

# A revision of the Indigofereae (Fabaceae) in Australia. 1. *Indigastrum* and the simple or unifoliolate species of *Indigofera*

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## Abstract

Wilson, Peter G.<sup>1</sup> and Rowe, R.<sup>1,2</sup> (<sup>1</sup>National Herbarium of New South Wales, Royal Botanic Gardens, Sydney NSW 2000, Australia; <sup>2</sup>present address: Environment Australia, GPO Box 787, Canberra ACT 2601, Australia) 2004. A revision of the Indigofereae (Fabaceae) in Australia. 1. *Indigastrum* and the simple or unifoliolate species of *Indigofera*. *Telopea* 10(3): 651–682. The first part of a revision of Australian representatives of the tribe Indigofereae (Fabaceae) is presented. Two genera are recognised for Australia, *Indigastrum*, with one variable species, *Indigastrum parviflorum*, and *Indigofera*. In this paper, we give a general introduction to the tribe and treat *Indigastrum* and those species of *Indigofera* with simple or unifoliolate leaves; the remainder of the species of *Indigofera* will be covered in a future publication. The twelve species of *Indigofera* (ten endemic, one native and one introduced) with simple or unifoliolate leaves are fully described and one species complex is indicated as worthy of further in-depth study. Where relevant, typification, variation, and conservation status are discussed. Five new species of *Indigofera* are described and illustrated: ***Indigofera ixocarpa***, ***I. rupicola***, ***I. petraea***, ***I. pilifera*** and ***I. triflora***. Two synonyms of *Indigastrum parviflorum* are lectotypified.

## Introduction

*Indigofera* and its allies are now widely considered to constitute a group of tribal rank, the Indigofereae (Rydberg 1923, Polhill 1981b, Schrire 1995); the tribe is predominantly one of the Old World tropics. Polhill (1981a: 199, fig. 4) considered it to be derived from a broadly defined, woody 'Tephrosieae' (=Millettieae) and *rbcL* sequence data (Doyle et al. 1997) appear to confirm that this is the case. In the latter study, two diverse representatives of the Indigofereae (*Indigofera* and *Phylloxylon*) form a strongly-supported clade that is associated with representatives of the Psoraleeae, Phaseoleae, Desmodieae, Abreae and two representatives of a polyphyletic Millettieae (*Tephrosia* and *Derris*); however, this association is not strongly supported by the *rbcL* data. In two more recent studies, of the Millettieae (Hu et al. 2000) based on sequence data from the *trnK* region, and of the genistoid tribes (Crisp et al. 2000) based on ITS sequence data, the tribe was well-supported but the topology of that part of the tree varied.

Schrire (1995) carried out a phylogenetic analysis of the tribe based predominantly on taxa from the Africa–Madagascar region. As a result he recognised seven genera, *Indigofera* plus *Cyamopsis*, *Indigastrum*, *Microcharis*, *Phylloxylon*, *Rhynchotropis* and *Vaughania*, compared with the four accepted by Polhill (1981b). Schrire's study reviews the history of the classification of the Tribe and the various taxonomic schemes proposed for the genus *Indigofera*, and provides a revised system of Sections and Subsections for taxa from the African region. Schrire's classification accommodates a number of widespread taxa and he (Schrire 1995, pers. comm.) has suggested sectional and subsectional positions for a number of Australian taxa. Barker et al. (2000) followed this study with a molecular survey of the tribe based on sequences from three

regions, chloroplast *trnL* and *trnK* introns, plus the nuclear ITS spacers, using outgroups from the core Millettieae. Their analysis confirmed that *Phylloxylon* is sister to the rest of the tribe. It also supported the generic segregates accepted by Schrire (1995) with the exception of *Vaughania*, which was nested in the *Indigofera* clade as sister to the anomalous species *Indigofera amnoxylum*. Barker et al. (2000) conclude that further research on the position of *Vaughania* is required. Schrire et al. (2003) conducted a combined analysis of molecular (ITS) and morphological data from 87 species of *Indigofera* that confirmed the findings of Barker et al. (2000) for the tribe Indigoferae. Schrire et al. (2003) also found four monophyletic clades within *Indigofera* itself: the Cape clade, the Boreotropical clade, the Paleotropical clade, and the Pantropical clade. All except the Boreotropical clade showed strong bootstrap support in parsimony analyses but all four received high likelihood scores under Bayesian analysis. The three endemic Australian species in the study (*I. pratensis*, *I. rugosa* and *I. australis*) were members of the Pantropical clade and formed a monophyletic group under both parsimony and bayesian analyses. Of the three widespread native species included, *I. trita*, *I. trifoliata* and *I. colutea*, the first two were members of the Boreotropical clade and the latter of the Paleotropical clade.

Bentham (1864) was the first to give a full account of the Australian species of *Indigofera* then known. He did not adopt any formal subgeneric classification; he did not use the sections set up by de Candolle (1825) or in any way anticipate the subgenera he adopted later (Bentham 1865). Bentham merely separated the species into two groups labelled 'Herbaceous Species' and 'Shrubby Species'. Apart from the contribution of Domin (1926), who described a number of new species and proposed a few nomenclatural changes, there has been little revisionary study of the genus in Australia.

Davidson and Davidson (1993) consider the possible time of establishment and development of various Australian genera of legumes. Their hypothesis is that one group of genera, including *Indigofera*, first became established in Australia during the late Miocene (5–11 Ma) with the widespread appearance of sclerophyllous vegetation. They suggest that radiation of these early, established genera may have entered a new phase during the early Pleistocene (post 2.5 Ma) during a time of rising temperatures and development of more open vegetation types. The most widespread Australian species, *Indigofera australis*, has the distribution, ecological preference and variability consistent with a long history in Australia. *I. australis*, and a number of other Australian species with  $\pm$  glabrous fruits, would fall in Schrire's sect. *Psiloceratiae*, a relatively unspecialised group judging by its position in his published morphological analysis (Schrire 1995). Schrire et al. (2003) carried out rate analyses that estimated the age of the Pantropical clade to be about 12–20 Ma, which would be consistent with the estimate given above for the age of the Australian endemic element.

Schrire (1995) presents two hypotheses of relationships for the tribe Indigoferae: a cladogram and a preferred phylogenetic tree one step longer. There is no major difference between these hypotheses. According to this analysis, the other genera in the tribe are basal and are either restricted to, or centred on, the Africa–Madagascar region. There are around 540 species of *Indigofera* in the same area and it should be noted that, within the genus, the widespread species and many of the tropical Asian and Australian species fall into the more derived groups. Schrire does not specifically mention American endemic species but, from his treatment of the sections set up by Rydberg (1923), these seem to fall into a variety of basal and derived groups. This clearly points to an origin of the tribe in West Gondwana with *Indigofera* itself extending to Australia and South America where it has diversified further. The later

analysis of Schrire et al. (2003) does not contradict these general conclusions. Species from northern Africa and Asia seem to belong to either more derived or to pantropical groups. This could indicate a more recent radiation of species by way of northern Africa to Asia and from there to Australia. Although most of the non-endemic species in Australia have distributions consistent with this hypothesis, there is no easy explanation for the absence of *Indigastrum parviflorum* (formerly *Indigofera parviflora*) from Burma (Sanjappa 1985) and other parts of Southeast Asia (de Kort & Thijsse 1984).

Schrire (1995) recognised infrageneric taxa for African species of *Indigofera* and had suggested (in litt. 1992) placement of some Australian species in this scheme. However, as a result of the analyses presented in Schrire et al. (2003), some of the relationships suggested in the earlier paper have been questioned and the classification system requires modification. So, in the present paper, the affinities of many Australian taxa are suggested (in notes under individual species) but placement of endemic Australian species in sections or informal groups is not attempted in any systematic way.

### Morphology

Schrire (1995) discusses a large number of morphological characters as a prelude to his cladistic analysis. We will consider only some of these characters, and then mostly in relation only to endemic Australian taxa.

#### Habit

As indicated by Schrire, the type of habit is likely to be of phylogenetic importance. The Australian species can be divided roughly into three categories based on habit. Plants that could be described as shrubs or large shrubs, such as *Indigofera brevidens*, *I. australis*, *I. adesmiifolia* and some members of the *I. pratensis* group, occur predominantly on the east coast in more mesic habitats or on better soil types. This accords well with Schrire's designation of this type of habit as plesiomorphic. Next, there are those species that occur as subshrubs or perennial herbs, for example *I. efoliata*, *I. baileyi*, *I. triflora*, the *I. georgei* and *I. rugosa* groups, and other members of the *I. pratensis* group; these occur in the more arid or seasonally dry parts of Australia. Annual herbs are apparently uncommon amongst the endemic species, with only two annual species, *I. haplophylla* and *I. ammobia*; these occur in the monsoon tropics (*I. haplophylla*) and the Tanami and Great Sandy Deserts (*I. ammobia*). The native species with wide extra-Australian distributions, particularly *I. colutea*, *I. hirsuta*, *I. linnaei*, *I. linifolia* and *Indigastrum parviflorum*, occur in a wide variety of habitats, mostly towards the northern parts of the continent, and often in disturbed sites. It is highly likely that these taxa now occupy a greater range than they did before European settlement and there is also a strong possibility that the Australian populations of these species have been augmented by the introduction of seed from non-Australian sources.

#### Trichomes/emergences/'glands'

The tribe Indigofereae is characterised by biramous hairs. This is one of only a few morphological synapomorphies for the tribe. The biramous hairs predominantly have arms of equal lengths but in some species unequally biramous hairs occasionally occur. *Indigofera hirsuta* is well documented as having very unequally biramous hairs (Gillett 1958, 1971: fig. 45/13, Prabhakar et al. 1985: figs 7–9, Schrire 1995: plate 3e) to the extent that they may superficially appear simple.

There are a number of different types of multicellular trichomes or emergences found in the tribe. These have long been recognised at species level and were used by Rydberg (1923) to define two Sections in *Indigofera*. The first kind of multicellular hair is the sticky, gland-tipped type found in *I. colutea* and *I. adenotricha*. In *I. colutea*, the density of these hairs varies markedly; some specimens are very heavily clothed in them, in others they are virtually restricted to the fruit, and in rare cases they seem to be lacking altogether. In the few available specimens of *I. adenotricha*, the gland-tipped hairs occur on all parts of the plant; the glandular tips of the hairs are about twice the size of those found in *I. colutea*.

Schrire (1995) includes the other prominent types of multicellular emergence under the category 'pearl bodies' but the definition of pearl bodies that he gives (citing O'Dowd 1982, see also Uphof 1962: 165) does not seem appropriate for the various structures observed in Australian species. None are lustrous and pearl-like, and none appear to be filled with lipid. However, Schrire (1989: 241) records that he had personally observed small, red, multicellular 'glands' in the leaf axils of some African species being 'milked' by ants; we have not observed this in any Australian species. Both O'Dowd and Uphof acknowledge that these structures are of heterogeneous origin in dicots and there is no evidence to indicate whether or not the main forms that occur in *Indigofera* are homologous. Schrire recognises two main classes, the clavate to cylindrical type and the hollow-discoïd type, and he himself treats them as independent characters in his analysis. These structures are both commonly called 'glands' in the literature but it has not been demonstrated that they have any glandular function. In this study we avoid use of the terms 'gland' and 'pearl body' for these structures and refer to these emergences merely as multicellular hairs or trichomes.

The clavate type of multicellular hair is very common in Australian species, although they are often inconspicuous and only occur in conspicuous clumps in a few species, viz. *I. adesmiifolia*, *I. australis*, *I. bancroftii*, *I. brevidens*, *I. centralis* ms., *I. coronillifolia*, *I. haemastica* and *I. helmsii*. They also form conspicuous clumps in the axils of the stipules in many specimens in the western Australian form of *I. australis*. These structures are orange-red to deep red in colour, the colour darkening with age. In a few species, clavate emergences may occur scattered on other parts of the plant, particularly on inflorescence axes and sepal margins (for an example of this, see Schrire 1995: fig. 6f). A variation of the usual clavate type occurs in *I. circinella* where they are more conical than club-shaped.

A probable variant of the clavate type is found in a few species. In these taxa the multicellular trichomes are uniseriate rather than multiseriate and are less rigid; they appear pointed. They are borne in similar places to the clavate type, i.e. on the rachis between leaf pairs and at the leaf axil. These linear trichomes are characteristic of, and well-developed in, *I. decipiens* ms. but are found to varying extents in a range of other species.

The hollow-discoïd type of emergence (Prabhakar et al. 1985) is characteristic of *I. trifoliata* and *I. glandulosa*; they are visible on the undersurface of the leaflets as yellow to dark brown spots.

Two Australian species, *I. ixocarpa* and *I. verruculosa*, have small, wart-like, multicellular emergences that are found on most aerial parts of the plant; to our knowledge, emergences like these have not been recorded for any extra-Australian

species. They do not appear to be stalked and may arise from depressions in the epidermis in the same way as the hollow-discoid type; anatomical investigation is needed to confirm this. In *I. ixocarpa* these structures appear to be the source of a viscid exudate that covers the stems, leaves and fruits while in *I. verruculosa* no such exudate is produced.

### Leaves

Leaves are pinnate (imparipinnate), trifoliolate, unifoliolate or simple. Unifoliolate and simple leaves have arisen many times in unrelated species by reduction. Gillett (1958) stresses that the distinction between simple and unifoliolate leaves should not be given too much significance, as the distinction is not always easy to apply. However, for the Australian species, we will maintain the distinction: unifoliolate leaves are defined as having a distinct articulation in the 'petiole', in many cases with stipellae present; the distal portion of the 'petiole' is homologous with the petiolule or leaflet stalk. Simple leaves, on the other hand, are defined as having a short, uniform petiole.

Leaflets are usually opposite on the rachis but are markedly alternate in a few species. In a few cases (*I. efoliata* and *I. adesmiifolia*) they are reduced and  $\pm$  caducous leaving phyllode-like rachises. This phenomenon is variable in *I. adesmiifolia* and is best developed in those populations with wider rachises and smaller leaflets. Stipellae are usually small or absent, but are conspicuously present (regularly 1 mm or more long) in at least seven species and are smaller, but discernible, in many others. In *I. oxyrachis*, the weakly spinescent rachis-tip appears to have been formed by fusion of the distal pair of stipellae.

Stipules are mostly small,  $\pm$  triangular and inconspicuous but some are more elongated, verging on setaceous. Stipules with scarious margins are found in one widespread native species (*I. linnaei*), and a few introduced species (*I. circinella*, *I. cordifolia*, *I. hendecaphylla* and *I. spicata*). It is worthy of note that all these species, except the simple-leaved *I. cordifolia*, have leaflets that are alternate on the rachis. Two other species, in particular, have rather specialised stipules. *I. helmsii* has broad triangular stipules that become recurved, hardened and somewhat spinescent. *I. cornuligera* ms. has stipules that are linear and tapering but become thickened at the base to produce a hardened horn-shaped organ.

### Flowers

Schrire (1995) gives a very detailed account of the variation in floral morphology in the tribe Indigofereae. He remarks that the more plesiomorphic taxa in the tribe, and in *Indigofera* itself, have calyx lobes that are shorter than to  $\pm$  equal to the length of the tube. Bentham (1864) recognised this and used the length of the calyx lobes relative to the tube as a major key character in his *Flora Australiensis*.

Schrire scores pink to mauve or white flowers as plesiomorphic in the tribe. The Australian species have flowers that are predominantly pink to mauve in colour but a few are red-flowered. *I. haematica* has a maroon standard but the other petals are pinkish. Occasional white-flowered forms of usually red-flowered species have also been recorded (e.g. in *I. erubescens* ms.).

Corolla indumentum is one of the main distinguishing characters between *Indigofera* and *Indigastrum* with the latter characterised by a glabrous corolla. In *Indigofera*, the back of the standard and the apex and upper margin of the keel are usually noticeably hairy, sometimes with dark-coloured hairs. Apart from the lack of hairs, *Indigastrum parviflorum* also has a keel that is open and somewhat spathulate at the apex; Schrire calls this a 'prolonged rostrum'.

The keel also has what Schrire (1995) calls 'lateral prominences' which take the form of pockets or spurs and which may interlock with the wings to produce a platform level with the upper margin of the keel. Nair and Tewari (1975) show that the tips of the spurs in *Indigofera enneaphylla* (= *I. linnaei*) are glandular and apparently exude nectar. In *Indigastrum* these pockets are rather shallow while in species of *Indigofera* they are prominent and spur-like. The interlocked wings and keel have long been known to be tripped by probing at the base of the flower (e.g. Henslow 1867) with the stamens and style remaining in their former position (see Fig. 3c). The falling platform releases a cloud of pollen that may effect self-pollination but may also serve to deposit pollen on the abdomen of an insect. Hence, the tripping of the flower may increase out-crossing although many, perhaps all, species are self-compatible. Standard length and staminal tube length have been stressed in the keys and descriptions since the tripping of the flowers very often results in the wings and keel falling from the flower. The staminal tube is persistent and can usually be measured in fruiting specimens.

Schrire considers that a synapomorphy for many groups of herbaceous taxa in *Indigofera* is the combination of short ovary and long style; however, he does not quantify this. In species found in Australia, some species that have few-seeded fruits, and therefore short ovaries, do have relatively long styles but this is not restricted to herbaceous taxa; in fact, the introduced herb *I. sessiliflora* has a style shorter than the ovary. Amongst the native, shrubby taxa, *I. rugosa* and *I. tryonii* have styles 1–2 times longer than their ovaries while *I. pilifera* has a style that is over twice the length of the ovary.

Anthers of *Indigofera* species almost always have a dark coloured connective. They are usually glabrous but in some species there are tufts of hairs at the base and sometimes at the apex as well, as is the case in the introduced species *I. decora*. These hairs have also been recorded in *I. rugosa*. A few hairs at the base of the anther have occasionally been observed in a few species (including *I. baileyi*) but Schrire scores hairs absent or few as plesiomorphic in the tribe. In this study, green anthers were observed in at least some specimens of the related species *I. haplophylla* and *I. ammobia*.

### Pollen

In a survey of the pollen morphology of the Indigoferaeae, Ferguson and Strachan (1982) sampled six species from specimens collected in Australia. Three of these species were endemics, viz., *Indigofera australis*, *I. 'brevidens'* (= *I. gilesii* ms.) and *I. 'haplophylla'* (= *I. rupicola*). The first two were classed as Type I, Subtype IC and the third was classed as Type III. The only taxon from Australia with Type IV pollen was the widespread *I. linnaei*. Ferguson and Strachan comment that Type I pollen occurs in predominantly woody groups and that there is a transition to Type III in more shrubby taxa, while Type IV occurs in more herbaceous groups which they consider as likely to be morphologically derived. Schrire (1995) considered that Types I and III graded into each other and that they represented the plesiomorphic state compared with Type IV pollen.

Wu and Huang (1995) propose a somewhat different classification of pollen in their study of Taiwanese *Indigofera* species and recognise five types rather than four. They include a number of species that occur in Australia, either as adventives (*I. tinctoria* [Type I], *I. spicata* [IV] and *I. suffruticosa* [V]) or as natives (*I. hirsuta* [Type II], *I. linifolia* [III] and *I. trifoliata* [IV]). The only species common to the two studies was *I. trifoliata*, which Ferguson and Strachan (1982) put into their type III. Wu and Huang (1995) also consider Type I pollen to be plesiomorphic and that both Types III and IV have arisen through modification of Type II pollen; Type V may be derived from Type IV or, perhaps, from a sub-type of Type I (Wu & Huang 1995: Fig 117).

Schrire and Sims (1997) examined pollen of 86 species in the tribe Indigoferae from Africa and Madagascar. Based on a phenetic analysis of pollen features, these authors recognised three groups within *Indigofera* itself, which they call groups A–C. Comparing these groups to the pollen types of Ferguson and Strachan (1982) they found Group A to be most comparable to Type 1C, Group B to Type 3 and Group C to Type 4C. Compared to the phylogenetic analysis of Schrire (1995) they found that in sect. *Indigofera* the larger-flowered, more plesiomorphic species had Group A pollen, while the more derived, smaller-flowered species were referable to Group B. Group C pollen characterises many of the derived tropical members of the genus.

### Pod

Schrire (1995) discusses features of the fruit relevant to the Australian taxa and these will not all be repeated here. De Kort and Thijsse (1984: 93) were the first to recognise that all species have a persistent fruit-base that remains with the calyx and staminal tube after the valves of the open pod have fallen. Schrire considers this a synapomorphy for the tribe.

There is much variation in size, orientation and indumentum. Schrire scores glabrous pods as apomorphic. Pods that are glabrous or have very few hairs occur fairly commonly in Australian species. Orientation, the angle at which the pod is held on the axis of the infructescence, is often distinctive for a species but in other cases the angle seems to vary. Most endemic species have terete pods but pods are noticeably subtorulose in at least one species, *I. chamaeclada* ms., and slightly so in some others.

Virtually all endemic species have endocarp tannins present. The exceptions, apart from *I. ewartiana* and *I. polygaloides*, which are members of the *I. trita* group (Wilson & Rowe 1994), are *I. baileyi* and *I. mackinlayi* ms. However, the last two species are variable in this and faint spots are visible in some specimens.

### Chromosome numbers

The base chromosome number for *Indigofera* is  $x=8$  (Frahm-Leliveld 1966, Goldblatt 1981) with occasional tetraploids ( $2n=32$ ); *Indigastrum* has a base number of  $x=7$ . As far as we can determine, there is only one chromosome count for an endemic Australian species, although counts exist for all widespread native and introduced species. Gupta and Agarwal (1982) record  $n=8$  for *I. brevidens*, but this name has been one of the most widely misapplied *Indigofera* names in Australia so, in the absence of a voucher, it is uncertain which species they examined. Further investigation would be required to establish whether species from arid Australia show a higher incidence of polyploidy, as implied by Frahm-Leliveld (1966).

### Toxicity

Non-protein amino acids: two toxic non-protein amino acids occur in *Indigofera*, canavanine and indospicine, both analogues of arginine. Canavanine is fairly toxic to some insects but is apparently harmless to mammals. Indospicine, on the other hand, is a strong hepatotoxin. An analysis of numerous seed samples (Charlwood et al. 1984) found measurable levels of indospicine in only six species, including *I. trita*, *I. hirsuta* and *I. spicata*. The delimitation of *I. spicata* has been reassessed (Du Puy et al. 1993) and *I. hendecaphylla* is now recognised as separate from it. It is not certain that both these species have been implicated in poisoning cases, but some published records (e.g. Morton 1989) definitely refer to *I. hendecaphylla*. As far as we are aware, there have been no reports of poisoning by *I. trita* or *I. hirsuta*. *Indigofera linnaei* is known to cause the condition 'Birdsville Disease' in horses, and although this species does contain indospicine (Dowling & McKenzie 1993: 78, Bruneton 1999: 279), which can affect dogs fed with contaminated horsemeat, this 'disease' is a neurological disorder and is not caused by Indospicine.

Aliphatic nitrocompounds: compounds derived from  $\beta$ -nitropropionic acid (NPA) have been recorded from very many species of *Indigofera* and may even occur in all of them. It has been suggested that NPA could be toxic by causing methaemoglobinaemia (through oxidation of haemoglobin hence blocking its oxygen-carrying ability). Similar nitrocompounds in *Astragalus* are known to have this effect but there is no evidence that any *Indigofera* species does. Although the precise cause of 'Birdsville Disease' is not known, some researchers (e.g., Majak et al. 1992) have suggested that NPA is implicated in some way.

### Systematic treatment

Where possible, taxa have been lectotypified. Nomenclatural issues and questions were addressed in accordance with the *International Code of Botanical Nomenclature* [ICBN] (Greuter et al. 2000).

### Key to genera of Indigofereae in Australia

Standard glabrous; keel rostrate; fruit somewhat bilaterally flattened, partitions between seeds membranous, endocarp never spotted ..... **Indigastrum**  
 Standard with hairs on back; keel not rostrate; fruit  $\pm$  round (rarely somewhat tetragonal) in section, partitions between seeds (when present) usually pithy, endocarp often spotted .....  
 ..... **Indigofera**

### *Indigastrum*

**Indigastrum** Jaub. & Spach, Ill. Pl. Or. 5: 101, t. 492 (1856)

*Indigofera* 'group' *Indigastrum* (Jaub. & Spach) Bak. f., Leguminosae Trop. Afr. 1: 161 (1926)

*Indigofera* subg. *Indigastrum* (Jaub. & Spach) Gillett, Kew Bull., Add. Ser. 1: 123 (1958)

Type: *I. deflexum* (A. Rich.) Jaub. & Spach (= *I. parviflorum*).

Annual herbs or subshrubs. Indumentum of equally two-armed hairs, appressed; multicellular and glandular hairs absent. Leaves pinnate, rarely 1–3-foliolate (but never exclusively unifoliolate); stipellae absent. Stipules present, not persistent or spinescent. Inflorescence a pedunculate axillary raceme; flowers pedicellate; bracts caducous. Calyx lobes 5, equal to or longer than the tube, with a broad u-shaped sinus between the upper lobes. Corolla pink, mauve or white; standard glabrous, base narrow, gradually tapering to the claw; wings glabrous; keel glabrous, lateral pockets pouch-like, apex open,  $\pm$  spathulate. Stamens 10, 9 filaments connate and 1 free; filaments alternating long and short; anthers apiculate, glabrous or anthers of the shorter stamens rarely with scales at the base. Ovary sessile, pubescent; ovules numerous. Style shorter than the ovary, incurved; stigma oblique. Pod usually straight and descending, linear, terete to slightly bilaterally flattened; endocarp never spotted. Seeds cylindrical or cuboidal, never globose, separated by papery outgrowths of the endocarp. Chromosome number  $2n = 14$ .

**Indigastrum parviflorum** (Wight & Arn.) Schrire, Bothalia 22: 168 (1992)

*Indigofera parviflora* Heyne ex Wight & Arn., Prod. Fl. Pen. Ind. Or.: 201 (1834)

Type citation: 'Heyne! in Wall.! L. n. 5457; Wight! cat. n. 859.—Mysore; Heyne. Cunnawady.'



Type (*vide* Schrire 1992): India, in herb. Wallich no. 5457, *Heyne s.n.* (K).

*Anila parviflora* (Wight & Arn.) Kuntze, Rev. Gen. Pl. 2: 939 (1891)

*Indigofera oxycarpa* F. Muell., Fragm. 3: 103 (1862) nom. illeg., non Desv. (1814)

Type citation: 'In collibus petraeis nec non ripas glareosas secus flumina Victoriae et Sturt's Creek.'

Lectotype (**designated here**): Sturts Creek, *F. Mueller s.n.* (MEL 586188, fruiting element).

*Indigofera brachyodon* Domin, Biblioth. Bot. 89 (3): 189 (1926)

Type citation: 'Queensland: Grassflächen der Rolling Downs zwischen Hughenden und Mt. Walker (DOMIN II. 1910).'

Lectotype (**designated here**): Locis graminosis in collibus Rolling Downs inter opp. Hughenden et Mt. Walker, *Domin 4532*, Feb 1910 (PR 527209).

Illustrations (all as *Indigofera parviflora*): Hacker (1990: 184) photo; Milson (1996: 50) photo; Wilson (1992) fig. 125B.

Erect, annual herb 0.2–0.75(–1.5) m high, with taproot. Young stems ridged, green, strigose; hairs moderately dense, appressed, equally biramous. Leaves pinnate, rarely uni- or trifoliolate; leaflets (1–)5–11. Petiole (3–)7–15(–20) mm long. Rachis furrowed; multicellular hairs between leaflet pairs absent; stipellae absent. Leaflets linear to narrowly elliptical or ovate, (10–)20–45 mm long, 1–6 mm wide, opposite. Upper surface of leaflet green, glabrous, or rarely sparsely hairy; hairs (if present) appressed. Lower surface of leaflet green, hairs sparse to moderately dense, appressed. Discoid glands on lower surface absent. Veins not prominent. Apex obtuse and shortly mucronate. Stipules narrowly triangular or subulate, 1–1.9 mm long, sparsely pubescent, not persistent or spinescent. Inflorescence (2–)10–30(–40) mm long, shorter than the leaf. Peduncle 0.5–0.9 mm long. Bracts ovate, 0.3–1.1 mm long. Flowers purplish to pinkish to red or orange. Pedicel 0.5–0.9 mm long. Calyx 1.5–3 mm long; hairs sparse to moderately dense, white, appressed; lobes equal to or longer than the length of the tube, unequal to subequal. Standard reddish, obovate, 5.9–6.5(–7.2) mm high, (3.5–)4.5–5.2 mm wide. Wing narrowly obovate, 6.5–8 mm long, (2.0–)2.7–3.5 mm wide. Keel 5.5–7.7 mm long, 1.2–1.5 mm wide, glabrous; apex spatulate, drawn out from body of the keel (1.0–)1.4–2.2 mm. Lateral pockets present but inconspicuous, 0.1–0.3 mm long. Stamens colourless. Staminal tube 3–3.8 mm long. Ovary moderately hairy with fine hairs. Pod descending, somewhat bilaterally flattened, (12–)20–40(–48) mm long, 2–3 mm deep, yellowish or brown, strigose; hairs moderately dense, appressed; apex upturned, shortly beaked; endocarp not spotted. Seed (10–)14 per fruit.

**Notes:** the basionym *Indigofera parviflora* is yet to be lectotypified. Although a particular specimen was indicated by Schrire (1992), there are a number of specimens at Kew that are consistent with the citation in the protologue; a lectotype is to be chosen from these syntypes (Schrire pers. comm.).

Although a poor specimen in other respects, we have chosen the fruiting element on the sheet MEL 586188 as lectotype of *Indigofera oxycarpa*. The fruits are unquestionably of *Indigostrum parviflorum* and Mueller's taxon was named for the distinctive fruit shape. The other two sheets at Melbourne (MEL 586184, 586185) and the two at Kew, all from the Upper Victoria River, consist only of flowering specimens.

Domin (1926) recognised *I. brachyodon* as distinct from *I. parviflora* based only on the short calyx lobes of his specimen. There are three sheets at PR containing type material; the material is presumably all part of a single collection (the 'collecting numbers' were added later). Of these, we have chosen the sheet PR 527209 as lectotype. This sheet consists of a single plant, including roots, that is both flowering and fruiting; PR 527210 has two flowering stems, without roots, that may not come from the same plant, and PR 527208 is a mixed sheet.

A few specimens from near Pine Creek, one from Litchfield National Park, and a few from north-eastern Queensland have only 1–3 leaflets and these seem also to have a more slender habit. In Africa, a separate subspecies (subsp. *occidentalis*) is recognised for populations with a lower leaflet number. A more detailed analysis of Australian populations might lead to the recognition of infraspecific taxa, but a study of the species across its entire range would be desirable to place this variation in context.

**Distribution and habitat:** Queensland, Northern Territory, and Western Australia: recorded from heavy black or red clay soils, gravelly loams or sand in grasslands and open savanna woodlands. It often occurs on roadsides and disturbed sites and is thus considered a weed (Lazarides et al. 1997). Beyond Australia it is recorded from north-eastern to southern Africa and India.

**Selected specimens:** Queensland: Burke: Mount Walker, S of Hughenden, *Wilson UNSW 13453 & Puttock*, 23 Apr 1982 (NSW, UNSW); 35 km N of Julia Creek on the Normanton road, *Pullen 10425*, 21 Mar 1977 (CANB); 67 km WNW of Mount Isa, 6 km N of Mingera, *Harris 647*, 9 Mar 1991 (NSW). Cook: 45 km from Walsh River crossing on Mungana–Wrotham Park road, *Clarkson 3020*, 9 Mar 1980 (BRI); 2 km NE of Marina Plains turn-off on the Musgrave to Lakefield road, *Clarkson 7111 & Simon*, 9 May 1987 (BRI, NSW, QRS); 36.3 km from Dixie Station on the track to Killarney, *Clarkson 8155 & Neldner*, 5 June 1989 (NSW); 24.2 km S of Batavia Downs on the Peninsula Development Road, *Clarkson 8327 & Neldner*, 19 Apr 1990 (NSW); 2.8 km from Lappa on road to Sunnymount, *Clarkson 9197*, 23 Feb 1992 (NSW). Gregory North: Mimong, *Blake 11512*, 16 May 1936 (AD, BRI). Leichhardt: Tanderra (Nardoo), c. 45 miles SW of Springsure, *Johnson 1315*, 15 Feb 1960 (BRI, CANB). Maranoa: Mt Abundance, 1.5 miles [c. 2.5 km] from Mitchell Highway, *Martin s.n.*, 25 May 1962 (BRI). Mitchell: Athol, c. 20 miles W of Blackall, *Everist 3805*, 28 May 1949 (BRI); 13.5 km east of Hughenden on road to Charters Towers, *Blaxell 89/059*, *Johnson & D'Aubert*, 26 July 1989 (NSW). Warrego: Morven, *Blake 10992*, 2 Apr 1936 (BRI, CANB).

Western Australia: Fitzgerald: Inglis Gap, Gibb River Road, *Wilson 220*, 10 May 1988 (NSW, PERTH). Fortescue: 1.9 km WNW of Wittenoom turn-off, North West Coastal Highway, *Wilson 1007*, *Rowe & Mitchell*, 10 Sep 1991 (NSW, PERTH, PRE, K, L); c. 30 km W of Millstream homestead on Pannawonica road, c. 2 km N of McCarthys Bore, *Mitchell PRP203*, 31 Mar 1994 (NSW). Gardner: above and about Port Warrender, *Symon 10240*, 29 May 1975 (PERTH); 40 km E of Kununurra, *Andrew 287*, 17 Jan 1979 (DNA).

Northern Territory: Barkly Tableland: 3 miles [c. 4.8 km] NW Alexandria homestead, *Chippendale NT 1896*, 22 Mar 1956 (BRI, DNA, NSW). Central North: 8 miles [c. 12.8 km] S of Tobermorey Homestead, *Latz 2536*, 22 May 1972 (CANB, DNA); approx. 2 miles W of Argadargada H.S., *Nelson 168*, 27 Mar 1962 (DNA). Central South: 13 miles [c. 20.8 km] S Hamilton Downs Station, *Maconochie 85*, 7 Apr 1967 (NSW); Mt Riddoch area, Harts Range, *Beaglehole 44426*, 25 May 1974 (MEL, NSW). Darwin & Gulf: c. 15 miles [24 km] NE of Pine Creek township, *Lazarides 157 & Adams*, 11 Mar 1965 (CANB, DNA); Fossil Head, *Leach 4226*, 23 Feb 1994 (NSW); Kapalga, *Dunlop 6056 & Taylor*, 9 Mar 1982 (NSW); *Dunlop 7676*, 29 Feb 1988 (NSW). Victoria River: 3 km W of Timber Creek, *Wilson 198 & Jacobs*, 7 May 1988 (NSW, BRI, DNA); Middle Creek, Top Springs–Victoria River Downs road, c. 25 km E of VRD, *Beaglehole 54563*, 10 July 1976 (DNA, MEL); 67.7 miles NE Tanami, *Chippendale NT 5703*, 13 Apr 1959 (CANB, DNA).

South Australia: Lake Eyre: 9 km S of Cordillo Downs, *Williams 8304*, 2 June 1976 (AD); 2 miles SE Alka-Seltzer Bore, Mt Dare Station, *Latz 4762*, 3 Apr 1974 (CBG, DNA).

*Indigofera**Indigofera* L., Sp. Pl. 2: 751 (1753)*Anil* Mill., Gard. Dict. ed. 4: 95 (1754)*Indigo* Adans., Fam. Pl.: 326 (1763)*Anila* Ludwig ex Kuntze, Rev. Gen. Pl. 1: 159 (1891)Type: *I. tinctoria* L. (lectotype designated by Britton & Brown 1913: 371)*Sphaeridiophorum* Desv., J. Bot. 1: 125 (1813)Type: *S. linifolium* (L.f.) Desv. [= *I. linifolia* (L.f.) Retz.]*Indigofera* subg. *Sphaeridiophora* Benth., in Benth. & Hook. f., Gen. Pl. 1: 494 (1865)*Bremontiera* DC., Ann. Sci. Nat. sér. 1, 4: 94 (1825)Type: *B. amnoxylum* DC. [= *I. amnoxylum* (DC.) Polhill]*Hemispadon* Endl., Flora 15: 385 (1832)Type: *H. pilosus* Endl. [= *I. pilosa* Poir.]*Oustropis* G. Don, Gen. Syst. 2: 214 (1832)Type: *O. microphyllus* (Hook.) G. Don [= *I. gracilis* Spreng.]*Eilemanthus* Hochst., Flora 29: 593 (1846)Type: *E. strobilifer* Hochst. [= *I. strobilifera* (Hochst.) Bak.]*Acanthonotus* Benth., in Benth. & Hook., Fl. Nigrit.: 293 (1849)Type: *A. echinatus* (Willd.) Benth. [= *I. nummulariifolia* (L.) Alston]*Indigofera* subg. *Acanthonotus* (Benth.) Benth., in Benth. & Hook. f., Gen. Pl. 1: 494 (1865)*Indigofera* subg. *Amecarpus* Benth. ex Harv., in Harv. & Sond., Fl. Cap. 2: 201 (1862)Type: *I. sessilifolia* DC. (lectotype designated by Gillett 1958: 9)

Annuals, subshrubs or shrubs. Indumentum typically of two-armed, sometimes with multicellular and/or gland-tipped hairs as well. Leaves simple, unifoliolate, trifoliolate or pinnate, discolorous; stipellae present in some species, persistent. Stipules present, sometimes spinescent and persistent. Inflorescence a pedunculate axillary raceme; flowers pedicellate; bracts usually deciduous, occasionally persistent. Calyx lobes 5, subequal or the lowermost longer; sinus between upper lobes v- to u-shaped. Corolla red or pink to purple; standard hairy on adaxial surface, base abruptly tapering to the claw; wings variously hairy; keel hairy at apex and upper margin fringed, lateral pockets spur-like. Stamens 10, 9 filaments connate and 1 free; filaments alternating long and short; anthers apiculate, glabrous or with tufts of hairs at the apex and/or the base. Ovary sessile, usually pubescent; ovules 1, 2 or numerous. Style longer, or sometimes shorter, than the ovary, incurved; stigma capitate. Pod straight or curved, spreading to descending, rarely ascending, globose to linear, terete or sometimes angular, usually dehiscent; endocarp very often spotted. Seeds globose to cylindrical or cuboidal, separated by papery or pithy outgrowths of the endocarp. Chromosome number  $2n = 16, 32$ .

### Key to species

- 1 Leaves all unifoliolate or apparently simple ..... 2  
 1 Leaves pinnate or trifoliolate .....see Part 2 (Wilson & Rowe, in prep.)  
 2 Leaves apparently simple ..... 3  
 2 Leaves unifoliolate, articulate on the petiole ..... 9  
 3 Pod at least 10 mm long; flowers pink to purple ..... 4  
 3 Pod up to 3 mm long; flowers red ..... 8  
 4 Stems covered with small wart-like protuberances; fruits viscid ..... **1. *I. ixocarpa***  
 4 Stems lacking wart-like protuberances; fruits not viscid ..... 5  
 5 Stipules mostly  $\leq 1$  mm long ..... 6  
 5 Stipules 1.2–3.5 mm long ..... 7  
 6 Leaves usually 3 mm wide ..... **2. *I. haplophylla***  
 6 Leaves linear, 1 mm wide ..... **3. *I. ammobia***  
 7 Leaves linear to narrowly elliptical,  $\leq 8$  mm wide ..... **4. *I. triflora***  
 7 Leaves obovate or elliptical (rarely oblong), usually  $> 10$  mm wide ..... **5. *I. rupicola***  
 8 Leaves linear to narrowly elliptical ..... **6. *I. linifolia***  
 8 Leaves broadly ovate to elliptical, cordate ..... **7. *I. cordifolia***  
 9 Pod usually  $< 20$  mm long, 4–5-seeded ..... 10  
 9 Pod usually  $> 20$  mm long, 6–10-seeded ..... 12  
 10 Leaf surface with long, spreading hairs ..... **9. *I. pilifera***  
 10 Leaf surface densely tomentose ..... 11  
 11 Leaf with conspicuously impressed veins; calyx lobes 3.5–5.5 mm long; corolla 6–10 mm long ..... **8. *I. rugosa***  
 11 Leaf lacking conspicuously impressed veins; calyx lobes 1.4–2.3 mm long; corolla 3–4 mm long ..... **10. *I. petraea***  
 12 Petiole 3–9 mm long; staminal tube 5–7 mm long ..... **11. *I. monophylla***  
 12 Petiole 9–21 mm long; staminal tube 3–4 mm long ..... **12. *I. schultzi***

### Systematic treatment – species with simple or unifoliolate leaves

The simple-leaved taxa appear to fall into two groups: the species with long pods (spp. 1–5) into sect. *Planisiliquae* Wight & Arn., Prod. Fl. Ind. Or. 1: 200 (1834), and those with short pods (spp. 6, 7) into sect. *Brachycarpae* Wight & Arn., Prod. Fl. Ind. Or. 1: 198 (1834). The unifoliolate taxa, likewise do not constitute a single relationship group. Schrire (pers. comm.) has suggested that most of them should be distributed through a number of subsections of sect. *Psiloceratiae* (Gillett) Schrire, but that *I. rugosa* is not related to the rather similar-looking plants in the *I. monophylla* complex. In the case of *I. schultzi*, it is clear that this species is closely allied to *I. saxicola* and is, therefore, a unifoliolate member of the *I. pratensis* group. So, the simple and the unifoliolate taxa do not form two natural groupings and most, if not all, species considered here are thought to be related to species with pinnate leaves.

**1. *Indigofera ixocarpa* Peter G. Wilson & Rowe, sp. nov.**

Ramuli foliaque verrucis parvis numerosis instructa; folia simplicia lamina conduplicata et apice recurvato; inflorescentiae longae, folia excedentes; flores parvi, malvacei; fructus viscidus.

Holotype: Western Australia: Beatons Pool, 1 km NW of Nullagine, *Newbey 10092*, 31 Mar 1984 (PERTH). Isotypes: NSW, K.

Spreading somewhat rounded shrub, 0.4–0.8 m high; young stems terete, green and covered with small green, red or black warts which also occur on the leaf margin and lower surface, stems, stipules and bracts; hairs sparse, appressed, equally biramous. Leaves simple; stipules triangular to linear, 0.4–3 mm long, glabrescent, not spinescent, not persistent, adnate to the leaf base and falling with it; petiole 0.7–1.5 mm long; multicellular hairs in the leaf axils lacking; stipellae absent. Lamina very narrow and obovate, or linear, 20–47 mm long; 1–3(–6.0) mm wide, with the sides folded upwards about the midrib with the edges usually meeting and the mucronate apex distinctly down-turned or hooked; upper surface green, with sparse, appressed hairs; lower surface green with sparse, appressed hairs; veins not prominent. Inflorescences 80–180 mm long, longer than leaves; peduncle 15–22 mm long; bracts triangular, 0.7–1.2 mm long; flowers pink to purple; pedicel 0.5–0.8 mm long. Calyx 1.8–2.5 mm long, with subequal lobes equal to the length of the tube, and moderately dense, white, appressed hairs. Standard pink, elliptical to obovate, 3.5–4.5 mm high, 3 mm wide. Wings oblong, 3.5–4 mm long, 1–1.3 mm wide. Keel 4–4.8 mm long, 1.5 mm deep; lateral pockets 0.8–0.9 mm long; apex beaked; hairs moderately dense, golden to brown, along the bottom. Staminal tube 2.5–3 mm long, colourless. Ovary sparsely hairy. Pod ascending to descending, terete, 16–26 mm long, 2.5–3.5 mm deep, brown, glabrous but covered with sticky fluid; apex shortly pointed; endocarp spotted; seed 6 per fruit. (Fig. 1).

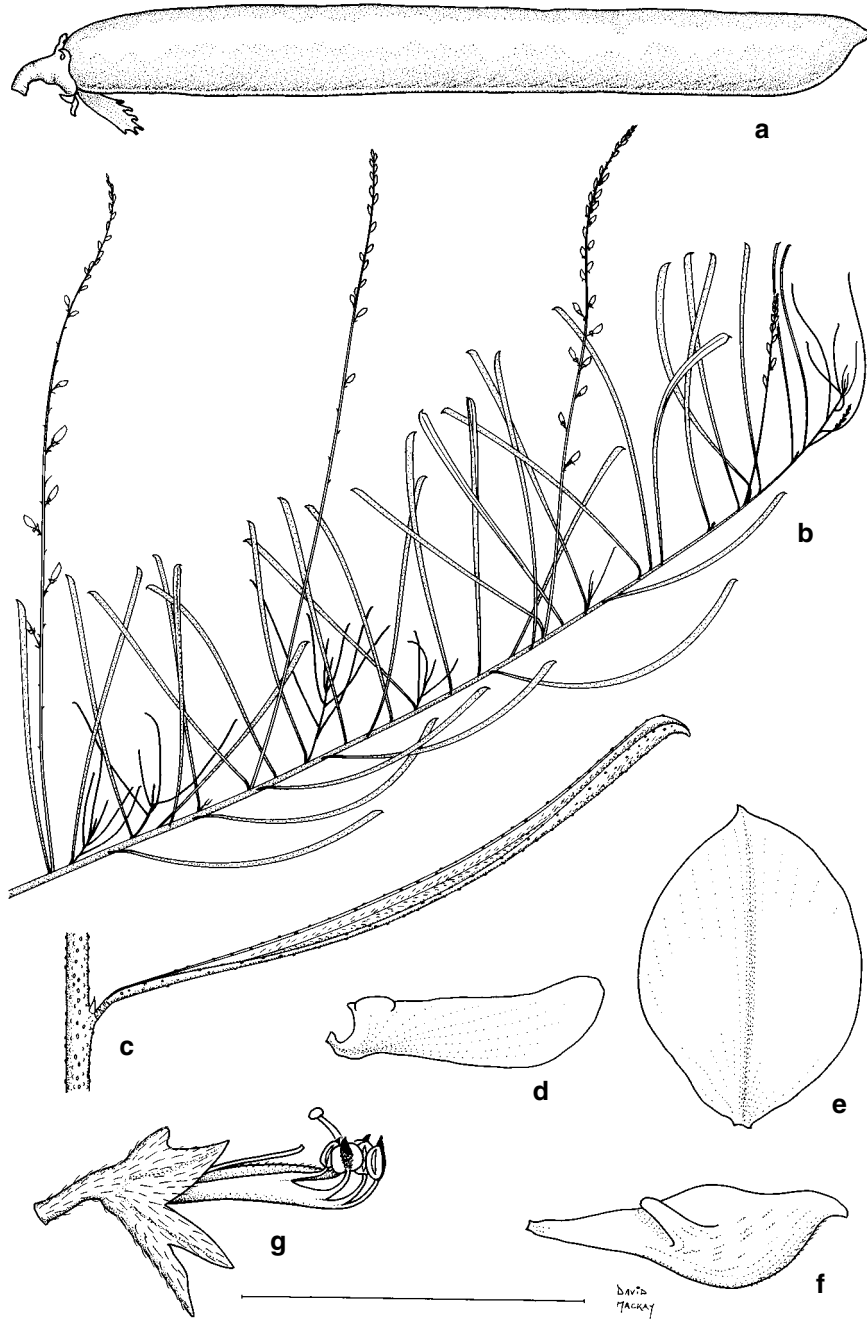
**Notes:** *I. ixocarpa* is likely to be most closely related to *I. verruculosa* from Arnhem Land by reason of the shared occurrence of the small warty protuberances, although the sticky coating on the fruits and young stems of *I. ixocarpa* does not occur in *I. verruculosa*. The simple (rather than unifoliolate) leaves, the long inflorescences, the small pink flowers and the ± glabrous fruits of this species also suggest an affinity with *I. ammobia* and *I. haplophylla* and their allies.

The epithet is derived from the Greek *ixos*, birdlime, in reference to the sticky fruit.

**Distribution and habitat:** this species is only known from four localities in the Fortescue District where it occurs on variably-drained stony and gritty alluvium and wash-out gravels. It has been collected in the bed of a small drainage line (near Nullagine) and also on the open stony slopes and summit of Mount Nameless and Marandoo Hill; it was formerly on the Mount Tom Price mine site.

**Conservation status:** Briggs and Leigh (1996) code this species 3KC-. Its conservation status is given as 'Priority Two' on *FloraBase* (Western Australian Herbarium 1998–2003). According to this source, a P2 rating is given to species that 'are known from one or a few (generally <5) populations, at least some of which are not believed to be under immediate threat (i.e. not currently endangered)'.

**Other specimens examined:** Western Australia: Fortescue: Tom Price mine, *Atkins HI-691*, 4 July 1980 (KARR); Beatons Pool, Nullagine, *Deighton 325*, 6 Oct 1982 (PERTH); Marandoo Hill, Hamersley Range, *van Leeuwen 1240*, 20 May 1992 (CANB, NSW, PERTH), *van Leeuwen 1320*, 19 Aug 1992 (NSW, PERTH); c. 1.8 km from summit of Mt Nameless, *Wilson 1080 & Rowe*, 14 Sep 1991 (CANB, K, MO, NSW, PERTH), *Wilson 1081 & Rowe*, 14 Sep 1991 (NSW).



**Fig. 1.** *Indigofera ixocarpa*. **a**, fruit; **b**, habit; **c**, leaf; **d**, wing; **e**, standard; **f**, keel; **g**, lateral view of calyx and androecium. (a, c–g from *Newbey 10092*; b from *Deighton 325*). Scale bar: a, d–g = 50 mm; b = 10 mm; c = 15 mm.

**2. *Indigofera haplophylla*** F. Muell., *Fragm.* 3: 102 (1862)

Type citation: 'Ad fontes rupestres torrensesque exarescentes montium ad originem fluminis Victoriae.'

Holotype: Upper Victoria River, *F. Mueller s.n.* (K).

*Anila haplophylla* (F. Muell.) Kuntze, *Rev. Gen. Pl.* 2: 939 (1891)

Erect or spreading annual herb, 0.2–0.5(–0.85) m high, with taproot; young stems slightly ridged, green, strigose with sparse to moderately dense, appressed or rarely short spreading, equally biramous hairs. Leaves simple; stipules triangular, 0.3–1 mm long, pubescent, not spinescent, persisting but not woody; petiole 1–3 mm long; rachis terete; multicellular hairs absent to moderately dense in the leaf axils, inconspicuous, red, club-shaped; stipellae absent. Lamina elliptical to narrowly ovate, (10–)20–50(–65) mm long, (1–)3–8(–12) mm wide; upper surface green with sparse, appressed hairs, rarely glabrous; lower surface green (paler than above), with sparse, appressed hairs; apex acute or obtuse and apiculate; veins not prominent. Inflorescences 25–80(–125) mm long, shorter to longer than leaves; peduncle (1–)5–15(–27) mm long; bracts triangular to ovate, 0.3–0.7(–1.0) mm long; flowers pink to purple; pedicel 1–2(–4.0) mm long. Calyx 2–2.8 mm long, with subequal lobes equal to or longer than the length of the tube and sparse to moderately dense, grey appressed hairs. Standard purple, ovate or obovate to orbicular, 4.5–5.7 mm high, 3.7–4.2 mm wide. Wings oblong to narrowly obovate with some hairs at base, 4.8–5.5 mm long, 1.5–1.7 mm wide. Keel 4.5–5.3 mm long, 1.7–1.8 mm deep; lateral pockets 0.6–1 mm long; apex rounded or rarely beaked; glabrous or with sparse hyaline hairs mostly along the bottom. Staminal tube 3.2–3.5 mm long, colourless. Ovary glabrous. Pod ascending to descending, terete, (10–)20–35 mm long, 2–2.5(–3.0) mm deep, brown, glabrous; apex shortly pointed or shortly beaked; endocarp spotted; seed (4–)7–9(–10) per fruit.

**Notes:** A specimen collected from near 'Shamrock' Station (*Mitchell 2757*), shows some features intermediate between this species and *I. ammobia*, particularly the rather narrow leaves.

**Distribution and habitat:** Queensland, Northern Territory and Western Australia; occurs in a wide range of habitats, from ridge tops to creek lines, and in a range of substrates, although it is generally found on gravelly or sandy soil in open woodland.

**Selected specimens examined:** Queensland: Burke: Spring Creek Scree Site, 23 km N of Mt Isa, *Harris 280*, 10 Mar 1989 (BRI).

Western Australia: Dampier: 5 km N of Shamrock Station Hsd at horticult. block, *Mitchell 2757*, 10 Nov 1992 (NSW 272404, BROOME). Fitzgerald: Lennard River Gorge, *Wilson 327*, 4 June 1988 (NSW 209870); Fern Creek, King Leopold Range, *Dunlop 7781 & Simon*, 9 Apr 1988 (BRI, NSW, PERTH); Tyra Islands, King Sound, *Mitchell 3982*, 31 May 1995 (NSW); Sunday Island, *Mitchell 2222*, 31 Mar 1992 (BROOME, NSW). Gardner: 1.9 km along Mulligans Lagoon Road, Kununurra (to N of Hidden Valley National Park), *Wilson 836 & Rowe*, 29 Aug 1991 (BRI, CANB, PERTH); Headwaters of Packsaddle Creek, Northern Carr Boyd Ranges, *Hartley 14355*, 7 Mar 1978 (CANB, PERTH); Longini Landing, near Kalumburu Mission and on coastline, *Symon 10195*, 16 May 1975 (AD, NSW, PERTH).

Northern Territory: Darwin & Gulf: Fitzmaurice River, *Leach 4068*, 20 Feb 1994 (MEL, NSW); 94 m [c. 120 km] E of Daly Waters, *Byrnes 2508*, 18 Mar 1972 (CANB, DNA, BRI); Cox River Station, *Latz 7329*, 12 July 1977 (DNA, CANB); Bukalara Plateau, *Rice 2291*, 12 Feb 1976 (CANB); Mt Gilruth, *Craven 8315 & Wightman*, 28 Mar 1984 (CANB, NSW); 36 km W of Cape Crawford, Carpentaria Hwy, *Cowie 1731 & Wilson*, 1 May 1991 (NSW). Victoria River: Keep River National Park, *Dunlop 5732*, 23 Feb 1981 (NSW, MEL); Victoria River District, *Evans 3182*, 13 Apr 1990 (MEL, NSW).

### 3. *Indigofera ammobia* Maconochie, J. Adelaide Bot. Gard. 2: 325 (1980)

Holotype: Western Australia: just S of Tobin Lake, Great Sandy Desert, A.S. George 15644, 6 May 1979 (PERTH). Isotypes: CANB, DNA.

Illustration: Maconochie (1980: 326).

Erect annual to short-lived perennial herb, 0.15–0.7 m high, with taproot; young stems terete, dull green, strigose, with moderately dense, appressed, equally biramous hairs. Leaves simple; stipules narrow and triangular, 0.3–1 mm long, glabrescent or sparsely pubescent, not persistent; petiole 0.5–1 mm long; multicellular hairs absent to sparse in the leaf and stipule axils, inconspicuous, red, club-shaped; stipellae absent. Lamina linear, (10–)20–45 mm long, 0.3–1 mm wide, the surface furrowed or margins in-rolled; upper surface dull green with sparse, appressed (rarely shortly spreading) hairs; lower surface dull green with sparse, appressed hairs; apex acute; veins not prominent. Inflorescence (5–)15–35(–55) mm long, shorter or rarely longer than leaf; peduncle 3–15 mm long; bracts triangular; 0.5–0.7 mm long. Flowers pink to purple; pedicel 0.5–1.5 mm long. Calyx (1.3–)1.5(–1.8) mm long, with subequal lobes equal to or longer than the length of the tube and moderately dense, grey, appressed hairs. Standard pink, obovate to orbicular, 3–3.2 mm high, 2.8–3 mm wide. Wings spatulate to narrowly obovate, 2.8–3.3 mm long, 1.1–1.3 mm wide. Keel 3.3–3.5 mm long, 1.3–1.5 mm deep, with lateral pockets 0.3–0.4 mm long; acute apex; hairs moderately dense, hyaline, at the tip and along the bottom. Staminal tube 1.8–3.2 mm long, colourless. Ovary glabrous. Pod ascending to spreading, terete, 15–30 mm long, 2–3 mm deep, brown, glabrous; apex shortly pointed; endocarp spotted; seed (5–)8(–10) per fruit.

**Distribution and habitat:** Northern Territory and Western Australia; red sand dunes and plains.

**Conservation status:** Albrecht et al. (1997) and White et al. (2000) give this species a conservation coding of 3k indicating that it is poorly known in the Northern Territory. This species occurs in the Great Sandy and Tanami Deserts and, although collected only occasionally, is probably not at risk. A coding of 3R is probably more appropriate.

**Selected specimens examined:** Western Australia: Canning: North of Dragon Tree Soak, Great Sandy Desert, George 14769, 10 Aug 1977 (AD, BRI, DNA, NSW). Fortescue: about 10 km E of Nimingarra Outcamp, near Shay Gap, Mitchell PRP 895, 24 Oct 1995 (NSW). Mueller: Wolfe Creek Meteorite Crater, Wilson 865 & Rowe, 31 Aug 1991 (NSW, PERTH, CANB).

Northern Territory: Tanami Sanctuary, Henshall 1253, 28 May 1976 (DNA); c. 40 km SSE of the Granites, Latz 8708, 23 June 1981 (DNA); Aboriginal soak, 20 km WNW of Lake Surprise, Tanami Desert, Latz 10071, 27 June 1985 (CANB [ex CBG]).

### 4. *Indigofera triflora* Peter G. Wilson & Rowe, **sp. nov.**

*I. haplophylla* affinis sed habitu perspicue perenni, stipulis longioribus et inflorescentia plerumque triflora differt.

Holotype: Queensland: North Kennedy: Warrigal Siding, Peter G. Wilson 610 & R. Rowe, 9 Sep 1990 (NSW). Isotype: BRI.

Erect perennial herb, 0.15–0.45 m high, with woody rootstock or taproot; young stems ridged, green, strigose with sparse, appressed to shortly spreading, equally biramous hairs. Leaves simple; stipules narrowly triangular to linear, 1.2–4 mm long, glabrescent, not spinescent, ± persistent; petiole 1–2 mm long; multicellular hairs absent to sparse in the leaf axils, inconspicuous, red, club-shaped; stipellae absent. Lamina narrowly ovate to narrowly elliptical or linear, (15–)25–55(–70) mm long, (0.9–)1.5–5(–8.0) mm wide; upper surface green, glabrous or with sparse, appressed hairs; lower surface green (paler than above), with sparse, appressed hairs; apex



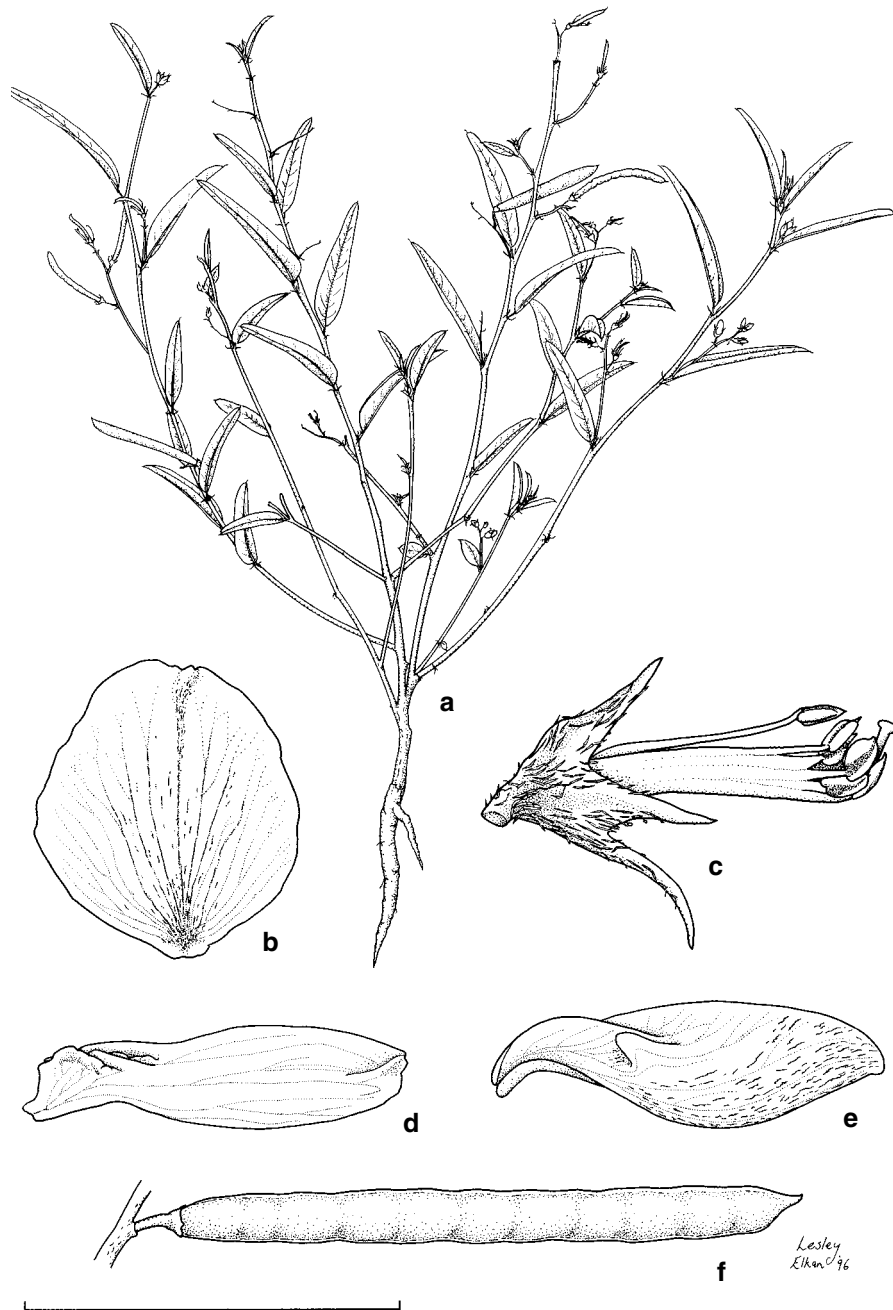


Fig. 2. *Indigofera triflora*. a, habit; b, standard; c, lateral view of calyx and androecium; d, wing; e, keel; f, fruit. (a–e from Wilson 610 & Rowe; f from Blake 8585). Scale bar: a = 75 mm; b–e = 5 mm; f = 20 mm.

obtuse or acute and apiculate; veins not prominent. Inflorescences (3–)13–30 mm long, shorter than leaves, generally with 3, very rarely 2 or 4, flowers; peduncle (1.0–)8–20(–28) mm long; bracts triangular, (0.4–)0.8–1.5 mm long, sometimes persistent; flowers pink to purple; pedicel (0.7–)1–2 mm long. Calyx 2–3(–3.3) mm long, with subequal lobes equal to or longer than the length of the tube and sparse, white to grey, appressed hairs. Standard pink, obovate to orbicular, 4.1–5.2 mm high, 3–4(–4.9) mm wide. Wings narrowly obovate, (4.0–)5–6 mm long, 1–2 mm wide. Keel 4.7–5.7 mm long, 1.5–2 mm deep; lateral pockets 0.5–1 mm long; apex beaked; glabrous or with sparse, hyaline hairs along the bottom. Staminal tube (2.0–)2.5–4 mm long, colourless. Ovary glabrous. Pod ascending, terete, (10–)20–30(–38) mm long, 2–2.5 mm deep, brown, glabrous; apex shortly beaked; endocarp spotted, sometimes faintly; seed (2–)7–9 per fruit. (Fig. 2).

**Notes:** This species has formerly been included in *I. haplophylla* but is easily distinguished from that species by its longer stipules, short, 3-flowered inflorescences and perennial habit. It also approaches *I. ammobia* in leaf morphology in parts of its range but can also be distinguished from that species by the stipule length. In *I. ammobia* the leaves are linear and up to 0.9 mm wide, while in *I. triflora* they are usually narrowly ovate to narrowly elliptical and at least 2 mm wide. However, specimens collected near St George, towards the southern end of its range, have leaves that are only 0.9–1.5 mm wide. The inflorescences are about the same length, but *I. ammobia* has a higher flower number (3–7). In any case, the species are allopatric and the perennial habit of *I. triflora* will distinguish it from *I. ammobia*, which appears to be an annual.

The epithet is derived from the Latin *triflorus*, 3-flowered, in reference to the predominantly 3-flowered inflorescences.

**Distribution and habitat:** recorded from the southern part of the Cook District of Queensland and extending into New South Wales in the Yetman area, where it is known from only a single collection. The few detailed site descriptions indicate that this species grows on sandy soil in open forest, often in disturbed areas like roadsides.

**Conservation status:** despite the geographic range of this species, specimens have been collected only rarely, so the conservation status remains uncertain. The plants are small, easily overlooked and growth from the rootstock may be seasonal and is evidently subject to grazing. The senior author has attempted to relocate the species in the Yetman area on about four occasions but without success.

**Selected specimens examined:** Queensland: Cook: Black Rock (Lynd), *Horsup 113*, Apr 1988 (BRI). North Kennedy: near source of Poison Creek, about 90 miles N of Hughenden, *Blake 8585*, 12 Apr 1935 (BRI, CANB). Mitchell: 10–18 km E of Torrens Creek, *Rebgetz 715*, May 1981 (BRI). Leichhardt: Gainsford, *Bowman s.n.* (MEL 585913, 586580). Maranoa: 26.1 km W of St George, *Bean 14475*, 28 Dec 1998 (BRI, NSW).

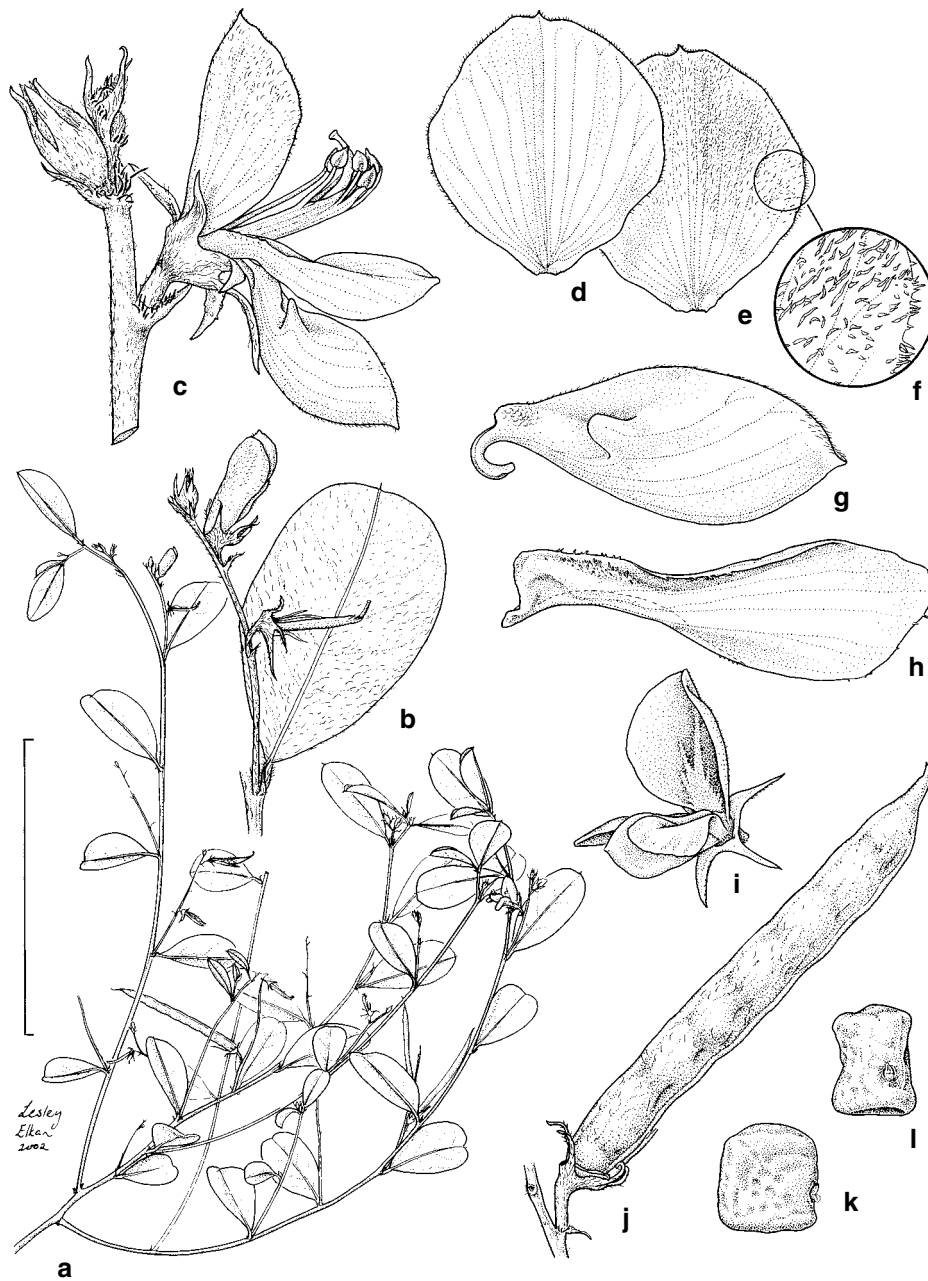
New South Wales: North Western Plains: 3 miles [c. 4.8 km] from Yetman on Texas road, *K. Wilson 796*, *Johnson & Jacobs*, 20 Nov 1974 (NSW).

##### 5. *Indigofera rupicola* Peter G. Wilson & Rowe, **sp. nov.**

Habitus decumbens vel adscendens; stipulae 1.2–3.5 mm longae; folia plerumque obovata, apice obtuso apiculatoque; bractea inflorescentiae semipersistentes; fructus plerumque 10–25 mm longi.

Holotype: Northern Territory: 70 km NE Pine Creek, *Wightman 1749*, 5 Mar 1985 (NSW). Isotypes: BRI, CANB, DNA, K.

[*Indigofera* sp. 3, Brennan (1996: 54)]



**Fig. 3.** *I. rupicola*. **a**, habit; **b**, inflorescence and leaf; **c**, bud and 'tripped flower'; **d**, **e**, **f**, front, back and detail of standard; **g**, keel; **h**, wing; **i**, flower; **j**, fruit; **k**, **l**, seed (lateral and ventral view). (a, b from Dunlop 3404; c-h, j-l from Wightman 1749; i from photograph of cultivated plant). Scale bar: a = 50 mm; b = 10 mm; c-e = 6 mm; f = 2.5 mm; g-h, k-l = 4 mm; i-j = 10 mm.

Decumbent to spreading, annual or perennial herb or subshrub, 0.05–0.45 m high, with woody rootstock or taproot; young stems ridged, green, strigose with moderately dense, appressed to shortly spreading, equally biramous hairs. Leaves simple; stipules linear, 1.2–3.5 mm long, glabrescent, not spinescent, not persistent (but not falling early); petiole 1–2 mm long; rachis terete, multicellular hairs in the leaf axils lacking; stipellae absent. Lamina obovate to elliptical, rarely oblong, narrowly elliptical or narrowly ovate, (5–)10–25(–40) mm long, (3–)5–10(–17) mm wide; upper surface green, glabrous or with sparse, appressed hairs; lower surface green, paler than above, with sparse, appressed hairs; apex obtuse and apiculate; veins not prominent. Inflorescences 5–35(–80) mm long, shorter than or equal to leaf, rarely longer; peduncle 1–10(–20) mm long; bracts triangular to ovate, 0.7–2 mm long, often persistent; flowers pink to purple, pedicel 0.5–2 mm long. Calyx 2.2–3(–3.8) mm long, with subequal lobes longer than the length of the tube and moderately dense, white, appressed, rarely shortly spreading hairs. Standard pink to purple, suborbicular, 4.8–6.5 mm high, 4–5.5 mm wide. Wings narrowly obovate, 5–6.5 mm long, 1.5–2.5 mm wide. Keel 5–6 mm long, 1.5–2.5 mm deep; lateral pockets 0.6–1 mm long; apex acute; hairs sparse to moderately dense, hyaline to white, at the tip and along the bottom; margin ciliate. Staminal tube 3–4.5 mm long, colourless. Ovary glabrous or moderately densely hairy when young. Pod ascending to spreading, terete, (8–)10–25(–33) mm long, 2 mm deep, brown, strigose to glabrescent; hairs sparse, appressed; apex shortly beaked; endocarp spotted; seed (4–)6–8 per fruit. (Fig. 3).

**Notes:** this new species is clearly related to the *I. haplophylla* group of species but may be distinguished from the other Australian taxa in this group by the more spreading, prostrate to ascending annual to perennial habit and the usually obovate leaves. The inflorescence bracts are also persistent in many cases, as in *I. triflora*.

There is some convergence in leaf shape with *I. haplophylla* in the specimen from Katherine Gorge and the one from Queensland, but the habit and stipule length indicate that they are both *I. rupicola*. Also, these two species appear to be ecologically distinct and seem not to occur sympatrically. On the other hand, specimens of *I. haplophylla* from Sunday Island, NNW of Derby, have broader leaves that approach *I. rupicola* in width but they have stipules that are typical of *I. haplophylla*.

There is a collection from Kununurra (*Andrew 436*, BRI, CANB, DNA) that was collected on sandy soil, and is somewhat different in aspect from the rest of the specimens, having longer and broader leaves, longer inflorescences and ± prostrate habit. It is retained here, with some doubt, pending further collections.

The epithet is derived from the Latin *rupicola*, rock-dweller, an allusion to the sandstone plateaux where most specimens have been collected.

**Distribution and habitat:** Western Australia, Northern Territory and Queensland; generally in savannah woodland on sandy soils of sandstone escarpments.

**Selected specimens examined:** Western Australia: Gardner: About 3 km E of Mitchell Falls in sandstone country, *Mitchell 3353*, 15 Mar 1994 (NSW, PERTH).

Northern Territory: Darwin & Gulf: Twin Falls, 1 km upstream, *Fensham 818*, 24 Mar 1988 (DNA); East Alligator River, *Dunlop 3404*, 2 Mar 1973 (BRI, DNA, MEL, NSW); 55 miles [c. 88 km] E of Pine Creek, *Byrnes 1333*, 29 Jan 1969 (BRI, DNA); Plum Tree Creek crossing, *Menkhorst 226*, 15 Feb 1989 (DNA); Katherine Gorge National Park, *Byrnes 2159 & Dunlop*, 23 Mar 1971 (CANB, DNA, NSW).

Queensland: Cook: Donkey Spring Creek, Bulleringa National Park, 80 km NW of Mt Surprise, *Forster 22496 & Booth*, 22 Apr 1998 (BRI, NSW).

**6. *Indigofera linifolia* (L.f.) Retz., Obs. Bot. 4: 29 (1786)***Hedysarum linifolium* L.f., Suppl. 331 (1781)

Holotype: India (LINN 921.5).

*Sphaeridiophorum linifolium* (L.f.) Desv., J. Bot. 3: 125 (1813)*Anila linifolia* (L.f.) Kuntze, Rev. Gen. Pl. 1: 160 (1891)

Illustration: Banks and Solander (1900: t.55); Weber (1986) fig. 309A; Urban (1990: 96) photo; Hacker (1990: 183) photo; Anderson (1993: 167) photo; Milson (1996: 49) photo.

Prostrate or spreading, perennial herb, 0.1–0.3(–0.5) m high, with taproot; young stems ridged, green, strigose with dense, appressed, equally biramous hairs. Leaves appearing simple, with no apparent articulation; stipules triangular, 1–3 mm long, pubescent, not spinescent, not persistent though occasionally persisting beyond leaf fall; petiole 0.5–1 mm long; multicellular hairs in the leaf axils lacking; stipellae absent. Lamina linear or narrowly lanceolate to narrowly oblanceolate, (6–)10–35(–50) mm long, 1–3(–4.0) mm wide; both surfaces green to grey-green, with moderately dense or dense hairs; apex acute and shortly mucronate; veins not prominent. Inflorescences (2–)5–15(–25) mm long, shorter than leaves; peduncle 0.5–1 mm long; bracts ovate with scarious margin, 0.7–1.5 mm long; flowers red; pedicel 0.5 mm long. Calyx 1.5–4 mm long, with subequal lobes longer or much longer than the length of the tube, and dense, grey, appressed hairs. Standard red, obovate to orbicular, 2.5–3.5 mm high, 1.7–3 mm wide. Wings narrowly obovate, 2.5–3 mm long, 0.7–1.2 mm wide. Keel 2.5–3.8 mm long, 0.8–1.1 mm deep; lateral pockets 0.3–0.7 mm long; apex acute or rounded; glabrous. Staminal tube 2.5–3 mm long, free ends pigmented. Ovary densely hairy. Pod ascending, globular, 2–3 mm long, 1.5–1.8 mm deep, white or grey, strigose; hairs dense, appressed; apex shortly beaked; endocarp not spotted or rarely some pale blotches; seed 1 per fruit.

**Distribution and habitat:** in Australia the species is found in Queensland, Northern Territory, Western Australia, South Australia, and New South Wales. It is found in a wide range of habitats, especially on disturbed sites like roadsides but also occurs on sand or rocky ridges in open woodland or grassland; it is considered to be a weed in some areas (Lazarides et al. 1997). The species has a wide distribution and is found in north-eastern Africa, through southern Asia to southern China, Ryukyu and Taiwan, and south through Thailand to Malesia.

**Selected specimens examined:** Queensland: Burke: Yelvertoft Station, *Gittins 782*, May 1963 (BRI, NSW); Shell Ridge, N end of Wernadinga Station, *Pullen 8996*, 1 May 1974 (BRI, CANB); Whitecliff Gorge Creek, *Wilson 626 & Rowe*, 10 Sep 1990 (NSW); North end, Bentick Island, South Wellesley Islands, *Tindale s.n. & Aitken*, June 1963 (AD 97306383). Burnett: Junction of Barambah Creek and Burnett River, 5 miles [c. 8 km] NE of Gayndah, *Lebler 35 & Durrington*, 22 Jan 1970 (BRI, CANB, NSW). Cook: 1 km north of Nassau River mouth, 300 m east of the beach, *Neldner 3034 & Clarkson*, 15 June 1990 (NSW); Flinders Island, c. 7 km N of Bathurst Head in the S end of Princess Charlotte Bay, *Clarkson 2295*, 11 June 1978 (BRI, CANB, NSW); Walsh River crossing on Burke Development Road, c. 11 km NW of Rookwood Homestead, c. 16 km NE of Mungana, *Conn 1329 & De Campo*, 3 June 1983 (CANB, MEL, NSW). Gregory North: Ardmore, 25 miles [c. 40 km] W of Dajarra, *Everist 3207*, 20 Nov 1947 (BRI). Gregory South: 47.8 km W of Windorah, *Wilson 423 & Pickering*, 23 Sep 1989 (BRI, NSW); Charleville, *Blake 5360*, 19 Apr 1934 (BRI 335782). Leichhardt: Apis Creek, Bruce Highway, 40 km W of Marlborough, *Halliday 356*, 5 Apr 1975 (BRI, HO); Tanderra (Nardoo); c. 45 miles [c. 72 km] SW of Springsure, *Johnson 1317*, 15 Feb 1960 (BRI 232917). Maranoa: Mitchell, *Blake 5778*, 4 May 1934 (BRI). Mitchell: 6 km NW of Malvernton (60 km W of Blackall) on stock route from Malvernton to Gowan Hills, *Johnson 3022*, 10 Nov 1975 (BRI 194173); Torrens Creek, *White 8670*, 19 Mar 1933 (BRI 232925). Moreton: Near Somerset Dam, *Blake 13972*, 26 Feb 1939 (BRI, CANB); Colleges Crossing, 6 miles [c. 9.6 km] NE of Ipswich, *Henderson 165*, 18 Jan 1967 (BRI, CANB). North Kennedy: West Point, Magnetic Island, *Forster 12765 & Bean*, 18 Jan 1993 (NSW); Ritson's plots,

Lansdown Pasture Research Station, *Lazarides* 7155, 5 Apr 1965 (BRI, CANB); Burdekin River area above Dalbeg on track to Gorge Weir, 20.9 km S of Expedition Pass Creek bridge, *Staples* 2101, 16 Apr 1975 (BRI, CANB). Port Curtis: Biloela, at experimental farm, *Smith* 3469, 22 Oct 1947 (BRI, NSW); Curtis Island, *Blake* 22517, 26 Mar 1966 (CANB). South Kennedy: Red Mountain, c. 40 km W of Clermont, *Wilson* 559 & *Rowe*, 7 Sep 1990 (NSW, BRI, PRE); Newry Island, *Hegerl* N233 & *Trinder*, 9 Dec 1986 (BRI, MEL). Warrego: 'Gilruth Plains', Cunnamulla, *McKee* 10358, 13 Apr 1963 (BRI, NSW); 46 km SE of Charleville along Boatman road, *Purdie* 93 & *Boyland*, 23 Mar 1976 (BRI). Wide Bay: Bundaberg, *Stanley* 906, 17 Mar 1980 (BRI).

New South Wales: North Coast: 'Plain Station', 10 miles [c. 16 km] S of Tabulam, *Atkinson s.n.* & *Quirk*, 5 Feb 1973 (NSW 299180). North Western Plains: MacIntyre River, Yetman, *Coveny* 12540, *Dunn & Plat*, 28 Mar 1987 (NSW, BRI, KYO, L, MEL, PERTH). North Western Slopes: edge of boat ramp, Lake Keepit, *Hosking* 1049 & *Wicks*, 28 Nov 94 (NSW).

South Australia: Lake Eyre: 5 miles [c. 8 km] N of Cordillo Downs, *Filson* 3404, 2 Oct 1960 (AD, MEL, NSW).

Western Australia: Ashburton: Foot of Mt Augustus, *Wittwer* 1076, 19 Aug 1973 (PERTH); Jigalong [Jiggalong] Depot, Tropic of Capricorn, *Royce* 1974, 7 June 1947 (PERTH). Canning: Anketell Ridge, Great Sandy Desert, *A.S. Mitchell* 1183, 14 May 1979 (DNA). Carnarvon: 29 miles N of Learmonth, *George* 2538, 3 June 1961 (PERTH); 10 miles S of Onslow, *George* 1151, 28 Aug 1960 (PERTH). Dampier: Mt Anderson Station, Fitzroy River, *Royce* 6912, 7 May 1962 (BRI, PERTH); 4 km S of Cape Bertholet, Dampierland, *Kenneally* 6038, 19 Apr 1977 (CANB, PERTH). Fitzgerald: Same Creek crossing, Gibb River Road, *Wilson* 255 & *Jacobs*, 17 May 1988 (NSW, PERTH); 18.3 km NE of Mary River crossing, *Beaughole* 53262, 19 June 1976 (PERTH). Fortescue: 6.2 km along track to Carawine Gorge, *Wilson* 921 & *Rowe*, 5 Sep 1991 (NSW, PERTH, PRE); 10 km SW of Boodarie Hsd on delta of Turner River, *A.A. Mitchell* 1752, 11 Apr 1989 (PERTH, NSW); 12 km N of Millstream, towards Mt Herbert, *Keighery* 730, 23 May 1976 (PERTH). Gardner: 1 km SW of Peanut Mill, Kununurra, *Wilson* 203 & *Jacobs*, 8 May 1988 (NSW, AD, MEL, PERTH); Tunnel Creek, Napier Range, *Dunlop* 7742 & *Simon*, 8 Apr 1988 (BRI, PERTH); South East Osborne Island, Bonaparte Archipelago, *Paul Wilson* 11084, 26 June 1973 (PERTH). Giles: Pass of the Abencerrages, Rawlinson Ranges, *Paul Wilson* 2403, 3 Aug 1962 (AD). Hall: Ord River at Blue Holes, Bungle Bungle National Park, *Menkhorst* 613, 13 July 1989 (DNA); Topyard Bore, 'Cherrabun', *Wolfe* 115 & *Martin*, 8 June 1970 (CANB). Keartland: Rudall River, *George* 10753, 21 May 1971 (CANB, PERTH). Mueller: Near Wolfe Creek Crater, *George s.n.*, Apr 1979 (DNA, PERTH).

Northern Territory: Barkly Tableland: 4.2 miles ESE of Frewina, *Perry* 662, 29 Apr 1948 (BRI, CANB, DNA); Kilgour Gorge, Mallapunyah Station, *Thomson* 551, 17 May 1984 (CANB, DNA); Elliott, *Chippendale NT* 1065, 10 Mar 1955 (AD, BRI, DNA, MEL, NSW). Central North: 11 miles NNE Donald Downs Station, *Perry* 3414, 12 Mar 1953 (BRI, CANB, DNA); 20 miles N of Barrow Creek, Stuart Highway, *Latz* 177, 23 Feb 1968 (AD, DNA, MEL); 46 miles [c. 73.5 km] SW of Mongrel Downs Homestead, *Latz* 727, 1 Aug 1970 (AD, DNA); Kollola Bore [=Cooloola Well], 4 miles [c. 6.4 km] NW Numagalong homestead, *Nelson* 1 & *Swinbourne*, 26 Aug 1965 (BRI, DNA, NSW); 15 miles [c. 24 km] N of Devils Marbles, *Chippendale NT* 941, 8 Mar 1955 (BRI, DNA); Boomerang Waterhole, Lander River, 42 miles NW of Willowra Homestead, *Chippendale NT* 4780, 30 July 1958 (BRI, DNA, NSW). Central South: Finke River near Glen Helen, *Leach* 531, 24 Feb 1985 (CANB, AD, MEL, NSW); Docker River township, *Henshall* 2896, 26 Mar 1980 (AD, DNA); McGrath Flat, 30 miles N of Alice Springs, *Nelson* 1659, 13 Feb 1968 (AD, BRI, DNA); Mt Liebig, north side, *Carr* 2357 & *Beaughole* 46136, 28 June 1974 (DNA, MEL). Darwin & Gulf: Mataranka, Stuart Highway, *Maconochie* 569, 18 Feb 1968 (AD, BRI, CANB, DNA); 1 km N of Pandanus Creek, c. 75 km SW of Borroloola, *Leach* 561, 5 May 1985 (CANB, DNA, MEL); 41 miles [c. 65.5 km] E of Pine Creek, *Nelson* 300, 13 Apr 1962 (AD, BRI, DNA, MEL, NSW); Hempel [Hempel] Bay, Groote Eylandt, *Specht* 358, 4 May 1948 (AD, BRI, MEL, NSW); Elcho Island, *Maconochie* 2075, 2 July 1975 (CANB, DNA). Victoria River: Auvergne Station, 35 km NW Timber Creek, *Must* 1621, 14 July 1977 (CANB, DNA); 13 miles [c. 15 km] NW of Wave Hill Police Station, *Perry* 2188, 21 June 1949 (BRI, CANB, DNA); 50 miles [c. 80 km] NE Tanami, *Chippendale NT* 5675, 12 Apr 1959 (DNA, MEL, NSW).

7. \**Indigofera cordifolia* Heyne ex Roth, Nov. Pl. Sp. 357 (1821)

Type: Ind. Or., *Heyne s.n.* (K, n.v.).

*Anila cordifolia* (Heyne ex Roth) Kuntze, Rev. Gen. Pl. 1: 160 (1891)

Prostrate perennial herb or subshrub, 0.1–0.3 m high, with taproot; young stems terete, greenish white, hirsute with dense to very dense, hyaline, spreading, unequally biramous hairs. Leaves simple; stipules triangular, fused to base of petiole, 1 mm long, pubescent with scattered long hairs, not spinescent, persistent, scarious; petiole 0.4–0.6(–1.0) mm long; multicellular hairs in the leaf axils lacking; stipellae absent. Lamina ovate to orbicular, cordate, 2.5–6.2(–7.0) mm long, 2.7–5.7(–6.5) mm wide; upper surface green with moderately dense, spreading hairs; lower surface green to white with moderately dense, spreading hairs; apex obtuse and apiculate; veins not prominent. Inflorescences 3–4 mm long including flowers, the axis c. 0.5 mm long, shorter than leaves ( $\pm$  sessile); bracts subulate, 1.5–2 mm long; flowers red; pedicel 0.2–0.5 mm long. Calyx 2.2–2.5 mm long, with subequal lobes  $\pm$  free to the base and dense, white, spreading hairs. Standard red, obovate to spathulate, 2.6–3 mm high, 1.5–2 mm wide, with obtuse apex and moderately dense, hyaline to white hairs at tip. Wings narrowly spathulate, c. 3 mm long, 0.5–0.6 mm wide, keel 2.8–2.9 mm long, 0.5–0.7 mm wide; lateral pockets 0.2–0.25 mm long; apex acute; glabrous. Staminal tube 2 mm long, colourless. Ovary densely hairy. Pod globular, 1.5–2 mm long, 1.2–1.5 mm deep, white or grey, strigose; hairs dense, shortly spreading to spreading; apex shortly beaked with persistent sterile ovary tip; endocarp very faintly spotted; seed spherical, irregularly 1–2 per fruit.

**Notes:** Bentham (1864: 196) recorded this species for Australia and cited a specimen (Port Essington, *Armstrong*). For many years, no other Australian collection of the species was known and the Armstrong collection could not be located at K or BM (Schrire pers. comm.). It is also known that some of Armstrong's collections were made in Timor but mislabelled as to locality (Bean 1996). However, the species has recently been recollected on the Cobourg Peninsula, in the vicinity of the original Port Essington settlement. It occurs on disturbed sites and is almost certainly an early introduction, perhaps from Timor, that has persisted in areas with some continuing human activity.

**Distribution and habitat:** in Australia, known only from the Cobourg Peninsula in the Northern Territory where it is found around camp sites near the coast. It is otherwise known from tropical Africa to India and eastern Indonesia.

**Selected Specimens examined:** Northern Territory: Darwin & Gulf: Cobourg Peninsula; Fort Wellington, Raffles Bay, *Cowie 3759*, 20 Apr 1993 (DNA, CANB, NSW); Cobourg Peninsula; Port Bremer pearling base, *Cowie 3704*, 19 Apr 1993 (DNA, AD, BRI, CANB, MEL, NSW, PERTH, K, L).

8. *Indigofera rugosa* Benth., Fl. Aust. 2: 199 (1864).

Type citation: 'Bed of the Fortescue river, N.W. coast, *F. Gregory's Expedition* (*Herb. F. Mueller*).'

Holotype: Fortescue River, *Maitl. Brown* (MEL).

Erect shrub, 0.2–1 m high; young stems terete or ridged, white or yellowish, tomentose to hirsute with very dense, spreading, equally or unequally biramous hairs. Leaves unifoliolate; stipules linear or subulate, 2–6 mm long, pubescent, not spinescent, not persistent; petiole 3–8 mm long; rachis furrowed, appearing terete; multicellular hairs at point of articulation sparse, inconspicuous, red to brown, club-shaped to pointed linear. Leaflet lacking stipellae; lamina broadly ovate to obovate or orbicular, (7–)13–28 mm

long, 7–25 mm wide; upper and lower surface white to grey, with dense, spreading hairs; apex obtuse and mucronate; veins prominent below and impressed above. Inflorescences 10–40 mm long, shorter than or rarely longer than leaves; peduncle 0.5–2 mm long; bracts triangular to subulate, 2–3.5 mm long; flowers pink to purple; pedicel 2–3.5 mm long. Calyx 4–7 mm long, with subequal lobes longer than to much longer than the length of the tube, and dense, white, spreading hairs. Standard purple or pink, ovate to orbicular, 7–10 mm high, 6.5–8.5 mm wide. Wings narrowly obovate or spatulate, 6–8 mm long, 2–3 mm wide. Keel 6–9 mm long, 2–3 mm deep; lateral pockets 1–1.5 mm long; apex acute or rounded; hairs dense, white at the tip and along the bottom; margin ciliate. Staminal tube 4–5.5 mm long, colourless. Ovary glabrous to densely hairy. Pod ascending to descending, terete, (5–)10–22 mm long, 3–4 mm deep, white, tomentose or hirsute; hairs dense, spreading; apex shortly pointed, the style often persisting; endocarp spotted; seed 4 or rarely 5 per fruit.

**Distribution and habitat:** Western Australia: in spinifex and mixed open shrubland on well drained, stony red sandy loams in ironstone country of the Hammersley region.

**Conservation status:** although uncommon, this species does not appear to be under threat.

**Selected specimens examined:** Western Australia: Fortescue: Gregory Range, opposite abandoned mine, *Wilson 946 & Rowe*, 5 Sep 1991 (NSW, CANB, PERTH); SE of Camp Anderson, Hamersley Range, *Wilson 1024 & Rowe*, 11 Sep 1991 (NSW, AD, CANB, K, MO, PERTH, UPS); About 85 km S of Munjina roadhouse, Newman road, *Pringle PRP 635*, 4 Sep 1995 (NSW).

#### 9. *Indigofera pilifera* Peter G. Wilson & Rowe, *sp. nov.*

*I. rugosae* affinis sed ab ea stipellis praesentibus, lamina non rugosa, calyce corollaque minore, fructibus hirsutis vice tomentosus distinguitur.

Holotype: Western Australia: Carr Boyd Range, 20 km ENE of Dunham River HS, *M. Lazarides 8520*, 12 Mar 1978 (NSW). Isotypes: BRI, CANB, DNA, PERTH.

Spreading shrub, 0.3–0.4 m high, 1 m wide; young stems terete, white or green to yellowish, hirsute with dense, spreading, unequally biramous and scattered linear multicellular hairs. Leaves unifoliolate; stipules narrowly triangular to subulate, 2–3.5 mm long, pubescent, not spinescent, persistent; petiole 2–5.5 mm long; rachis terete, or slightly furrowed; multicellular hairs at point of articulation sparse, inconspicuous, orange or red, pointed linear. Leaflet with conspicuous stipellae 1–2 mm long; lamina ovate to elliptical, 10–28 mm long, 6–16 mm wide; upper surface pale grey to green, with moderately dense, spreading hairs; lower surface grey to green, paler than above, with moderately dense, spreading hairs; apex acute or obtuse and mucronate; veins prominent below. Inflorescences 35–90 mm long, longer than leaves; peduncle 2–7 mm long; bracts narrowly triangular, 1.5–2 mm long; flowers pink to purple; pedicel 0.5–0.8 mm long. Calyx 2.5–3.9 mm long, with subequal lobes longer than the length of the tube and moderately dense, white, spreading hairs. Standard purple or pinkish mauve, broadly elliptical to orbicular 4.5–5.5 mm high, 4–5 mm wide. Wings spatulate, 4–5 mm long, 1–1.5 mm wide. Keel 4.5–5.5 mm long, 1.5 mm deep; lateral pockets 0.5 mm long; apex acute; hairs moderately dense, hyaline to white, at the tip and along the bottom. Staminal tube 3–3.5 mm long, colourless. Ovary densely hairy. Pod descending to deflexed, terete, 8–12 mm long, 2.5–3 mm deep, brown, hirsute; hairs moderately dense, spreading; apex shortly pointed, the style sometimes persisting; endocarp spotted; seed cuboid, 4 per fruit. (Fig. 4).

**Notes:** the epithet is derived from the Latin *pilifer*, bearing hairs, in reference to the pilose leaves.



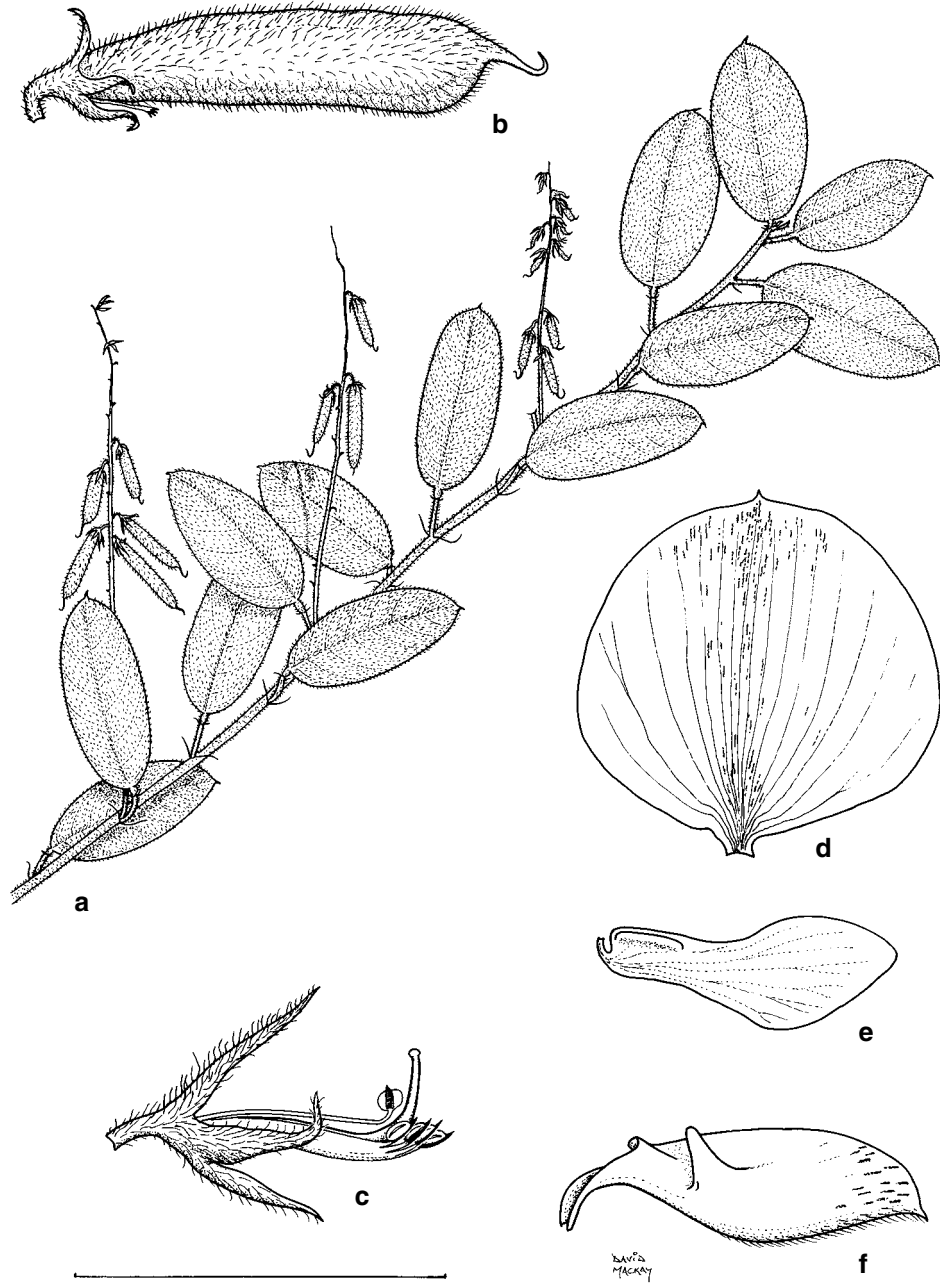


Fig. 4. *I. pilifera*. a, habit; b, fruit; c, lateral view of calyx and androecium; d, standard; e, wing; f, keel. (all from Lazarides 8520). Scale bar: a = 50 mm; b = 10 mm; c-f = 5 mm.

**Distribution and habitat:** *I. pilifera* is only known from a few collections from ranges in the vicinity of Kununurra, between 15°30'S and 16°30'S, where it is recorded as occurring on steep sandstone hills in open woodland.

**Conservation status:** although this species is poorly collected, it occurs in areas that are, as far as is known, not under any immediate threat. Further surveys will be necessary to assess distribution and population size for this species.

**Other specimens examined:** Western Australia: Gardner: Ivanhoe Station, East Kimberleys, Langfield 378, [c. 1952] (PERTH); Deception Range, Wilson 841 & Rowe, 30 Aug 1990 (NSW, CANB, K, PERTH).

#### 10. *Indigofera petraea* Peter G. Wilson & Rowe, **sp. nov.**

*I. rugosae* foliis dense tomentosis similis sed lamina non rugosa, calyce corollaque minore, distinguitur.

Holotype: Western Australia: Barlee Range Nature Reserve, S. van Leeuwen 1545, 11 Aug 1993 (NSW 403825). Isotypes: KARR, PERTH.

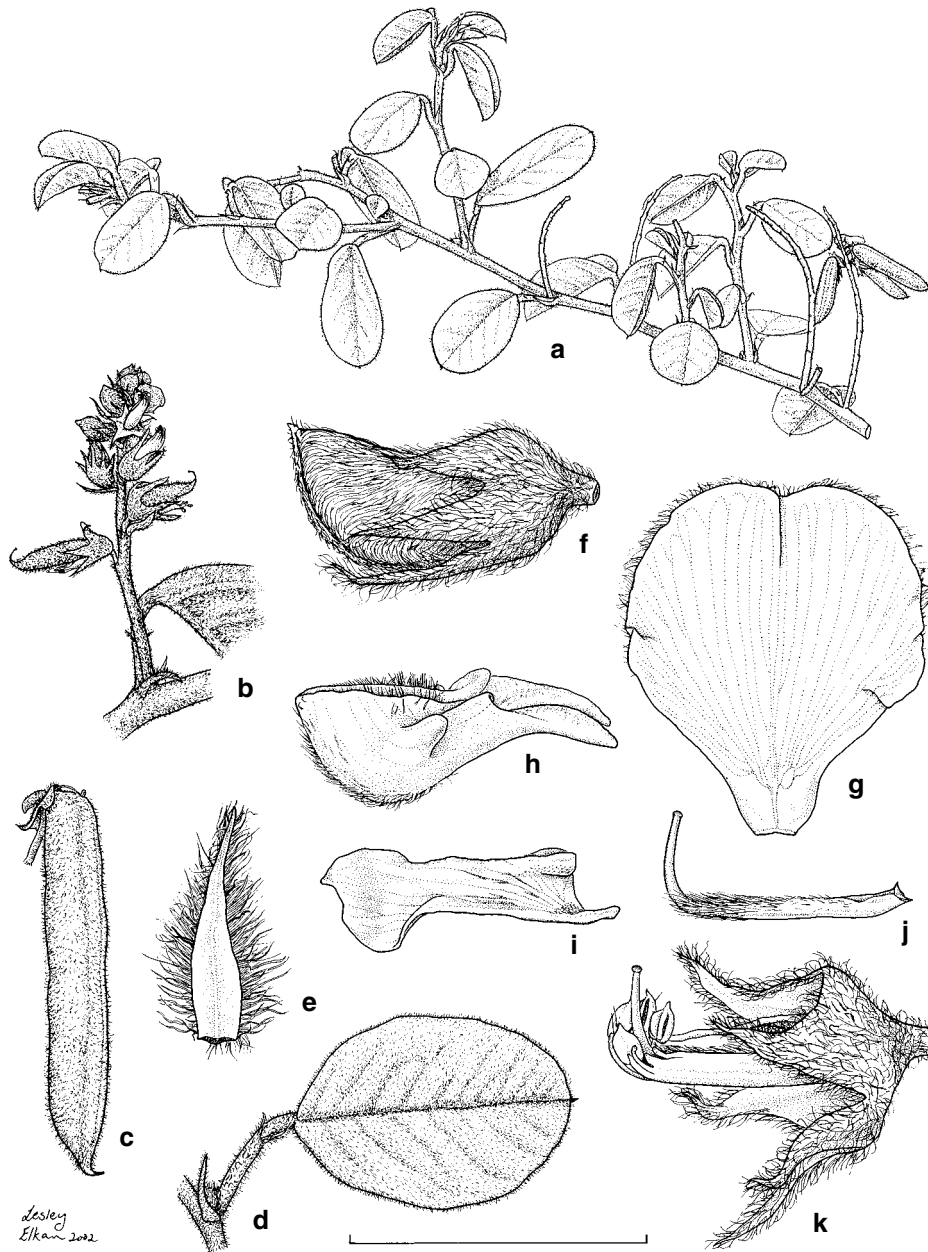
Erect shrub 0.7–1.5 m high; young stems terete, yellowish becoming white to grey, tomentose with very dense, spreading, equally biramous (stalked) hairs. Leaves unifoliolate; stipules linear to subulate, 3.5–5 mm long, pubescent, not spinescent, not persistent; petiole 2.5–6.5 mm long; multicellular hairs at point of articulation sparse, conspicuous or inconspicuous, red to brown, pointed linear. Leaflet with inconspicuous to conspicuous setaceous stipellae 1–2.5 mm long; petiolule 1.5–3.5 mm long; lamina broadly elliptical, 10–27 mm long, 8–18 mm wide; upper and lower surface grey to white with dense, spreading hairs; apex obtuse (with small, dark mucro); veins not prominent above (laterals prominent below). Inflorescences 20–45(–55) mm long, shorter than to longer than leaves; peduncle 4–10 mm long; bracts ovate and subulate, 2.5–3.6 mm long; flowers deep pink to dark purple-red; pedicel c. 1 mm long. Calyx 3–3.8 mm long, with subequal lobes equal to or longer than the length of the tube, 1.4–2.3 mm long and dense, white or grey to brown, spreading hairs. Standard obovate, 3.3–4 mm high, 3–4.5 mm wide; hairs dense, hyaline or brown; apex obtuse with small apiculum. Wing oblong, 1.7–4.1 mm long, 0.6–1.1 mm wide. Keel 3–4 mm long, c. 1 mm deep; lateral pockets c. 0.5 mm long; apex rounded; hairs dense, white or brown, along the bottom. Stamens colourless or pigmented at the distal end; tube 2.0–3.5 mm long. Ovary densely hairy, 2–2.5 mm long. Pod descending, terete, 13–18 mm long, 2.5–3.5 mm deep, yellowish to white, pubescent; hairs dense, spreading; apex shortly pointed; endocarp spotted (confined to pithy partitions); seed cuboid, 3–6(–7) per fruit. (Fig. 5).

**Notes:** the epithet is taken from the Latin *petraeus*, growing among rocks, in reference to the rocky habitat.

**Distribution and habitat:** Western Australia: apparently confined to the Barlee Range where it occurs in skeletal sandy soil over massive silcrete in shrubland with *Triodia*.

**Conservation status:** this species has only recently been discovered but does not appear to be under any immediate threat. It is conserved within the Barlee Range Nature Reserve.

**Other specimens examined:** Western Australia: Ashburton: Barlee Range, 8.2 km S of Wongida Well, 34.4 km N of Mt Maitland, 17.5 km SSW of Mt Florry, van Leeuwen 2190, 6 Sep 1995 (KARR, NSW, PERTH); Barlee Range Nature Reserve, 5.1 km S of Yadiyugga Claypan, 18.7 km SSW of Mt Florry, 9.9 km ESE of Minnie Spring (on Henry River), 17.4 km N of Joy Helen Mine, van Leeuwen 5081, 31 Jul 2002 (KARR, NSW, PERTH); Glenflorrie Station, 1.4 km north of boundary to Barlee Range Nature Reserve, 6.3 km NNE of Yadiyugga Claypan, 8.5 km SW of Mt Florry, 14.8 km NE of Minnie Spring (on Henry River), 28.5 km NNE of Joy Helen Mine, van Leeuwen 5082, 31 Jul 2002 (KARR, NSW, PERTH).



**Fig. 5.** *I. petraea*. **a**, habit; **b**, inflorescence; **c**, fruit; **d**, leaf; **e**, bract (adaxial view); **f**, bud; **g**, standard; **h**, keel; **i**, wing; **j**, ovary; **k**, lateral view of calyx and androecium. (**a**, **c** from *van Leeuwen* 2190; **b**, **d**, **j** from *van Leeuwen* 1545; **e**, **f**–**i**, **k** from *van Leeuwen* 5082). Scale bar: **a** = 60 mm; **b**, **d** = 20 mm; **c** = 15 mm; **e**–**k** = 4 mm.

**11. *Indigofera monophylla* DC., Prod. 2: 222 (1825).**

Type citation: '?' in *Novae Hollandiae orâ orientali*.

Holotype: Nouvelle Hollande, côte ouest (G-DC *n.v.*, NSW microfiche).

Erect to prostrate shrub or subshrub, 0.2–1(–2.4) m high, with woody rootstock; young stems terete to ridged, white to brown, strigose or tomentose with dense to very dense, appressed to spreading, equally biramous hairs. Leaves unifoliolate; stipules triangular, often narrowly, (0.5–)1–4.5(–8.0) mm long, pubescent, not spinescent, persistent or not; petiole (1.0–)3–9(–12) mm long; rachis furrowed, often slightly; multicellular hairs at point of articulation absent to moderately dense, conspicuous or inconspicuous, red to dark brown, club-shaped. Leaflet with inconspicuous to conspicuous stipellae (0.2–)0.5–1 mm long; lamina ovate, elliptical, obovate or orbicular; (4.5–)10–30(–45) mm long, (3.5–)8–25(–33) mm wide; upper surface grey, white or green with sparse to dense, appressed to spreading hairs; lower surface grey, white or green with sparse to dense, appressed to spreading hairs; apex obtuse and mucronate; veins prominent or not prominent. Inflorescences (10–)20–120(–210) mm long, equal to, or longer than the leaf; peduncle (1.5–)4–20(–43) mm long; bracts triangular (0.5–)1–2.5(–6.0) mm long; flowers pink to purple or red; pedicel 0.5–1.8 mm long. Calyx (1.5–)2–3(–4.0) mm long, with unequal to subequal lobes less than to longer than the length of the tube and moderately dense or dense, white to almost black, appressed to shortly spreading hairs. Standard red, purple or pink, ovate to orbicular, 6.5–8.5(–9.4) mm high, 5.3–7.6 mm wide. Wings spatulate or narrowly obovate, 6–8.9 mm long, 2–3 mm wide. Keel 6.8–8.9(–9.5) mm long, 2–3 mm deep; lateral pockets 0.7–2 mm long; apex acute or rarely rounded; hairs moderately dense to dense, grey to dark brown, at the tip and along the bottom; margins ciliate. Staminal tube 5–7.3 mm long, colourless or free ends and tube pigmented. Ovary moderately to densely hairy. Pod spreading to descending, terete, (12–)18–30(–37) mm long, 3–4 mm deep, grey to brown, strigose to tomentose; hairs moderately dense to dense, appressed to spreading; apex pointed; endocarp spotted; seed (4–)8–10 per fruit.

**Notes:** as accepted here, this taxon is extremely variable. It varies in habit from an almost prostrate multi-stemmed shrub to a tall shrub over 2 m high and is variable in leaf size and morphology. There are apparently two common forms: one that occurs on rocky hills that has prominent lateral venation and another that occurs mostly on plains and has much less conspicuous lateral venation; there is a possible correlation of flower colour with these forms. The type is of the more prominently-veined form. There are a couple of other variants as well (Trudgen pers. comm.), including *Indigofera* sp. Bungaroo Creek, and this complex requires further in-depth study to clearly define segregate taxa.

**Distribution and habitat:** Northern Territory and Western Australia: found on rocky hills including limestone, the Great Sandy Desert, red sand and Pindan country, also loamy plains, watercourses and roadsides.

**Conservation status:** not at risk.

**Selected specimens examined:** Northern Territory: Central North: 45 km W of Sangsters Bore, Tanami Desert, *Latz 8115*, 28 Sep 1978 (NSW, CBG, K, MO, NSW); Central Mount Stuart, *Maconochie 707*, 26 June 1969 (AD, DNA, NSW); Vaughan Springs, *Winkworth 430*, 4 July 1954 (CANB). Central South: Laura Vale, *Tietkens s.n.*, 24 May 1889 (AD, DNA, MEL). Victoria River: Birrindudu Station, *Lang 5*, 22 July 1993 (NSW).

Western Australia: Ashburton: 30 km E of 'Three Rivers' Homestead, Great Northern Highway, *Mitchell 1651*, 24 Apr 1988 (NSW); Postcutters Bore, *Beard 6094*, 22 Aug 1970 (NSW). Austin: 100 m N of Yoothapina turn-off, on Great Northern Hwy, *Wilson 1150 & Rowe*, 18 Sep 1991 (NSW, PERTH, PRE); 16 miles SW of Mannine [Nannine], *Speck 724*, 8 Sep 1957 (CANB); 48 miles [c. 77.75 km] from Wiluna on Sandstone road, *Bennett 21*, July 1941 (PERTH). Canning: 52.6 km N of Shay

Gap, *Wilson 898 & Rowe*, 4 Sep 1991 (NSW 246773, PERTH); Anketell Ridge, Great Sandy Desert, *A.S. Mitchell 1111 & 1209*, 14 May 1979 (AD, DNA). Carnarvon: 53.0 km SW of Nanutarra, *Wilson 1111 & Rowe*, 15 Sep 1991 (NSW, PERTH); Cape Range - Rough Range at 20.0 km on road to coast from Learmonth, *Briggs 8812 & Johnson*, 6 Aug 1991 (NSW, L, MEL, MO, PERTH); Middle Gascoyne River Crossing, *Symon 9997*, 15 May 1975 (NSW, PERTH). Dampier: Edgar Range, SE of Broome, *Kenneally 5523*, 7 Aug 1976 (CANB, PERTH); Great Northern Highway, 35.5 km S of Lagrange Mission turn-off, *Wilson 885 & Rowe*, 3 Sep 1991 (NSW, E, PERTH, PRE, US). Fitzgerald: Great Northern Highway, c. 25 km W of Wolfe Creek turn-off, *Wilson 868 & Rowe*, 31 Aug 1991 (NSW, K, L, PERTH, RSA); 10 miles [c. 16 km] E of Margaret River Station, *Lazarides 6328*, 13 July 1959 (NSW, AD, BRI, DNA, MEL). Fortescue: Duck Creek, out from Mt Brockman, *Blockley 311*, 9 July 1966 (CANB, PERTH); 1.1 km W of Oakover River, *Wilson 950 & Rowe*, 5 Sep 1991 (NSW, MO, PERTH, UPS); Dolphin Island, Dampier Archipelago, *Royce 7204*, 5 June 1962 (PERTH). Hall: 6 miles NE of Gordon Downs Station, *Perry 2446*, 13 July 1949 (BRI, CANB, MEL, NSW); East Branch of Wolf Creek, c. 60 km S of Halls Creek, *Carr 3567 & Beaglehole 47345*, 13 July 1974 (PERTH). Keartland: Near Rudall R., *George 10859*, 24 May 1971 (CANB, NSW); 1 mile [c. 1.6 km] N of Googhenama Rockhole, *Royce 1811*, 19 May 1947 (PERTH). Mueller: Dovers Hills, *George 8984*, 27 July 1967 (NSW, PERTH); Djaluwon Creek, near S end of Lake Gregory, *George 15421*, 26 Apr 1979 (DNA, PERTH).

## 12. *Indigofera schultzi* F. Muell., *Fragm.* 7: 105 (1870)

Type citation: 'Prope portum Darwinii; Schultz (482).'

Holotype: Port Darwin, *Schultz 482* (MEL 586275). Probable isotypes: AD, E.

Erect subshrub, 0.3–0.6 m high; young stems slightly four-angled or ridged, grey and green, or brown, strigose with sparse to moderately dense, small, appressed, equally biramous hairs. Leaves unifoliolate with a conspicuous point of articulation; stipules triangular, 0.5–1 mm long, pubescent, not spinescent, not persistent; petiole 9–21 mm long; rachis furrowed; multicellular hairs at point of articulation moderately dense, inconspicuous, dark brown, club-shaped. Leaflet with inconspicuous stipellae, 0.2–1 mm long; lamina ovate to orbicular, 25–103 mm long, 20–60 mm wide; upper surface grey and green, glabrous or with sparse, very small appressed hairs; lower surface grey and green, paler than above, glabrous or with sparse, very small appressed hairs; apex obtuse or acute and apiculate; veins visible but not prominent. Inflorescences 35–115 mm long, longer than leaves; peduncle 6–24 mm long; bracts triangular, 5–8 mm long; flowers pink to purple; pedicel 2.5–3.5 mm long. Calyx 1.5–2.3 mm long, with subequal lobes less than or equal to the length of the tube, and moderately dense, hyaline, white or brown, appressed hairs. Standard pink or lavender, ovate; 6–8 mm high, 5.3–6.5 mm wide. Wings spatulate to narrowly obovate, 5.3–8 mm long, 1.5–2.5 mm wide. Keel 6.3–8 mm long, 1.5–2 mm deep; lateral pockets 0.6–1 mm long; apex acute; hairs sparse to moderately dense, hyaline to golden along the bottom; margin ciliate. Staminal tube 3.2–4 mm long, free ends, or free ends and tube, pigmented. Ovary moderately hairy. Pod ascending to descending, terete, 21–40 mm long, 2.5–3 mm deep, brown, strigose; hairs very small, moderately dense, appressed; apex shortly beaked; endocarp spotted; seed 6–8 per fruit.

**Notes:** *I. schultzi* is most closely related to *I. saxicola* and there are a number of specimens that represent probable intergrades between these two species. These will be discussed more fully under *I. saxicola* in part 2 of this revision.

**Distribution and habitat:** only known from a small area of the Northern Territory in the Finnis River area.

**Conservation status:** Leach et al. (1992) and Briggs and Leigh (1996) code this species 2R. It is listed as 'Rare' in the *IUCN 1997 Red list of Threatened Plants*.

**Selected specimens examined:** Northern Territory: Darwin & Gulf: Finnis River area, *Parker 153*, 12 Aug 1973 (BRI, CANB); NE of Finnis River crossing, *Dunlop 3122*, 16 Jan 1973 (CANB, DNA); 9 miles [c. 14.5 km] from Rum Jungle, *Blake 16738*, 8 Aug 1946 (BRI, DNA).

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