The *Indigofera filifolia* complex (Fabaceae) in southern Africa

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ABSTRACT

The *Indigofera filifolia* Thunb. complex, previously known as a widespread polymorphic species, is segregated into three species. *I. filifolia* is retained as a variable species and two allied species, *I. gifbergensis* C. H. Stirton & J. K. Jarvie and *I. ionii* J. K. Jarvie & C. H. Stirton are described as new.

INTRODUCTION

The pantropical genus *Indigofera* comprises some 800 species. It forms a large and distinctive part of the tribe Indigofereae which also contains two closely related genera *Cyamopsis* and *Rhyncotropis* along with an anomalous Madagascan genus *Phylloxyon* (Polhill 1981).

*Indigofera* was once the main source of indigo dye but its importance dwindled as cheaper synthetic analogues were developed to replace the plant source of the dye. There is, however, a renewed interest in the genus and it has begun to be of some value as a source of forage legume (De Kort & Thijssen 1984).

The last major revision of *Indigofera* in Africa was by Gillett (1958), who recognized 278 species. He divided the African representatives into 5 subgenera, 5 sections and 19 subsections. As this revision was a precursor to a taxonomic revision of the genus for the *Flora of Tropical East Africa* he treated only 70 species in any detail. The work is essentially regional and ignores to a considerable extent areas such as southern Africa.

Our overall knowledge of southern African species of *Indigofera* is still dependent on the 1862 revision by William Harvey. This account was subsequently added to and modified by the following workers: Baker (1905), Brown (1925, 1926), Dinter (1932), Fourcade (1932), Bremerkamp (1932), Guthrie, Pillans & Salter (1939), Dyer (1944), Suessenguth & Merxmüller (1951), Merxmüller & Schreiber (1957), Schreiber (1970) and Stirton (1982).

The present investigation focuses on the widespread polymorphic species *I. filifolia* in South Africa. Gillett (1958) placed *I. filifolia* Thunb. as the sole member of his section *Juncifolieae*. His diagnosis is limited to the presence of petioles many times longer than the small terminal leaflet, persistent when the latter falls off; fruiting pedicels erect and spreading; and endocarp spotted with seeds ± separated.

We are indebted to Mr Ion Williams for drawing our attention to a small aphyllous plant which did not appear to fit the description of *I. filifolia*. He felt certain that it represented a new species. We confirm this and name it *I. ionii* in his honour. As part of our study we also looked at all the available South African aphyllous specimens of *Indigofera* that seemed pertinent to the *I. filifolia* group. We conclude that what had been known as *I. filifolia* Thunb. in herbaria should be separated into three species: *I. filifolia* Thunb., *I. ionii* J. K. Jarvie & C. H. Stirton, and *I. gifbergensis* C. H. Stirton & J. K. Jarvie.

KEY TO SPECIES

1a Leaflets 3–5, terminal leaflet present, narrowly obovate to obovate, base obtuse; petiole 14–25 mm long; stipules narrowly triangular; flowers 5–6(7) mm long

2a Dense, erect shrub up to 1 m tall; leaflets recurved mucronate, obovate, biramous hairs present on lower surface but restricted to the margin; inflorescence 15–30-flowered; flowers brick-red; calyx-teeth finger-like, sinus between vexillar teeth narrow; standard broadly elliptic; peg on outer surface of keel blade pointing upwards; scales present at base of anthers; upper parts of filaments alternately thick and thin; seeds dark chestnut or khaki and covered in black blotches and stripes, elliptic.................................1. *gifbergensis*

2b Small lax wiry herb, sparsely branched; leaflets with straight mucro, narrowly obovate, biramous hairs sparsely but evenly distributed over lower surface; inflorescence 6–10-flowered; flowers pink; calyx teeth triangular, sinus between vexillar teeth broad; standard very broadly ovate; peg on outer surface of keel blade pointing upwards; scales present at base of anthers; upper parts of filaments alternately thick and thin; seeds olive-green, oblong..................................................2. *ionii*

1b Leaflets 6–8, upper leaflets absent or reduced to scales, elliptic, base cuneate; petiole 40–60 mm long; stipules filiform; flowers (7.5)8.0–10.5 mm long........................................3. *filifolia*

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1. Flowers brick-red ............................................ *I. gifbergensis*
Flowers pink .................................................. *I. ionii*, *I. filifolia*
2. Leaflets with straight mucro ............................ *I. ionii*, *I. filifolia*
Leaflets recurved-mucronate ................................ *I. gifbergensis*
3. Anthers tufted; short filaments thicker than long filaments ........................................... *I. ionii*, *I. filifolia*
Anthers without tufts; filaments uniformly thin ... *I. gifbergensis*
4. Peg on outer surface of keel blade pointing downwards ........................................... *I. ionii*
Peg on outer surface of keel blades pointing upwards .................................................. *I. gifbergensis*, *I. filifolia*
5. Fruits compressed ........................................ *I. ionii*, *I. filifolia*
6. Seeds dark chestnut or khaki, blotched ........... *I. gifbergensis*, *I. filifolia*


*Frutex erectus lignosus ad 1 m altus, valde ramosus, caulibus veterioribus glabris, junioribus appresso-striulosis glabrescentibus. Stipulae conferruminatae, basi petioli adnatae, ad 4 mm longae, anguste triangulares. Folia regularia, imparipinnata. Foliola obovata, 6–8 × 3,0–3,5 mm, basi obtusa, recurvato-mucronata. Inflorescentiae axillares, racemose, laxae, 15–30-florae; peduncle 60–140 mm long; Flowers 5–6 (7) mm long, red, each subtended by a 2,0–2,3 mm long, narrowly triangular, rapidly caduous bract; pedicel < 1 mm long. Calyx 2–3 mm long; tube 1,5 mm long; teeth equal, 1,5 mm long, triangular, sparsely fringed with flattened biramous hairs. Standard broadly elliptic, 5–6 × 4,0–4,5 mm; claw short; auricles absent; apex rounded; appendages absent. Wing petals 5,5–6,0 × 2,0–2,5 mm, upper part flattened near the margin, raised above but equal in length to the keel blades, few scattered hairs present. Keel blades 6 mm long, 2–3 mm wide at maximum, fringed along upper margin. Androecium 5 mm long; vexillum stamen free; anthers uniform, 0,7–0,8 mm long, broadly apiculate, anthers on long filaments basifixed, anthers on short filaments dorsiixed; scales absent. Pistil 5,0–5,5 mm long, glabrous, narrowly oblong, sessile, 7–8-ovuled; style upcurved, height of curvature 2 mm; stigma capitata. Fruits narrowly oblong, 25–30 × 2,5–3,0 mm, chestnut-brown, dehiscent; inner surface shiny white; sepa up to 2 mm wide, barrel-shaped, separating the seeds, white with red flecks when in dry state. Seeds elliptic, 2,5–2,7 × 1,7–1,8 mm, dark chestnut or khaki, covered in large black blotches and stripes with small speckles in between; hilum exserted. Figure 1.

*Indigofera gifbergensis* is restricted to mountainous regions from Kobe Pass in the north to Cedarberg Snoekkop in the south (Figure 2).

This mountain fynbos endemic flowers from late August to November. It occurs between 600–1 650 m.

**FIGURE 1.—Indigofera gifbergensis**

- 1, flower, × 5,5; 2, calyx opened out, × 6,8; 3, standard opened out, × 8,2; 4, inner face of wing petal, × 8,2; 5, outer face of keel petal showing position and shape of the peg, × 8,2; 6, androecium flattened out, × 8,2; 7, pistil, × 8,2; 8, fruit with section cut away to show seeds and sepia, × 7; 9, seed, × 6,8; 1–7, Kerfoot 5922. 8–9: Leipoldt 3366.
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FIGURE 2.—Distribution of Indigofera gifbergensis, ▼: I. filifolia, ● in southern Africa.

Station along road to Groenberg (AA): 10.1967, Emdon 143 (PRE, STE); Pakhuis Mountain (AA), 12.1940, Leipoldt 3366 (BOL); 11.1929, Thode A2112 (PRE); 9.1940, Compton 9598 (NBG); 9.1937, Compton 6939 (NBG); 12.1981, Stirton 10196 (STE); Sneukop, Cedarberg (CD), 2.1936, Compton 6207 (NBG). Without precise locality: 8.1936, Thorne s.n (SAM 52891).

This distinctive species is easily separated from I. filifolia and I. ionii by its stiff compact habit, small brick-red flowers, the absence of tufts on anthers and its blotched seeds.


Herba perennis decumbens usque 0,8 m alta. Stipulae ad caulem appressae, glabrae. Folia juventute praesentia, imparipinnata, petiolata. Foliola anguste ovata, 3 (4 vel 5), 8—10 x 3—5 mm, lateralia minora, basi obtusa, apice mucronata, supra glabra, subtus sparse aequaliter pubescentia. Petioli 15—25 mm longi. Inflorescentiae axillares, 6—10-florae, racemose, laxae, 40—70 (80) mm longae. Flores 5—6 (7) mm longi, unoquoque bractea caduca anguste triangulari 2,5—3,0 mm longa subtenta; pedicellus filiformis, 2,0—3,5 mm longi, 8—10 x 3—5 mm longi. Flora carinae 3,0—3,5 mm longi; tubus 1,5—1,6 mm longi, glaber, dentibus 1,5 mm longis, ± aequalibus, triangulilibus. Vexillum 5—7,0 mm longum et latum, transverse late ovatum; auriculae et calli absentes. Alae 6,8—7,0 x 2,5 mm, margine inferiore involutas; extremitas infera laminae incisa. Petala carinae 6,5—7,0 x 2,0—2,5 mm, apice pubescentia. Androecium 6,0—6,5 mm longum; stamine vexillari libero; antherae uniformes, <0,5 mm longae; ovatae, apiculatae, squamis basibus praesentibus; filamenta antherarum basifixarum longa, tenuia; filamenta antherarum medifixarum, breviarum, crassiorum. Pistillum 5—6 mm longum, compressum, anguste oblongum, 8-ovulatum. Fructus 3,0—3,5 mm longus, compressus, dehiscens; septa <1 mm longa. Semina oblonga, 2—3 x 2 mm, olivacea.

TYPE.—Cape, Vogelgat, near Hermanus, I. Williams 3519 (K, holo.); NBG, iso.]

Small wiry erect or sprawling herb up to 0,8 m tall; sparsely branched, mostly near the base. Stipules free, 2,5—3,0 mm long, appressed to stem, glabrous. Leaves present during early stages of growth, imparipinnate, petiolate. Leaflets 3, occasionally 4 or 5, narrowly obovate, 8—10 x 3—5 mm; terminal largest; base obtuse, apex mucronate, straight, glabrous above, sparsely and evenly scattered with biramous hairs beneath. Petiole 15—25 mm long; petiolule <1 mm long. Inflorescences axillary, 6—10-flowered, racemose, lax, 40—70 (~80) mm long. Flowers 5—6 (7) mm long, each subtended by a 2,5—3,0 mm long, narrowly triangular caducous bract; pedicel filiform, 2,0—3,5 mm long, elongating and thickening during fruit formation. Calyx 3,0—3,5 mm long, glabrous; tube 1,5—1,6 mm long; teeth 1,5 mm long, more or less equal, triangular; sinus between vexillar teeth broad. Standard 5,0—7,0 mm long and wide, very broadly ovate, claw very short, venation fine, branched from three traces at base, apex slightly emarginate; auricles and appendages absent. Wing petals 6,8—7,0 x 2,5 mm, infolded along lower margin; auricle inflated and flattened; with scattered hairs along the margin to-
wards the apex; lower end of blade notched. Keel petals 6.5–7.0 × 2.0–2.5 mm, apex pubescent. Androecium 6.0–6.5 mm long; vexillar stamen free; anthers uniform, < 0.5 mm long, ovate, apiculate, tufted at base; basifixed anthers on long thin filaments; medifixed anthers on short stout filaments. Pistil 5–6 mm long, compressed, < 0.5 mm long, glabrous, straight, narrowly oblong, 8-ovuled; style upcurved, height of curvature 1.5 mm. Fruit 30–35 mm long, compressed, surface coarsely rippled, margins distinctly ribbed, dehiscent; septa < 1 mm long, white with small orange flecks. Seeds oblong, 2–3 × 2 mm, olive-green. Figure 3.

**Indigofera ionii** is restricted to the mountains of the south-western Cape (Figure 4). This fugitive fynbos species favours damp areas, usually on tussocks in river beds, vleis and marshes. It flowers sporadically from August to April, with peaks between September and January. It occurs from 500–700 m.

**CAPE.**—3418 (Simonstown): plateau between Constantiaberg and Noordhoek (–AB), Leyvis 6648 (BOL); west of Groottop (–AB), 1.1940, Salter 8305 (BOL); Noordhoek Mountain (–AB), 11.1942, Barker 2091 (NBG); marsh west of Klaasjagersberg (–AB), 1.1936, Salter 5751 (BOL, BM, NBG); 8.1938, Salter 7606 (BM); Constantiaberg (–AB), 3.1940, Bond 192 (NBG); 9.1922, Schlechter 1469 (BOL); 12.1943, Compton 15463 (NBG); Redhill (–AB), 1.1940, Lewis 709 (NBG); source of Prinskasteel River (–AB), 1.1948, Salter 83202 (BOL); stream south of Constantiaberg (–AB), 11.1896, Wolly-Dodd 1914 (K); Cape Point (–AD), 8.1944, Compton 15833 (NBG); near Smitswinkel (–AD), Leyvis 6850 (BOL); Compton s.n. (BOL); Booskraal near Brightwater; Cape of Good Hope Nature Reserve (–AD), 12.1981, Grobbelaar 2647 (PRE); beacon near Smith’s farm (–AD), 11.1939, Salter 8279 (BOL); Modderdam (–BA), 12.1938, Salter 7874 (BM, BOL, PLE); 12.1938, Salter 7875 (BOL); Muizenberg Mountain (–BB), 12.1948, Compton 21210 (NBG); Rooi Els Flats (–BD), 11.1945, Leighton 1448 (BOL); flats south west of Klein Hangkloof (–BD), 9.1969, Boucher 356 (STE); near Sommersfontein (–BD), 9.1969, Boucher 711 (STE); near Kleinmond (–AC), De Vos 855 (STE); Palmiet Valley near Albertyn’s house (–AC), 10.1948, De Vos 1045 (STE); Vogelpool, Vogelgat, near Hermanus (–AD), 3.1984, Williams 3543 (K, NBG); Williams 3519 (K, NBG); 9.1984, Stirton 10762 (K); marshy slopes at head of Boskloof between Steenbras and Kogelberg (–BD), 2.1975. Esterhuysen s.n. (BOL). Without precise locality: Forbes s.n. (K).

**FIGURE 4.—**Distribution of Indigofera ionii in southern Africa.

Lebeckia contaminata Ker: 104 (1816) non Thunb. (1800). L. contaminata Ait.f.: 261 (1812) non Willd. (1803). Indigofera filifolia Ker: notes 2 (1817). Spartium contaminatum Ait.: 10 (1789) non L. (1771). Type: Cape of Good Hope, Masson s.n. (UPS-Thunb. 17338, holotype). Figure 5.

Indigofera junccea DC.: 225 (1825); Mordant de Launay: 227 (1834). Type: cultivated from seed sent from Cape seeds in 1814 by Messrs. Whitley, Brame & Milne at the Fulham Nursery and then sent to Sims in October 1819 as Lebeckia contaminata (BM, holotype).

Indigofera aphylla Ker: 104 (1816) non Thunb. (1800). Type: ‘Kap der guten Hoffnung (Cape of Good Hope), cultivated in the Cape of Good Hope’, Cels s.n. (G, holotype!).

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Tree-like shrub up to 2 m tall, open habit, woody, branches sparsely appressed strigulose when young but glabrous when mature. Stipules free, filiform, strigulose, up to 2 mm long, parallel to axis of branch. Leaves common on younger plants, petiolate, basal pair largest, up to 2 mm long, parallel to axis of branch. Basal leaflets 6–8, elliptic, rarely narrowly obovate, 15–20 × 8–10 mm; base cuneate; apex mucronate, straight; glabrous above, sparsely and evenly scattered with appressed bifurcate hairs beneath. Petiolo 40–60 mm long; petiolules up to 2 mm long. Inflorescences axillary, clustered at ends of branches forming a pseudocompound structure, racemose, lax, up to 50-flowered. Flowers (7,5) 8,0–10,5 mm long, each subtended by a short 1–2 mm long, narrowly triangular, rapidly caducous bract; pedicel 4,0–4,3 mm long. Calyx 4,0–4,5 mm long; tube 1,7–3,4 mm long; teeth unequal, 1,1–3,0 mm long; triangular sinus between vexillar pair very broad, hairs few, scattered in the sinuses of the teeth. Standard (6,1) 8,4–9,2 (10,2) × (5) 6,3–7,6 mm, orbicular; claw very short; venation fine, branching from three traces at the base; apex slightly hooded, auricules and appendages absent. Wing petals 9–10 × 2,5–3,0 mm, constricted in the middle; auricle inflated and flattened. Keel petals 9 × 3,0–3,5 mm; apex pubescent. Androecium 9–10 mm long; vexillar stamen free; anthers uniform, 1 mm long, apiculate and tufted, anthers on long filaments basifixed, those on short filaments dorsifixed, scales present. Pistil 6,6–9,0 (9,9) mm long, terete, < 0,5 mm wide, glabrous, arched, narrowly oblong, 8–14-ovuled; style upcurved, height of curvature 2 mm. Fruit 40–55 × 4 mm, dark brown, dehiscent. Seeds 2,6–2,7 mm long and wide, chocolate-brown, hilum protruding, transversely oblong. Figure 6.

Indigofera filifolia is a widespread fynbos endemic occurring from the Cape Peninsula eastwards to Heidelberg (Figure 2). It favours damp sites and is especially common along watercourses. The plants flower throughout the year but with a peak from February to March. This species cop­pices strongly after burns.
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4.1980, 4.1979, (-AD), 4.1984, (BOL, NBG); 4.1946, Waal s.n. (SAM 32330); Zeyher s.n.
Genadendal, Baviaanskloof (-BA), 3.1933, near Stanford, foot of Kleinrivier Mountains (-AD), 4.1952, NBG); Babylon's Tower (-AD), 2.1941, Louw's Bos (-BD), 3.1963, Riviersonderend (-BB), 4.1950, bergkloof near Nuwepos (-DA), 4.1975, 4.1923, berg (-AA), 3.1948,verity field notes and comprehensive collections of mortality and kindness to the second author and for his accuracy and comprehensive collections of I. ionii. Finally the first author would like to thank Drs Barbara Pickersgill, J. Barnett and R. Wadsworth (Reading University); Dr I. C. Trueman (Wolverhampton Polytechnic); Brenda Timmons, Chloe Bennett and Lani Rubin for help and advice.

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