). Underberg dist., upper Umkomaas, *Wedermann & Oberdieck* 1366 (K, PRE). Mpendle dist., Elandskop, banks of Elands river, *Webb* 12 (NH, NU). Lions river dist., Umgani Poort, *Moll* 1406 (K, NH, NU, PRE). Estcourt dist., Tabamhlope, *Pentz* 314 (K, PRE). Weenen dist., Muden, *Sim* 19134 (PRE). Bergville dist., National Park, banks of Broome Hill waters, *Galpin* 9572 (K, PRE). Nkandla dist., Qudeni

forest, *Edwards* 2636 (K, NU, PRE). Vryheid dist., Emnyati, *Gerrard* 1212 (K: type of *B. velutina*).

ORANGE FREE STATE. Harrismith dist., Witzieshoek, along the banks of the Elands river, *Flanagan* 2000 (GRA, NH, PRE); Rensburg's Kop, *Van Zinderen Bakker* 4 (PRE).

LESOTHO. Without precise locality "Drakensbergen", *Stokoe* 1546 (PRE).

*B. verticillata* is a decidedly variable species. Nowhere perhaps is this more immediately obvious than in the leaves which vary considerably in size, in the type of margin, and in the degree of pubescence: they may be entirely glabrous, variously pubescent or velutinous. Harvey (1859) with very limited material described the leaves of *B. triphylla* as "nearly glabrous". Hiern (1904) amended the description to "glabrous, subglabrous or pubescent" but did not hesitate to take up Harvey's manuscript *B. velutina* described as "softly pubescent or velvety". This putative species was further supposedly distinguished from *B. triphylla* by the possession of 1-flowered peduncles as opposed to 3-flowered peduncles in the latter. The type of *B. velutina* came from Emnyati Mt. near Vryheid in northern Natal and no further specimens have been collected from this botanically little known area. But *Hutchinson* 4498 (K) from Natal National Park is an excellent match of the type. *Van Zinderen Bakker* 4 (PRE) from nearby Rensburg's Kop in the Orange Free State is also velutinous and there are a number of collections with velutinous leaves from the Engcobo—Ntywenka area of the eastern Cape besides many specimens from widely scattered areas that are "softly pubescent". The precise locality of Harvey's original specimen of *B. triphylla* is not known, but Pirie forest, which is in the area of the old "eastern frontier" of the Cape, has yielded both glabrous and pubescent specimens. The only other glabrous specimen that I have seen came from Ngeli Mt. on the Cape-Natal border (*Strey* 6295) while *Edwards* 2636 from Qudeni forest in Zululand is almost glabrous. There is no correlation between degree of pubescence and geographical distribution and specimens from even a very limited area, for example Natal National Park, vary in indumentum.

All or some or none of the hairs on the undersurface of the leaf, on the petioles, twigs, inflorescence branches and pedicels may be gland-tipped. Specimens with gland-tipped hairs have been recorded only from Natal and they grow together with non-glandular plants. There is no justification for retaining *B. natalensis* supposedly distinguished by its non-glandular pedicels.

Both MacOwan (1890) and Hiern (1904) stressed the importance of the number of flowers in the inflorescence in distinguishing species. This criterion is valid only within limits. The inflorescence of *B. cymosa* is indisputably many-flowered. In *B. verticillata*, however, the number of flowers in an inflorescence may vary between 1 and 7 even on a single plant. (See Table 1). Numerous herbarium sheets show 1-flowered and 3-flowered peduncles in one gathering. This accounts for the synonym *B. triphylla*.

The corolla can vary in size, undoubtedly sometimes as a result of drought. More real variation is seen in the size, particularly the spread, of the upper lip. Fig. 1, Dd, was drawn from a specimen collected at Hogsback near Kingwilliamstown in the eastern Cape. This flower is very like that illustrated by Harvey (1859, tab. 37) in the plate accompanying the original description of *B. triphylla*. The upper lip is narrow and the mouth relatively widely

open. In Natal, flowers tend to have a larger, wider-spreading upper lip and the mouth is more nearly closed (Fig. 1, Dc). Thus flowers from the Cape and from Natal look rather different but I consider variation in the size of the upper lip an insufficient character on which to base the distinction of taxa,

		Number of flowers per inflorescence						
		1	2	3	4	5	6	7
Shrub No.	1	19	1	29	1	4	—	1
"	2	13	—	7	—	—	—	—
"	3	18	3	11	—	—	—	—
"	4	4	1	5	—	—	—	—
"	5	1	1	1	—	—	—	—
"	6	20	—	—	—	—	—	—
"	7	6	—	11	3	—	—	6
"	8	8	—	—	—	—	—	—
"	9	—	—	—	3	—	—	—
"	10	—	—	—	—	1	—	2

Table 1. Number of inflorescences having the indicated number of flowers per inflorescence on each of ten different shrubs from the same locality (Natal, Estcourt dist., Kamburg, "Gladstone's Nose", *F.B. Wright* s.n. (NU)).

particularly as specimens throughout the range of the species agree well in other details of floral morphology. It has already been pointed out that all species of *Bowkeria* have the anticous filaments thickened, twisted and toothed at the base. The supposed distinction between Hiern's *B. gerrardiana* and Harvey's *B. triphylla* therefore has no validity.

## 2. *B. citrina* Thode in Kew Bull. 1922:30 (1922).

Type: Natal, Utrecht div., by the tributary streamlets of the Pongola river near Rooipoort, 1270 m, *J. Thode* s.n. (K!, NH!).

Shrub, branches gland-dotted, pubescent, the hairs sometimes gland-tipped. *Leaves* lanceolate, about  $5-8 \times 0.6-1.8$  cm, apex acute, base cuneate, margin entire or obscurely serrulate, pubescent above and below, dotted with yellow glands particularly on the lower surface; petiole about 3-5 mm long, gland-dotted, pubescent, hairs sometimes gland-tipped. *Inflorescences* 1-flowered; peduncles 1-2 cm long; pedicels about 5 mm long. *Bracts* up to 1.5 mm long, narrowly lanceolate and closely resembling the leaves. *Calyx* segments oblong-lanceolate, acute to acuminate, 0.6-1 cm long, 2-3 mm broad, the posticous lobe slightly the larger, thin-textured, pubescent and gland-dotted outside and in, mid-vein very conspicuous, margin somewhat undulate. *Corolla* about 1.5-2 cm long, 1 cm broad, bright canary yellow spotted purple on the inside of the anticous face and glandular there, pubescent and gland-dotted outside, glabrous inside; tube bellied on the anticous side above a short, narrow, cylindric base; mouth gaping; upper lip erect, margin revolute, lower lip about as long as the upper, slightly porrect, margins of the lobes strongly revolute. *Stamens*: posticous filaments about 6 mm long, anticous about 7 mm long and slightly exerted at anthesis; anther lobes about 2 mm long. *Ovary* about 2.5 mm long, less than 1 mm broad, vertically ribbed, dotted with yellow glands; style about 8 mm long, slightly exceeding the stamens. *Capsule* about 1 cm long.

NATAL. Utrecht dist., Pongola Mts. to Kaffir Drift, *Thode* A337 (K, NH, PRE); Pemvaan river, on the road from Paulpietersburg to Wakkerstroom,

Hilliard 4784 (E, K, NH, NU, PRE). Paulpietersburg dist., Luneberg, summit Ncaga Mt., *Galpin* 11434 (PRE).

TRANVAAL. Wakkerstroom dist., Madhlangampisiberg, "Groothoek", Killick 3926 (NU, PRE).

This is a pleasantly aromatic shrub smelling strongly of lemon verbena. Its neat habit and pretty yellow flowers recommend it as a garden subject. The waxy-white and curiously shaped flowers of *B. verticillata* and *B. cymosa* are also attractive in the garden.

3. *B. cymosa* MacOwan in Journ. Linn. Soc. Bot. 25:390 (1890); Hiern in Thiselton-Dyer, Fl. Cap. 4, 2:221 (1904).

Types: South Africa, Transvaal, Macamac, J. H. M'Lea in herb. *Bolus* 3001 (K!, PRE!); without precise locality, Mrs. Saunders 154 in herb. *Wood* 3891 (K!, NH!).

Syn.: *B. calceolarioides* Diels in Engl. Bot. Jahrb. 26:120 (1898). Type: Transvaal, Spitzkop near Lydenburg, *Wilms* 1083.

Shrub or small tree, young branches pubescent, dotted with sessile, colourless glands, older branches glabrescent, conspicuously lenticellate. *Leaves* lanceolate to ovate, up to  $15 \times 4$  cm, apex acute to acuminate, base cuneate, margin entire or obscurely serrulate, often rugose above, usually pubescent, sometimes glabrous particularly above, gland-dotted on both surfaces, glands particularly conspicuous below: petiole 3–5 mm long, pubescent, gland-dotted. *Inflorescences* many-flowered, the branches and pedicels pubescent and gland-dotted; pedicels about 5 mm long. *Bracts* about  $2 \times 0.5$  mm. *Calyx* segments elliptic to subrotund, about  $3 \times 3$  mm, very obtuse, thick-textured but with a narrow membranous marginal wing, margin ciliate, otherwise segments glabrous or sparsely pubescent and copiously gland-dotted, viscid, the anticus pair porrect, pressed against the corolla pouch. *Corolla* almost spherical, up to 1 cm in diam., white, the pouch spotted or streaked crimson inside and glandular there, glabrous, slightly viscid particularly at the base; tube greatly swollen on the anticus side and together with the inflated lower lip forming a deep pouch; mouth gaping at anthesis; upper lip erect, fan-shaped, obscurely bilobed, margin revolute, lower lip hemispherical below, deltoid above in front view, obscurely 3-lobed, margin revolute. *Stamens*: posticus filaments about 1.5 mm long, anticus about 5 mm long and slightly exerted at anthesis; anther lobes about 1.5 mm long. *Ovary* about 2 mm long, 1 mm broad, gland-dotted; style about 2.5 mm long, lying behind the stamens and overtopping the shorter pair. *Capsule* 5–7 mm long.

SWAZILAND. Mbabane dist., Mbeluzi valley, *Compton* 25006 (K, PRE). Pigg's Peak dist., near Havelock, King's Forest, *Hilliard & Burt* 3651 (E, NU).

TRANVAAL. Barberton dist., Barberton, Highland Creek, *Galpin* 775 (K, GRA, NH); Rimer's Creek, *Thorncroft* 121 (K, NH). Nelspruit dist., Kaapschehoop, Devil's Kantoer, *Pole-Evans* 965 (K, PRE). Belfast dist., Belfast, *Smuts* 827 (K); Dullstroom, Crocodile river falls, *Galpin* 13361 (K, PRE). White River dist., Plaston, *Holt* 357 (NH). Lydenburg dist., Lydenburg, *Rogers* 14332 (K); Ohrigstad dam and nature reserve, *Smit* 30 (PRE).

Lydenburg-Pilgrimsrest dist. boundary, Mt. Anderson, *Galpin* 13726 (K; PRE localised as "Sabie valley"). Pilgrimsrest dist., Three Sisters Mt., Bourke's Luck Mine, *Galpin* 14268 (K, NH, PRE); Rosehaugh, *Rogers* 23006 (PRE); Sabie, *Munro* s.n. (PRE 30395); Mariepskop, *van der Schijff* 4361 A (K, PRE). Pietersburg dist., Woodbush, *Eastwood* 1113 (PRE).

At anthesis, the flowers are held horizontally; the upper lip and stamens now roof the pouch. The filaments of the longer pair of anthers are slightly curved at the tips so that the anthers lie hidden in a little cavity immediately below the middle lobe of the lower lip. The mouth of the corolla is held closed as long as the anthers are in this position. Slight downward pressure on the lower lip jerks the anthers free, there is a little explosive puff of pollen and the corolla mouth gapes slightly open with the anthers now exerted. The style ascends behind the filaments and is bent at the tip: this positions the stigma between the upper and lower pairs of anthers. Pollination presumably takes place when an insect depresses the lower lip and brushes pollen on to the stigma as it probes into the flower or withdraws from it: all the anthers ripen at the same time. The crimson spots on the floor and walls of the pouch converge on the bases of the filaments which are splashed with crimson and possibly guide the pollen vector. There are also glistening glands inside the pouch and on the ovary.

I have never seen pollination take place and seed is seldom set in my garden where *B. cymosa* grows well and flowers freely although some 250 miles almost due south of the nearest locality (Mbabane) where the species occurs naturally. Copious seed is set in the wild.

In *B. verticillata* too the flowers, and consequently the stamens, lie horizontally at anthesis. All the stamens are included, however, and there is no mechanism for holding the mouth of the corolla closed as in *B. cymosa*.

#### ACKNOWLEDGMENTS

I wish to thank the curators of the herbaria at Trinity College, Dublin, Natal Herbarium, Durban, Albany Museum, Grahamstown, Royal Botanic Gardens, Kew, and the Botanical Research Institute, Pretoria for sending specimens on loan or giving me access to their collections. I am greatly indebted to Mrs. A. Batten, Mrs. H. Bokelmann, Miss G. V. Britten, Mr. B. L. Burt, Mr. W. R. Trauseld, Mr. H. Wells and Mr. F. B. Wright, all of whom helped me in various ways.

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