A revision of *Plagiocarpus* (Fabaceae: Brongniartieae)

Ian R. Thompson

National Herbarium of Victoria, Royal Botanic Gardens Melbourne, Birdwood Avenue, South Yarra, Victoria 3141, Australia; e-mail: ian.thompson@rbg.vic.gov.au

Abstract

A revision of the northern Australian genus *Plagiocarpus* Benth. (Fabaceae: Brongniartieae) is presented. Six new species are described in the formerly monotypic genus: *Plagiocarpus arcuatus* I.Thomps., *P. arnhemicus* I.Thomps., *P. conduplicatus* I.Thomps., *P. dispermus* I.Thomps., *P. lanatus* I.Thomps. and *P. longiflorus* I.Thomps. Distribution maps and an identification key are presented.

***Keywords*:** taxonomy, Australia, tropical.

Muelleria 28(1): 40-52 (2010)

Introduction

Plagiocarpus Benth. is a genus of small shrubs in the Fabaceae endemic to northern Australia. It is one of six Australian genera in tribe Brongniartieae, a tribe also represented by a few central and South American genera, including *Brongniartia* Kunth. *Plagiocarpus axillaris* Benth. is the only species ever described in *Plagiocarpus*. The genus is easily distinguished from other genera in the Brongniartieae by its sessile, digitately trifoliolate leaves, solitary, subsessile, yellow-petalled flowers and glabrous, subsessile, one- or two-ovulate ovaries.

The phylogeny of the Brongniartieae is not completely resolved. Recent phylogenetic studies include a morphological study by Crisp and Weston (1987), and a morphological and molecular study by Thompson *et al*. (2001), while data on plant alkaloids is presented in Ross (2001). Morphologically it appears that the six Australian genera form a natural group, with *Plagiocarpus* probably most closely related to *Lamprolobium* Benth., *Thinicola* J.H.Ross and *Cristonia* J.H.Ross based on aril and leaf morphology and the pale keel. On the other hand, the ellipsoid pods of *Plagiocarpus* are most similar to those of *Hovea* R.Br. and the leafless species of *Templetonia* R.Br.

Plagiocarpus occurs in far northern Australia, north of latitude 17° S, and from the Kimberley in Western Australia eastwards to Arnhem Land in the Northern Territory. The only exception to this distribution is a markedly disjunct record from far north-western Queensland. The distribution of the genus overlaps that of *Templetonia hookeri* (F.Muell.) Benth. and *Hovea arnhemica* J.H.Ross.

The only published taxonomic review of *Plagiocarpus* was one presented by Ross (1992) who considered, despite noting a moderate degree of morphological variation, that the genus should remain monotypic. In this paper, Ross also discussed an unpublished manuscript prepared by John Maconochie in the late 1970s in which a second species was proposed.

In the current study, the pattern of morphological variation elucidated by the author calls for the recognition of six new species. Of the seven species described below, three are endemic to Western Australia, three endemic to the Northern Territory, and one occurs in Western Australia, the Northern Territory and Queensland.

Methods

The pattern of morphological variation in the study group, as reflected in the taxonomy presented below, was determined through examination of herbarium material with the aid of a dissecting microscope. Assessment of floral morphology was aided by reconstituting dried material in hot water with detergent added. Specimens from AD, BRI, CANB, DNA, MEL and PERTH were examined.

Taxonomically useful characters recognised in this study include: plant stature; the distribution, orientation and density of hairs; the shape, width, degree of folding, shape of apex and length of apiculum of leaflets; the shape, size and indumentum of bracts and bracteoles; the shape and size of the calyx and petals; the width, beak robustness and seed number of pods; and aril morphology.

Taxonomy

Plagiocarpus Benth., *in* J.D.Hooker (ed.), *Icon. Pl.* 12: t. 1162 (1873)

***Type*:** *P. axillaris* Benth.

Erect shrubs or subshrubs, 0.2–1(–2) m high, taprooted. *Indumentum* dense on younger branches, bracts, bracteoles and calyx, variably present and variably dense on leaves; hairs simple, straight, white to pale orangish, antrorse, appressed, divergent, or spreading. *Stems* single, or plants sometimes becoming multi-stemmed. *Leaves* apparently estipulate, alternate, mostly longer than internodes, sessile, digitately trifoliolate, usually suberect; leaflets all similar in length; petiolule c. 0.5 mm long, pulvinate; lamina with margins flat or recurved, with venation reticulate, slightly raised; apex apiculate, with apiculum mostly recurved; indumentum appressed, divergent or spreading, generally denser along margin and midrib; lateral leaflets narrow-elliptic, slightly asymmetrical, with lateral portion wider than medial, flat to concave proximally, flat or nearly so distally; medial leaflet slightly narrower than lateral leaflets, flat, concave, or folded, sometimes strongly so, sometimes conduplicate distally. *Inflorescences* axillary, of solitary flowers; pedicels to 1.5 mm long; bract and bracteoles small, generally slender; bract basal; bracteoles inserted c. at base of calyx. *Calyx* with tube slightly to moderately shorter than lobes, glabrous internally, generally persistent in fruit; calyx lobes generally similar, with apices acute; upper lobes more or less free, sometimes shorter and sometimes slightly broader than lower lobes, sometimes with apices divergent; petals all similar in length, clawed; standard and wings pale yellow; standard generally folded over other petals, mostly shallowly emarginate; wings auriculate, with an auricle lobe projecting downwards, keel not or hardly auriculate, pale, greenish at apex; stamens all fused to form a tube open adaxially; anthers dimorphic, alternately c. 0.8 mm long and basifixed, and c. 0.5 mm long and subdorsifixed and versatile; ovary short-stipitate, glabrous or rarely with isolated hairs on suture, 2-ovulate, style slender, stigma dilated or not. *Pods* short-stipitate, elliptic to oblong-elliptic or subcircular in profile, 9–13 mm long excluding beak, slightly gibbous dorsal to beak, slightly to moderately compressed, glabrous, sublustrous or lustrous, 1- or 2-seeded; vestigial ovules, when present, to c. 0.5 mm long. *Seeds* ellipsoid, plump or mildly compressed, 5–7 mm long, brown; hilum subapical, 0.5–1 mm long; aril annular, broad-elliptic or circular, wall smooth or somewhat knobbly, with a vertical lobe projecting from one side or towards apical end; orifice 0.2–0.7 mm wide.

***Notes on morphology*:** LEAVES (Figs 1, 2 & 3). Although in this treatment leaves are described as compound, the lateral leaflets could reasonably be interpreted as leafy stipules as they have no connection with the medial leaflet, and they appear to insert at the same position as stipules do in other genera of the Brongniartieae. Lateral leaflets are asymmetrical with the lateral half of the lamina up to 20% wider than the medial half. The distinction is more obvious in broader-leafleted species (see Fig. 2a in particular). The species described below can be divided into a broad-leafleted group of five species and a narrow-leafleted group of two species.

FLOWERS (Figs 1, 4 & 5). Flowers are generally hidden by leaves in herbarium sheets; leaflets must be pulled back or removed to reveal them. The standard has only been seen in a folded state in pressed specimens, and field observations indicate that it seldom opens out to any great extent and probably only briefly under ideal conditions (M.D. Barrett pers. comm.). The standard

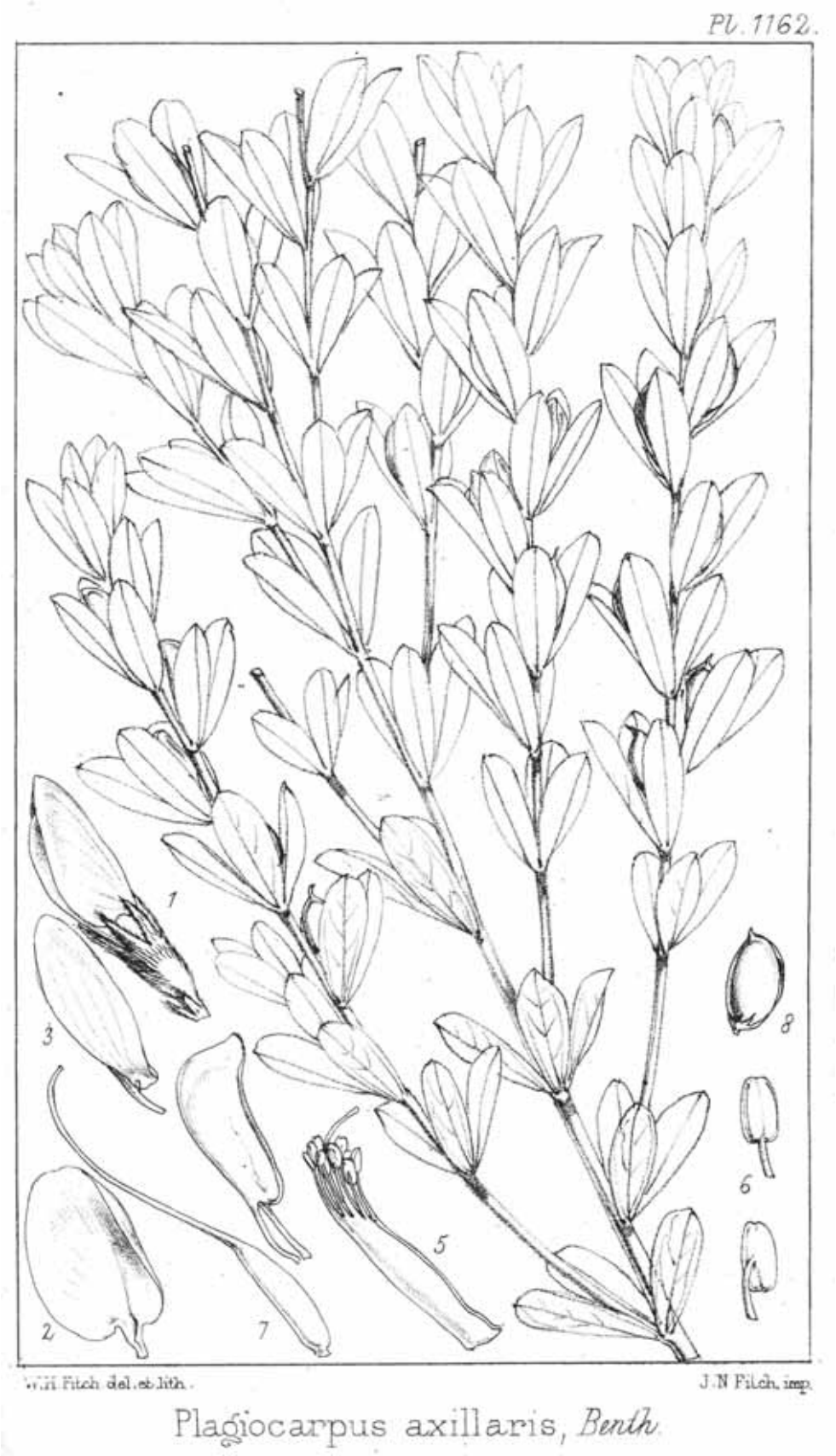

Figure 1. Original plate of *Plagiocarpus axillaris*. Source: Bentham (1876, plate 1162). Fruiting branches and drawings of flowers and fruit: 1. whole flower, including pedicel,bract and bracteole, 2. standard, 3. wing, 4*. keel, 5. stamen-tube with protruding style and stigma of pistil, 6. basifixed and dorsifixed anthers, 7. pistil, 8. pod and persistent calyx. Branches and pod approximately actual size. Flower parts 1–5 × 4; pistil × 6. *The number 4 is missing in the original.

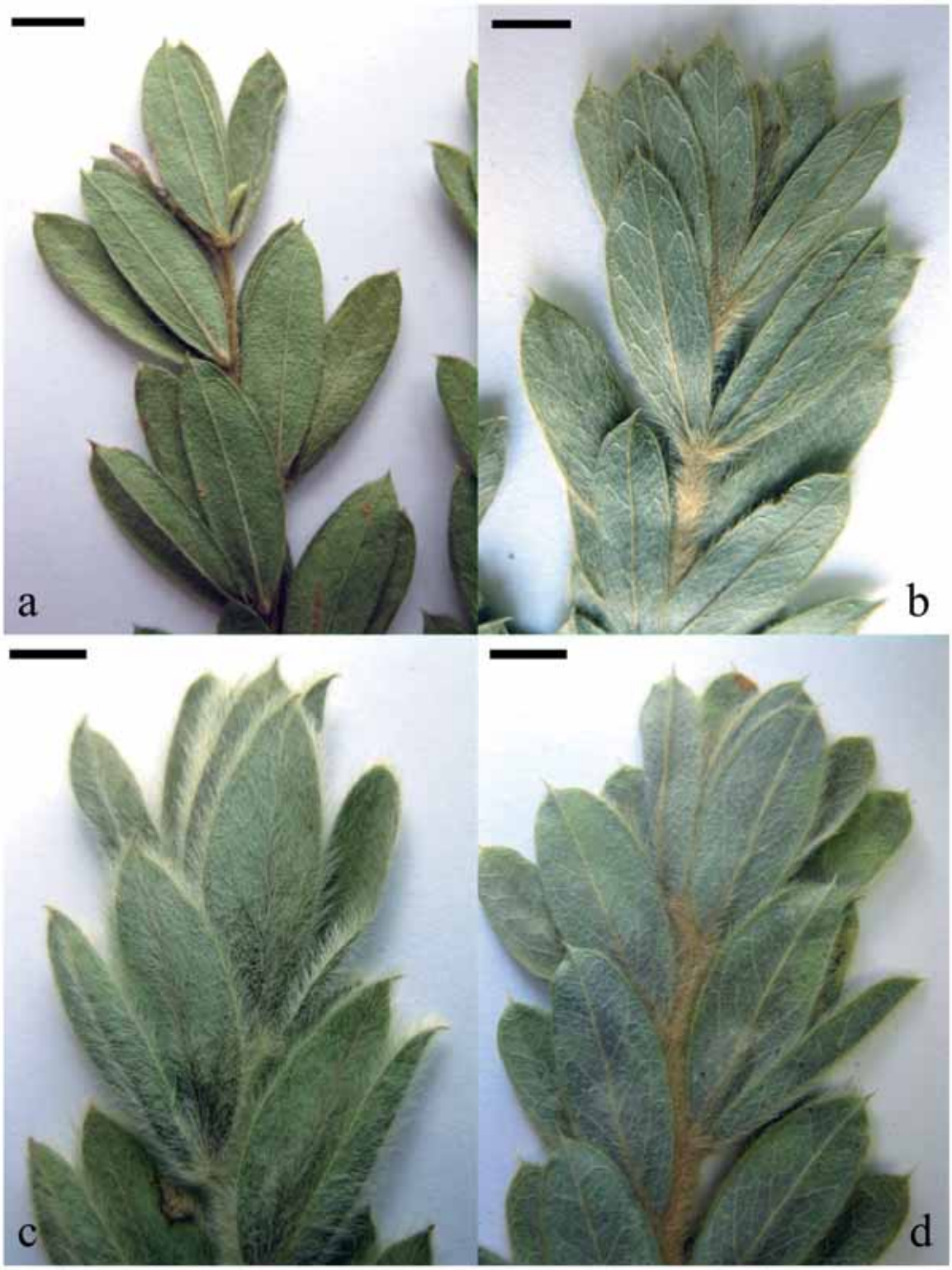

Figure 2. Leaves and branchlets. a. *Plagiocarpus axillaris* **(C.R. Michell 4147 DNA); b.** *P. arnhemicus* **(holotype); c.** *P. longiflorus* **(D.J. Dixon 1618 DNA); d.** *P. dispermus* **(***P. Foulkes* **327 PERTH). Scale bars all 5 mm.**

Figure 3. Leaves and branchlets. a. *Plagiocarpus dispermus* **(grey-leaved form,** *A.A. Mitchell 2416* **PERTH); b.** *P. lanatus* **(holotype); c.** *P. conduplicatus* **(holotype); d.** *P. arcuatus* **(***S. King 134* **DNA). Scale bars all 5 mm.**

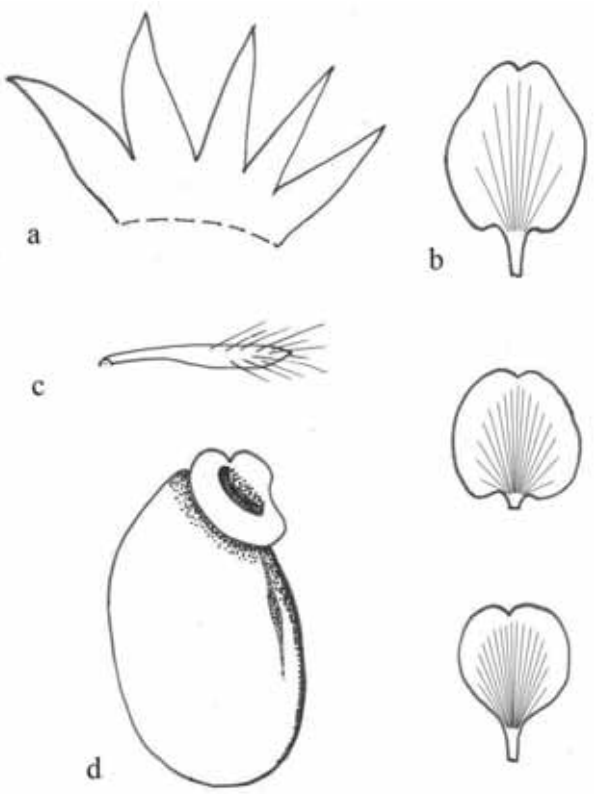

Figure 4. Flower parts and seed. a. Calyx opened out, upper lobes at left (generalised); b. Standard petals: top to bottom: *Plagiocarpus longiflorus* **(C.R. Michell 2178 DNA),** *P. lanatus* **(holotype),** *P. conduplicatus* **(holotype); c. Bract of** *P. conduplicatus* **(side view showing one half of folded lamina); d. Seed (generalised). Scale: a × 4.5; b. × 2; c. × 10; d. × 6.**

claw is sometimes geniculate (Fig. 5b). Wing petals have conspicuous transverse wrinkling proximally and lobed auricles. Their claw is shorter than that of the standard and keel petals. Keel petals lack auricles or auricles are rudimentary. Figure 4b shows the main variation in standard shape; species not represented have standards similar in general shape to those of *P. longiflorus*.

FRUIT (Figs 1 & 5). Measurements of the pod-beaks do not include the withered style that variably persists. Pod-valves change shape slightly at dehiscence, and are about 1 mm longer than pre-dehiscence. A comparison of post-dehiscence valves and beaks are presented in Figure 5d.

***Notes on the protologue*:** The genus *Plagiocarpus* and single species *P. axillaris* were described in part 3 of volume 12 of *Hooker's Icones Plantarum*, published as a separate part in December 1873. This publication has not been seen by the author; however, based on citations historically presented for the protologue, the text is presumed to be on unnumbered pages. A complete four-part volume was published in 1876, and in this publication the protologue is presented on pages 56 and 57 (Bentham 1876).

1. *Plagiocarpus axillaris* Benth., *in* J.D.Hooker (ed.), *Icon. Pl.* 12, part 3: t. 1162 (1873)

***Type*:** Northern Territory. Port Darwin, *F. Schultz 639*, 15.xi.1869; lecto: K, *fide* J.H. Ross, *Muelleria* 7: 422 (1992); iso: AD.

Subshrubs to c. 0.4 m high, becoming multi-stemmed from base. *Stems* 1–3 mm in diameter; young branches with a moderately dense, whitish to pale tan indumentum, with hairs 0.5–1 mm long, appressed or sometimes mildly divergent. *Leaflets* 14–22 mm long, with apex rounded to subacute; apiculum 0.1–0.5(–0.8) mm long, usually pale throughout, not or hardly exceeding adjacent hairs; indumentum sparse to scattered, with hairs 0.3–1 mm long, ± appressed; lateral leaflets asymmetrically elliptic, 4–8 mm wide; medial leaflet narrow-obovate or oblong-elliptic, 3.5–6 mm wide, flat or slightly concave. *Bract* 1–1.5 mm long, bracteoles 0.5–1 mm long. *Calyx* 3.5–4 mm long, including tube 1.5–1.8 mm long; upper lobes slightly broader than lower ones, with apices slightly divergent; standard c. 9 mm long, including claw 2 mm long, limb 6–7.5 mm wide, base cordate, apex rounded or shallowly emarginate; wings 8–9 mm long, including claw c. 1 mm long, limb 2.5 mm wide; keel 8–9 mm long, including claw 1.5 mm long, limb c. 3 mm wide; stigma hardly wider than style. *Pods* 10–11 mm long excluding beak, 5–6 mm wide, c. 4 mm deep, sub-lustrous, 1-seeded; beak mostly 1–2 mm long, c. 1 mm wide at base, ungrooved. *Seeds* 5 mm long, 3 mm wide, 3 mm deep; aril circular, 1.6–2 mm long, with wall smooth, aperture 0.5–0.7 mm long; lobe 0.3–0.6 mm high, 0.8–1 mm wide.

***Selected specimens of c. 20 examined*:** **NORTHERN TERRITORY.** Nitmiluk National Park, N boundary, *C.R. Michell 4147*, 8.iv.2002 (DNA); Port Keats, *G. Wightman 598 & C. Dunlop*, 11.viii.1983 (DNA); near Mt Greenwood, *S.T. Blake 16564*, 23.vii.1946 (BRI, DNA); Moyle River, 70 km E of Port Keats, *P.K. Latz 13790*, 10.v.1994 (CANB, DNA, MEL 2092980, NSW, PERTH); Beside Allia Creek, c. 70 km S from Daly River Mission Settlement, Daly River Aboriginal Reserve, *N.G. Walsh 3664*, 10.v.1994 (DNA, MEL 2020616); Cox Peninsular Road, *J.L. Egan 5480*, 17.i.2005 (CANB, DNA); headwaters of Cui-Eci Creek, *I. Cowie 4922 & D.E. Albrecht*, 12.v.1994 (DNA, MEL 724061).

Key to species

1 Broadest lateral leaflets ≤ 5 mm wide; medial leaflet usually moderately to strongly folded **2**

1: Broadest lateral leaflets > 5 mm wide, or if narrower, then medial leaflet not moderately to strongly folded **3**

2 Indumentum ± appressed; leaves glabrous or inconspicuously hairy; medial leaflet mostly obtuse to truncate (folded) with apiculum to c. 0.5 mm long ..... **6. *P. conduplicatus***

2: Indumentum ± spreading; leaves conspicuously hairy; medial leaflet acute (folded) with apiculum 0.6–1.5 mm long ..... **7. *P. arcuatus***

3 Claws of standard and keel petals 1–1.5 mm long; leaves lanate (fleecy) with surfaces much obscured ..... **5. *P. lanatus***

3: Claws of standard and keel petals 2–3 mm long; leaves sparsely-haired, or villous or sericeous-villous with surfaces not or only mildly obscured **4**

4 Sub-shrubs to c. 0.4 m high; secondary stems/primary branches 1–2 mm diameter; apiculum mostly < 0.5 mm long; branch indumentum generally appressed; leaf hairs sparse to scattered, < 1 mm long ..... **1. *P. axillaris***

4: Shrubs mostly > 0.5 m high; primary branches mostly > 2 mm diameter; apiculum > 0.5 mm long; branch indumentum generally divergent; leaf hairs scattered to dense, 1–2 mm long **5**

5 Upper lobes of calyx shorter than lower lobes; pods 7–9 mm wide, commonly 2-seeded (leaves commonly going dark on pressing; Western Australia) ..... **4. *P. dispermus***

5: Upper lobes of calyx as long as lower lobes; pods 5–7 mm wide, 1-seeded (leaves generally remaining green on pressing; Northern Territory) **6**

6 Calyx 3.5 mm long; keel 7–8 mm long; leaflets moderately hairy (Arnhem Land) ..... **2. *P. arnhemicus***

6: Calyx 4.5 mm long; keel 10–11 mm long; leaflets rather densely hairy, sericeous (Victoria River area) ..... **3. *P. longiflorus***

***Distribution and habitat*:** Occurs in the far north-west of the Northern Territory (Fig. 6). Grows in sand on sandstone slopes in woodland and forest.

***Flowering period*:** Flowers at various times, mostly summer and autumn.

***Etymology*:** The epithet chosen by Bentham is presumed to refer to the axillary flowers in *Plagiocarpus* (From Latin, *axillaris*, axillary).

***Notes*:** A long stout taproot c. 1 cm in diameter is evident in a few specimens. The pods have a beak that is more robust than in other species and is ungrooved. In other species there is usually some evidence of a shallow groove on each side of the beak. The original plate of *P. axillaris* is reproduced in Figure 1 and leaf morphology is shown in Figure 2a.

2. *Plagiocarpus arnhemicus* I.Thomps., *sp. nov*.

A P. axillari *Benth. planta robustiore, indumento villoso, apiculo foliolorum longiore, rostro leguminum graciliore, arillo sulcato basaliter plerumque differt.*

***Type*:** Northern Territory. Arnhem Land, 19 km east of Jabiru, *R.W. Johnson 4625*, 19.iv.1989; holo: DNA; iso: AD, BRI, MEL 287026.

Shrubs 0.5–0.8 m high, with base of plant not seen. *Stems* to c. 5 mm diameter, major branches 2–4 mm diameter; young branches with a dense, pale orangish indumentum, with hairs 1–2 mm long, moderately divergent to almost spreading. *Leaflets* 13–22 mm long, with apex subacute to rounded; apiculum 0.8–1.5 mm long, pale throughout, sometimes exceeding adjacent hairs; indumentum sparse to moderately dense, with hairs 1–1.5 mm long, appressed or slightly divergent; lateral leaflets asymmetrically elliptic, 5–7 mm wide; medial leaflet narrow-obovate or oblong-elliptic, 4.5–6 mm wide, flat or slightly concave. *Bract* c. 1 mm long, bracteoles 0.5–1 mm long. *Calyx* 3.5 mm long, tube c. 1.5 mm long, upper lobes similar to lower ones, with apices hardly divergent; standard 9 mm long, including claw 2–2.5 mm long, limb 5.5–6.5 mm wide, base cordate, apex hardly emarginate; wings 7.5–8 mm long, including claw 1 mm long, limb 2–2.5 mm wide; keel 7.5 mm long, including claw c. 1.5 mm long, limb 2–2.5 mm wide; stigma hardly dilated. *Pods* 9–11 mm long excluding beak, 5–6 mm wide, c. 4 mm deep, sublustrous or lustrous, 1-seeded; beak 0.5–1 mm long, 0.5–0.7 mm wide at base. *Seeds* 5.5 mm long, 3.5 mm wide, 2–2.5 mm deep; aril slightly longer than wide, c. 2.5 mm long, wall smooth or partly fissured on top, commonly obscurely to conspicuously grooved basally,

Figure 5. Flowers and fruit a. Flower of *Plagiocarpus arnhemicus*, **leaflet removed (***K. Brennan 1774* **DNA); b. Petals of** *P. longiflorus* **(***C. Dunlop 8200* **MEL); c. Undehisced pods of** *P. dispermus*, **grey-leaved form (***A.A. Mitchell 2416* **PERTH); d. Dehisced pod valves, from left to right from top –** *P. axillaris* **(***C.R. Michell 4147* **DNA),** *P. arnhemicus* **(***C.R. Michell 210* **DNA),** *P. longiflorus* **(***P.S. Short 5483* **DNA),** *P. dispermus* **(***R.L. Barrett 1705* **MEL),** *P. conduplicatus* **(***R.L. Barrett 4818* **MEL),** *P. arcuatus* **(***J. Egan 2098* **MEL); e. Pod of** *P. dispermus* **split open, revealing developing seeds (***R.L. Barrett 4876* **MEL); f. Pod of** *P. arnhemicus* **split open showing persistent unfertilised ovule on one valve (***K. Brennan 1323* **DNA). Scale bars all 5 mm.**

aperture c. 1 mm long; lobe 0.5 mm high, c. 1 mm wide.

Selected specimens of seven examined: **NORTHERN TERRITORY.** Upper East Alligator, Arnhem land, *C. Michell 210 & S. Knox*, 18.vi.1996 (DNA); Koongarra saddle, Kakadu National Park, *R.Thackway*, 16.v.1983 (CANB); Barramundi Gorge, *K. Brennan 1323*, 8.iv.1991 (DNA); Upper East Alligator River, *D.T. Liddle 1566 & Dempster*, 20.vi.1996 (DNA).

***Distribution and habitat*:** Occurs in Arnhem Land in the far north of the Northern Territory (Fig. 6). Grows on sandstone escarpments or slopes in eucalypt woodland or *Allosyncarpia* S.T.Blake forest or shrubland.

***Flowering period*:** Flowers summer and autumn.

***Etymology*:** The epithet refers to the fact that this species is endemic to Arnhem Land and is the only species of *Plagiocarpus* recorded for this region.

***Notes*:** Of the broader-leafleted species, *P. arnhemicus*

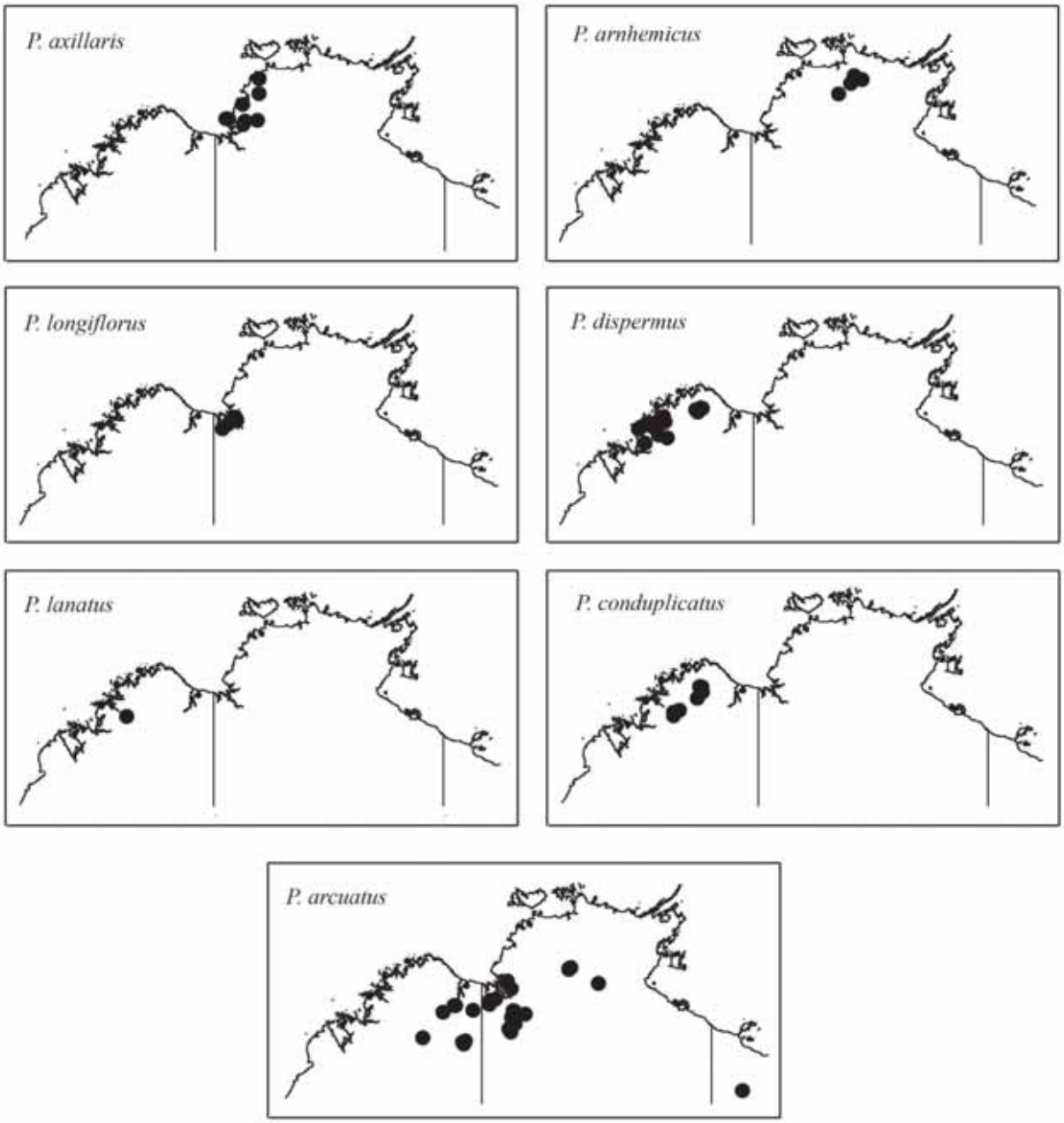

Figure 6. Distributions of *Plagiocarpus axillaris*, *P. arnhemicus*, *P. longiflorus*, *P. dispermus*, *P. lanatus*, *P. conduplicatus*, **and** *P. arcuatus*.

is the most similar to *P. axillaris* in terms of leaf indumentum. However, *P. arnhemicus* is a larger plant with a more divergent branch indumentum, longer apiculum and a more slender pod-beak. The aril of the seeds is often obscurely to conspicuously notched basally, a feature not seen in the aril of other species. The aril is rounded and smooth apically whereas in other species the apex is occasionally weakly indented. Leaves of *P. arnhemicus* are shown in Figure 4b and a flower *in situ* in a pressed specimen is shown in Figure 3a.

3. *Plagiocarpus longiflorus* I.Thomps., *sp. nov.*

A P. axillari *Benth. planta robustiore, indumento villoso, apiculo foliolorum longiore, floribus longioribus, rostro leguminum graciliore differt.*

***Type*:** Northern Territory. Spirit Hills Conservation Reserve, Victoria River district, *D.J. Dixon 1618*, 11.iii.2006; holo: DNA; iso: BRI.

Shrubs 0.4–1(–2) m high, with base of plant not seen. *Stems* not seen; major branches 2–4 mm diam; young branches with a dense, cream or orangish indumentum, with hairs 1.5–2 mm long, moderately divergent. *Leaflets* 16–26 mm long, with apex subacute to rounded; apiculum 0.5–1 mm long, pale throughout or tip becoming brown, brittle, not or hardly exceeding

adjacent hairs; indumentum dense, sericeous, with hairs 1–1.5 mm long, appressed or slightly divergent, generally divergent from margins; lateral leaflets asymmetrically elliptic, 5–8 mm wide; medial leaflet narrow-obovate or oblong-elliptic, 3–6 mm wide, mostly slightly to moderately concave or folded. *Bract* c. 1 mm long, bracteoles 0.5 mm long. *Calyx* 4.5–5 mm long, tube 1.5–2 mm long, upper lobes slightly wider than lower ones, with apices divergent; standard 10–12 mm long, including claw 3–3.5 mm long, geniculate, limb 7–8 mm wide, base slightly cordate, apex not or hardly emarginate; wings 10–11 mm long, including claw c. 1 mm long, limb 3.5 mm wide; keel 10–11 mm long, including claw c. 2 mm long, limb 3–3.5 mm wide; stigma hardly dilated. *Pods* 11 mm long excluding beak, 5–6 mm wide, 4 mm deep, sublustrous, 1-seeded; beak 0.8–1 mm long, c. 0.7 mm wide at base. *Seeds* 5.5–6 mm long, 4 mm wide, 3 mm deep; aril c. circular, 2 mm long, wall smooth, aperture c. 0.5 mm long; lobe 0.4–0.5 mm high, c. 0.8 mm wide.

Selected specimens of c. seven examined: **NORTHERN TERRITORY.** Bradshaw Station, *C.R. Michell 2178*, 18.ii.1999 (DNA); c. 94 km NW of Timber Creek, *P.S. Short 5483 & J.O. Westaway*, 4.iv.2007 (DNA); Victoria River area, *C.R. Dunlop 8200 & G.J. Leach*, 9.v.1989 (BRI, DNA, MEL 222787).

***Distribution and habitat*:** Occurs in the Victoria River area in the far north-west of the Northern Territory (Fig. 6). Grows on sandstone escarpments or slopes in woodland, often with *Triodia* spp.

***Flowering period*:** Flowers spring to early autumn.

***Etymology*:** The epithet refers to the relative long flowers in this species (From Latin *longus*, long and *flos*, flower).

***Notes*:** *Plagiocarpus longiflorus* is one of the four species with both broad leaflets and a conspicuous leaf-indumentum. It is distinguished from the others by a combination of its long flowers, 1-seeded pods and the somewhat sericeous leaves (Fig. 2c). The corolla of this species is shown in its natural arrangement in Figure 5b.

4. *Plagiocarpus dispermus* I.Thomps., *sp. nov*.

A P. axillari *Benth. planta robustiore, indumento villoso plerumque, apiculo foliolorum longiore, leguminibus majoribus biseminalibus rostro graciliore differt.*

***Type*:** Western Australia. South side of Wulungi Chasm, Prince Regent River, *M.D. Barrett 965*, 29.i.2000; holo: PERTH.

[Remaining syntypes of *P. axillaris* collected from the Prince Regent River area of Western Australia (*A. Cunningham 192*, 1821 K and *A. Cunningham s.n.* K) are sterile specimens but are probably referable to *P. dispermus* based on general appearance and locality.]

Shrubs 0.4–1 m high, with base of plant not seen. *Stems* not seen; major branches mostly 2–4 mm in diameter; young branches with a dense, whitish or cream indumentum, with hairs 1–1.5 or occasionally 2–2.5 mm long, divergent, spreading or rarely appressed. *Leaflets* 14–25 mm long, with apex subacute to rounded; apiculum 0.5–1.5 mm long, pale throughout, usually shortly exceeding adjacent hairs; indumentum mostly moderately dense, with hairs loosely appressed, or spreading when hairs longer; lateral leaflets asymmetrically elliptic, mostly 5–8 mm wide; medial leaflet oblong-elliptic, elliptic or narrow-obovate, 4–6 mm wide, slightly to moderately concave or folded. *Bract* c. 1 mm long, bracteoles 0.5–1 mm long. *Calyx* c. 4 mm long, including tube c. 1.5 mm long, upper lobes slightly shorter than lower ones, with apices hardly divergent; standard 9–10.5 mm long, including claw 2.5 mm long, limb 8.5 mm wide, base slightly cordate, apex emarginate; wings 9–10 mm long, including claw 1–1.5 mm long, limb 3.5–4 mm wide; keel 9–10 mm long, including claw 2.5 mm long, limb 3–4 mm wide; stigma noticeably wider than style. *Pods* 12–13 mm long excluding beak, 7–9 mm wide, 6–7 mm deep, lustrous, 2-seeded; beak 0.5 mm long, 0.5 mm wide at base. *Seeds* 5.5 mm long, 3.5–4 mm wide, c. 3.5 mm deep; aril circular or very slightly longer than wide, c. 2 mm long, wall smooth, aperture c. 1 mm long; lobe 0.8 mm high, c. 1.2 mm wide.

Selected specimens of c. 15 examined: **WESTERN AUSTRALIA.** Augustus Island, Bonaparte Archipelago, *P.G. Wilson 10809*, 16.v.1972 (PERTH); Junction of unnamed creek and Sale River, 30 km ESE of mouth, West Kimberley, *K.F. Kenneally 9597*, 13.v.1986 (PERTH); Planigale Creek, Drysdale River National Park, North Kimberley, *K.F. Kenneally 4450*, 19.viii.1975 (PERTH); 2 km SE of Wulungi Chasm on N side of Prince Regent River, *R.L. Barrett 1705 & M.D. Barrett*, 10.i.2001 (MEL, PERTH); c. 10 km S of King Cascade falls, Prince Regent River, *M.D. Barrett 724B*, 2.ii.1999 (PERTH); Peninsula NE of

Frederick Harbour at mouth of Hunter River, *P.A. Fryxell, L.A. Craven & J.McD. Stewart*, 8.vi.1985 (CANB); 5.2 km SW of junction of Pitta Creek and Prince Regent River, West Kimberley, *M.D. Barrett* 1839, 28.i.2007 (PERTH). **Grey-leaved form:** Hunter River, 300 m upstream from tidal-fresh water interface, 14˚59′09″S, 125˚29′14″E, *A.A. Mitchell & T. Willing 2416*, 10.iv.1992 (DNA, PERTH).

***Distribution and habitat*:** Occurs in the Kimberley in far north-eastern Western Australia (Fig. 6). Grows on sandstone escarpments or slopes in eucalypt woodland.

***Flowering period*:** Flowers January.

***Etymology*:** The epithet refers to the number of seeds commonly formed in each pod (From Greek, *di-* two and *sperma*, seed)

***Notes*:** Leaves of *P. dispermus* often turn dark, sometimes patchily, in the pressing process. This darkening is not seen in species of *Plagiocarpus* from the Northern Territory but is sometimes seen in *P. conduplicatus*. The circumscription of floral parts of *P. dispermus* is based on the very few available flowering specimens. Typical leaf morphology is shown in Figure 2d and pod morphology is shown in Figures 5d–e.

Several collections from the Prince Regent River region (e.g. *A.S. George 12630*, PERTH; *R.L. Barrett 3736*, PERTH) approach *P. arcuatus* in leaf morphology and indumentum type. However, flower, seed and fruit morphology, at least from the former collection, is the same as that of typical *P. dispermus*. It is uncertain whether the pods are two-seeded. The collections may represent a distinct taxon or they could be hybrid specimens, although *P. arcuatus* has not yet been recorded in this part of the Kimberley. They are treated as *P. dispermus* in this revision. Further collections are needed to properly ascertain the status of this form.

A grey-leaved form with an appressed indumentum has been collected from the mouth of the Hunter River (*A.A. Mitchell & T. Willing 2416*, DNA, PERTH). The greyness is not due to hairs as hairs are not particularly dense on the leaves (Fig. 3a). The specimen has particularly glossy pods (Fig. 5c) and pod and seed dimensions match those of typical *P. dispermus*. Flowering material in particular is needed to ascertain a suitable taxonomic status for this entity.

5. *Plagiocarpus lanatus* I.Thomps., *sp. nov*.

A P. axillari *Benth. indumento lanato, apiculo longiore, unguibus petalorum brevioribus differt.*

***Type*:** Western Australia. 17 km NW of Mount Hann, *M.D. Barrett 905*, 26.i.2000; holo: PERTH.

Shrubs to c. 0.7 m high, with base of plant not seen. *Stems* not seen; major branches 2 mm diam.; young branches with a dense white indumentum, with hairs c. 2 mm long, more or less spreading, matting together. *Leaflets* 15–23 mm long, with apex obtuse to subacute; apiculum 0.6–1 mm long, mostly brown, brittle, not or hardly exceeding adjacent hairs; indumentum very dense, with hairs c. 2 mm long, loosely appressed, hugging margins; lateral leaflets asymmetrically narrow-elliptic, 5–6.5 mm wide; medial leaflet oblong-elliptic or narrow-obovate, 4.5–5.5 mm wide, flat or slightly concave. *Bract* c. 1 mm long, bracteoles to c. 1 mm long. *Calyx* 3.5 mm long, with upper lobes similar to lower, with apices more or less straight; standard 7 mm long, including claw 1–1.5 mm long, limb c. 7 mm wide, base strongly cordate, apex broadly emarginate; wings 7–8 mm long, including claw 0.8–1 mm long, limb 3–3.5 mm wide; keel 6.5–7 mm long, including claw 1–1.3 mm long, limb 2.8 mm wide; ovary bearing a few long hairs on lower suture, stigma noticeably dilated. *Pods* not seen. *Seeds* not seen.

***Distribution and habitat*:** Occurs near Mount Hann in the western parts of the Kimberley in far north-eastern Western Australia (Fig. 6). Recorded from cracks in almost bare sandstone, associated with *Triodia* sp.

***Flowering period*:** Flowers January.

***Etymology*:** The epithet refers to the woolly or fleecy indumentum of this species (From Latin *lanatus*, woolly).

***Notes*:** Known from a single collection but readily distinguished from other species by both petal morphology (Fig. 4b) and indumentum type (Fig. 3b). Fruit and seeds have not been seen. *Plagiocarpus lanatus* occurs in the same general area of the Kimberley as *P. dispermus*. Although some forms of *P. dispermus* have hairs of similar length, the indumentum is villous rather than woolly or fleecy.

6. *Plagiocarpus conduplicatus* I.Thomps., *sp. nov*.

A P. axillari *Benth. planta robustiore, foliolis*

angustioribus, foliolo medio conduplicato plerumque truncato, floribus minoribus, rostro leguminum graciliore differt.

***Type*:** Western Australia. Above Carson Escarpment, c. 41 km south from Carson River homestead, *J.H. Willis*, 10.vi.1984; holo: MEL 239739.

Shrubs to 2 m high, single stemmed from base. *Stems and major branches* 2–4 mm diam.; young branches with a moderately dense, whitish indumentum, with hairs 0.5–1 mm long, appressed. *Leaflets* 12–20 mm long, with apex of lateral leaflets acute, that of medial leaflet obtuse, rounded or obliquely truncate (folded); apiculum 0.1–0.5 mm long, pale throughout or brown at tip, exceeding adjacent hairs; indumentum sparse with hairs c. 0.5 mm long, appressed, commonly soon glabrescent, lateral leaflets very narrow-elliptic or lanceolate, 2–3.5 mm wide; medial leaflet narrow-oblong, folded with halves appressed, at least distally, 1–1.8 mm wide. *Bract* 1.5–2 mm long, spathulate, strongly convex, tending to persist; bracteoles 1–1.5 mm long. *Calyx* c. 3.5 mm long, including tube 1.5 mm long, with all lobes similar; standard 7–7.5 mm long, including claw 2 mm long, limb c. 6 mm wide, base cuneate, apex broadly emarginate; wings c. 7 mm long, including claw 1.2 mm long, limb 2.5 mm wide; keel 6–6.5 mm long, including claw 1.5 mm wide, limb 2.5 mm wide; stigma a little wider than style. *Pods* 11–12 mm long excluding beak, 5–6 mm wide, 3.5–4.5 mm deep, 1-seeded; beak 0.2–1 mm long, c. 0.5 mm wide at base. *Seeds* 5.5–6.5 mm long, 3–4 mm wide, c. 2 mm deep; aril broad-elliptic, c. 2 mm long, wall smooth, aperture 0.8 mm long; lobe c. 0.7 mm high, c. 0.7 mm wide.

***Selected specimens of 10 examined*: WESTERN AUSTRALIA.** 9.9 km NE of Mt Agnes, West Kimberley, *R.L. Barrett 4065 & M.D. Barrett 4065*, 28.i.2007 (DNA, MEL, PERTH); Top of Carson Escarpment near Wonjarring Gorge, 12.5 km E of Theda Homestead, north-eastern Kimberley, *M. Lazarides 8718*, 25.iii.1978 (CANB, PERTH); Near summit of Mt Bomford, Drysdale River Station, *R.L. Barrett 1560 & M.D. Barrett*, 5.i.2001 (MEL 2290945, PERTH); Above gorge off upper Prince Regent River, 3.5 km NW of Mt Agnes, *M.D. Barrett 1141*, 9.i.2001 (MEL 2290944, PERTH); 6.2 km ENE of junction of Prince Regent River and Pitta Creek, *R.L. Barrett 1769 & M.D. Barrett*, 12.i.2001 (MEL 2290947, PERTH); Coucal Gorge, Carson Escarpment, Drysdale River National Park, *A.S. George 13861*, 15.viii.1975 (PERTH).

***Flowering period*:** Flowers autumn to early winter.

***Distribution and habitat*:** Occurs in the Kimberley in far north Western Australia (Fig. 6). Grows on sandstone plateaux.

***Etymology*:** The epithet refers to the medial leaflet (From Latin *conduplicatus*, folded together lengthwise).

***Notes*:** *Plagiocarpus conduplicatus* is readily distinguished by leaf morphology (Fig. 3c). It is also distinctive in the following respects. Its branches are all precisely oriented in one plane; in other species there is a similar tendency, but it is not as marked. Bracts and bracteoles are relatively large, and the oblanceolate to spathulate, proximally-glabrous, persistent bracts distinguish *P. conduplicatus* from all other species (Fig. 4c). In other species the bract is quite inconspicuous and covered in hairs. Only one flowering specimen of *P. conduplicatus* has been recorded, and in this specimen the standard-limb is cuneate in contrast to the slightly cordate limb in other species. The flower is also shorter than in most other species. *Plagiocarpus conduplicatus* and *P. dispermus* co-occur on Mt Bomford on Drysdale River Station (M.D. & R.L. Barrett, pers. comm.).

7. *Plagiocarpus arcuatus* I.Thomps., *sp. nov.*

A P. axillari *Benth. planta robustiore, indumento villoso, foliolis angustioribus plus recurvatis apiculo longiore, foliolo medio fortiter concavo, rostro leguminum graciliore, arillo granuloso differt.*

***Type*:** Western Australia. Cockburn Range, 46 km south-south-west of Wyndham, north-eastern Kimberley, *M. Lazarides 8578*, 16.iii.1978; holo: CANB; iso BRI, DNA, PERTH.

Shrubs 0.4–1 m high, with base of plant not seen. *Stems* to 5 mm in diameter; major branches 2–4 mm in diameter; young branches with a dense, whitish indumentum, with hairs 1.5–2 mm long, spreading. *Leaflets* 12–16 mm long, often recurved distally, with apex acute; apiculum 0.6–1.5 mm long, pale throughout or tip becoming brown, usually exceeding adjacent hairs; indumentum dense with hairs 1.5–2 mm long, divergent to spreading, occasionally glabrescent abaxially; lateral leaflets very narrow-elliptic or lanceolate, 3–5 mm wide; medial leaflet very narrow-elliptic, 2.5–3.5 mm wide, moderately convex to strongly folded, sometimes with halves appressed distally. *Bract* c. 1 mm long; bracteoles c. 1 mm long. *Calyx* 3–3.5 mm long, including tube 1–1.5 mm long, upper lobes

slightly broader than lower ones, with apices divergent; standard 8.5–10.5 mm long, including claw 2–2.5 mm long, limb 6–8 mm wide, c. truncate to slightly cordate, apex not or hardly emarginate; wings 9–10 mm long, including claw 1–1.5 mm long, limb 2.5–4 mm wide; keel 9–10 mm long, including claws c. 2 mm long, limb 2.5–3.8 mm wide; stigma hardly wider than style. *Pod* 9–10.5 mm long excluding beak, 5-6 mm wide, 4–5 mm deep, sublustrous to lustrous, 1-seeded; beak 0.5–1 mm long, 0.5–0.7 mm wide at base. *Seeds* 5.5–6.5 mm long, 3–4 mm wide, c. 3 mm deep; aril c. circular, 2–2.5 mm long, wall eroded on top, generally granular to knobbly, aperture 0.7 mm long; lobe 0.3–0.5 mm high, 0.6–0.9 mm wide.

Selected specimens of c. 40 examined: **WESTERN AUSTRALIA.** Winnama Gorge, Mabel Downs station, SE Kimberley, *E.A. Chesterfield 212*, 14.v.1984 (CANB, MEL 1534484, PERTH); Osmond Valley Station, East Kimberley, *K.A. Menkhorst 694*, 25.xi.1989 (DNA, PERTH); Helicopter Spring, S Turkey Creek, *I.D. Cowie 1883*, 19.vii.1991 (DNA, PERTH); Mornington Wildlife Sanctuary, 250 km E of Derby, *S. Legge & S. Murphy 463*, 23.iv.2005 (CANB); 20 km by road W of Bindoola creek, Kimberleys, *A.C. Beauglehole 51413*, 27.v.1976 (MEL 570516, PERTH). **NORTHERN TERRITORY.** c. 90 km E of Carlton Hills Station, *R.A. Perry 2642*, 28.vii.1949 (DNA); Katherine Gorge lookout walk, *J. Egan 2098*, 18.iv.1993 (DNA, MEL 711281); Bradshaw station, *C.R. Michell 2117 & C. Yates*, 20.ii.1999 (DNA); Headwaters of Pack Saddle Creek, Northern Carr Boyd Ranges, *T.G. Hartley 14404*, 8.iii.1978 (CANB, DNA, MEL 695831); Fitzmaurice River, *M.J.A. Barritt 1406*, 15.v.1994 (BRI, DNA, MEL 725407); Keep River, National Park, Spirit Hills area, c. 21 km ENE of Ernie Lagoon, *I.D. Cowie 11727*, 19.iv.2007 (DNA, MEL 2316427); 11 km SW of Jasper Gorge Rd, *K.G. Brennan 4420*, 5.iv.2000 (DNA); Broadarrow Creek, Gregory National Park, *D.E. Albrecht 7228*, 12.iv.1996 (DNA, MEL 283337); tributary of Snake Creek, 30 km WSW of Bullita Outstation, Gregory National Park, *N.G. Walsh 4406 & C.A. Coles*, 16.iv.1996 (DNA, MEL 2032243). **QUEENSLAND.** 12 km S of Mellish Park homestead, *P.L. Harris 702*, 18.ix.1993 (BRI, MEL 234384).

***Distribution and habitat*:** Occurs in far north-eastern Western Australia, northern Northern Territory and far north-western Queensland (Fig. 6). Grows on sandstone and quartzite mostly on escarpments, sometimes in valleys, in open woodland or open shrubland.

***Flowering period*:** Flowers summer.

***Etymology*:** The epithet refers to the arched leaflets (From Latin *arcuatus*, curved).

***Notes*:** This species has distinctive arcuate and long-apiculate leaflets and a distinctive villous indumentum (Fig. 3d). A few specimens from the Kimberley in Western Australia have leaves with a nearly glabrous abaxial surface (*A.C. Beauglehole 51413* MEL 570516, PERTH; *Cooper & Jensen MULE 463* PERTH) but the adaxial surface is villous. Western Australian plants (Cockburn Range *G.W.Carr 3367* MEL 570517) have flowers with broader and slightly longer petals than those from the Northern Territory. As discussed under *P. dispermus*, a few specimens from the Prince Regent River area of the Kimberley are somewhat intermediate between *P. arcuatus* and *P. dispermus* in leaf and indumentum characters. They have been assigned to *P. dispermus* but are possibly hybrids.

Acknowledgements

I am grateful to staff at the Royal Botanic Gardens Melbourne for their assistance with loan processing, and particularly Alison Vaughan for assistance with creating maps, Matthew and Russell Barrett for their valuable plant collecting and comments, and the directors of AD, BRI, CANB, DNA, and PERTH for providing loans. This study was funded by a three year ABRS grant (Grant no: 207-01).

References

Bentham, G. (1876). *Plagiocarpus axillaris*. In J.D.Hooker (ed.), *Hooker's Icones Plantarum,* vol. 12, pp. 56–57. Williams & Norgate: London.

Crisp, M.D. and Weston, P.H. (1987). Cladistic and legume systematics, with an analysis of the Bossiaeeae, Brongniartieae and Mirbelieae. In C.H.Stirton (ed.), *Advances in Legume Systematics*, vol. 3, pp. 65–130. Royal Botanic Gardens, Kew: London.

Ross, J.H. (1992). A note on *Plagiocarpus* Benth. (Fabaceae: Brongniartieae). *Muelleria* **7**, 421–423.

Ross, J.H. (2001). Two new endemic Australian genera in the Tribe Brongniartieae (Fabaceae) to accommodate two species formerly included in *Templetonia* R.Br. *Muelleria* **15**, 7–14.

Thompson, I.R., Ladiges, P.Y. and Ross, J.H. (2001). Phylogenetic Studies of the Tribe Brongniartieae (Fabaceae) using nuclear DNA (ITS-1) and Morphological data. *Systematic Botany* **26**, 557–570.