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A Revision of *Linospadix* in Australia, with the Description of a New Species

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Linospadix (commonly known as walking-stick palms) is a genus of understory palms occurring in Eastern Australia and New Guinea. The features that have historically been used to characterize the genus are as follows: a spicate inflorescence; leafbases not forming a tubular crownshaft; prophyll partially hidden within the leafbases; peduncle long and bare, semiterete to dorsiventrally flattened; peduncular bract tubular, attached at the distal end of the peduncle below the fertile portion (rachis) and fully enclosing the fertile portion; peduncular bract papery, withering early and eventually deciduous, leaving either a clean scar or persistent bract remnants; flowers in triads, sessile, spirally arranged in shallow pits in the proximal three-fourths of the rachis, paired or single staminate flowers in distal one-fourth; staminate flowers globose, bullet-shaped, or angled/pyramidal in bud, widely or not widely opening at anthesis; stamens few to many; anthers dorsifixed or approaching basifixed; pistillode absent, or small with three apical lobes; pistillate flowers globose to ellipsoidal, but same size or smaller than the staminate flower when in bud, stigma trifid, moderately protruding at anthesis; fruit small, globose, ellipsoidal, turbinate, or cylindrical, with stigmatic remains apical, colored yellow, pink, or red at maturity; endocarp adhering to the seed; endosperm homogeneous.

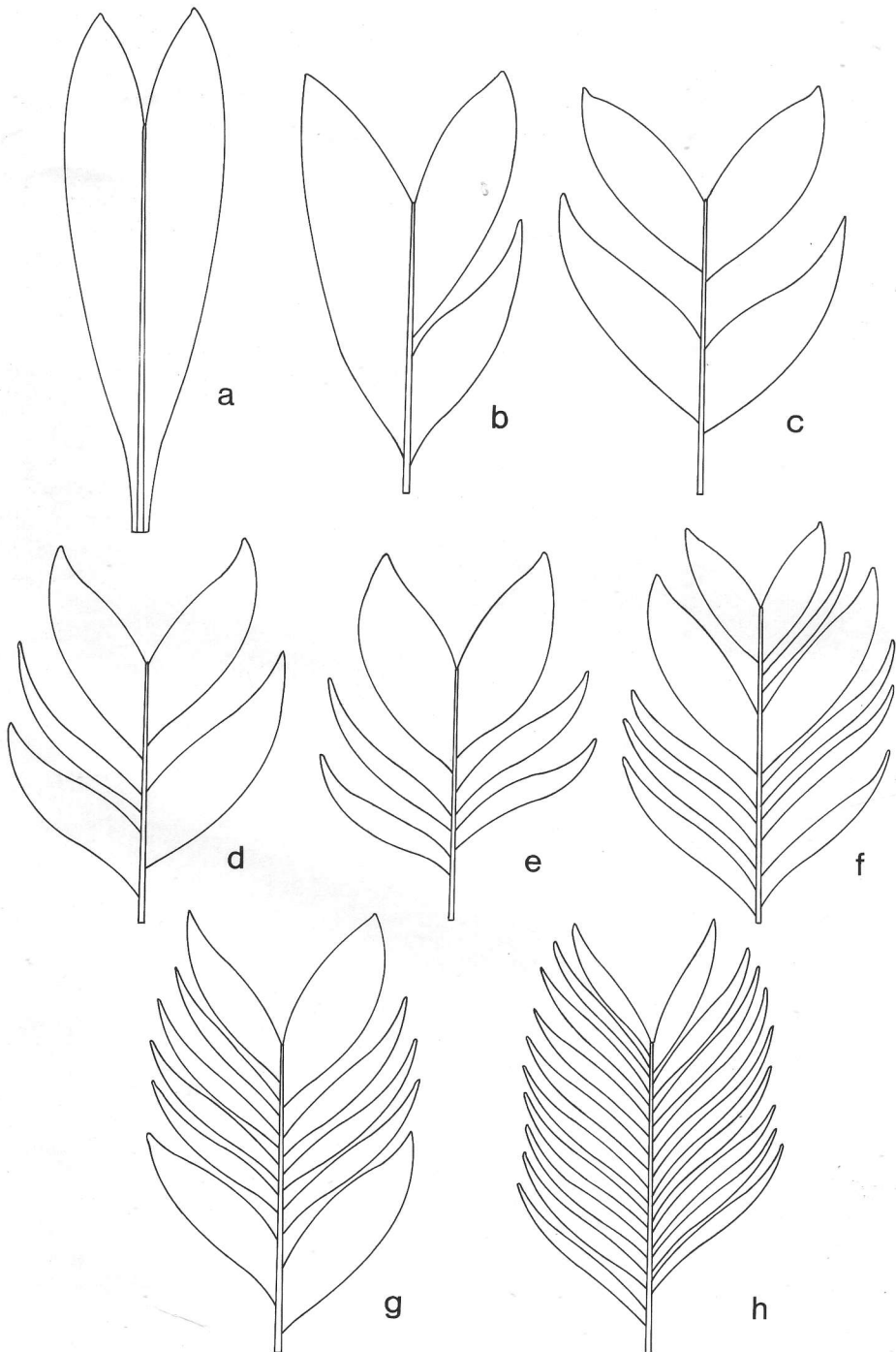
Related genera—*Calyptrocalyx*, *Howea*, *Laccospadix*, and *Paralinospadix* (which along with *Linospadix* comprise the subtribe *Linospadicinae*: tribe *Areceae*: subfamily *Arecoideae*)—have historically been separated on characters such as the condition of the endosperm (ruminant or homogeneous), habit (solitary or clustering), size, the position of attachment of the peduncular bract (either toward the base or the apex of the peduncle), and

the type of stamen attachment (dorsi- or basifixed). Uhl and Dransfield (1987) suggested that these genera could be regarded as subgenera of a single genus, though preliminary examination of relationships by Ferrero and Dowe (in preparation) suggests that there is sufficient heterogeneity within the group to justify maintaining the present generic distinctions.

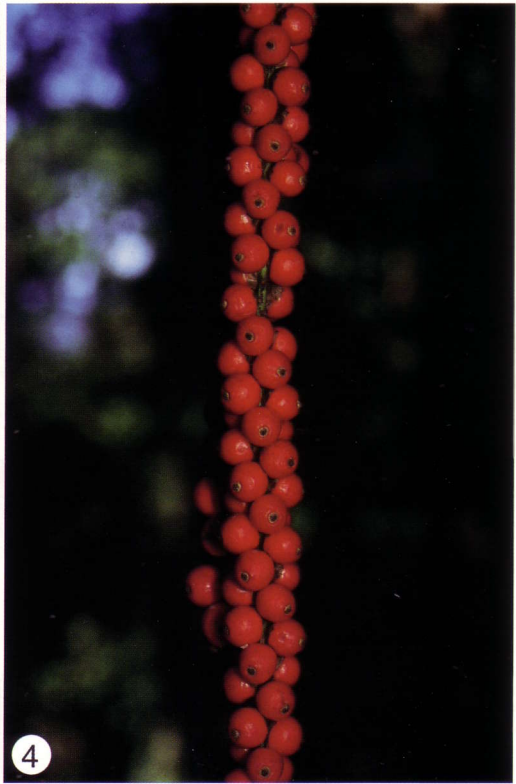
C. T. White (1936) was understating identification difficulties when he said of *Linospadix* . . . “differences between the various species are rather difficult to follow.” This can particularly apply in the field when two or more species occur together. All the Australian species are very variable in leaf form, having, apart from irregular pinnate forms, evenly and finely segmented forms. Variation of leaf segmentation is presented in Figure 1. The manner in which the leaf segments change into either single pinnae or groups of united pinnae has influenced some authors to create new species based on this aspect [e.g., *L. aequisegmentosa* (Domin) Burret = *L. palmeriana* (F. M. Bailey) Burret, and *Bacularia intermedia* C. T. White = *L. minor* (W. Hill) F. Muell.]. Fruit color at maturity can vary, being either yellow or red in *L. apetiolata*, *L. microcarya*, *L. minor*, and *L. palmeriana*, though it is red only in *L. monostachya*. There is some variation, which is of diagnostic value in flower and fruit structure, based on shape and orientation of petals, stamen number, the degree to which petals open at anthesis, and lamina morphology. A composite inflorescence with bracts and fruit of all species is presented in Figure 2.

Taxonomic History

Wendland (1875) established the genus *Linospadix* to include a single species, *Linospadix mon-*



1. Variation of leaf segmentation within *Linospadix* in Australia. The species in which each form occurs are as follows. a: *L. apetiolata* only. b: All except *L. monostachya*. c: All except *L. monostachya* and *L. apetiolata*. d: All except *L. monostachya*. e: All except *L. monostachya* and *L. apetiolata*. f: *L. monostachya* only. g: *L. apetiolata* and *L. microcarya* only. h: All except *L. apetiolata*. Drawing by Lucy Smith.





ostachya, which Martius (1837) had originally placed as *Areca monostachya* and Mueller (1870) as *Kentia monostachya*. To this was added the future *L. minor*, first described by Hill (1874) as *Areca minor* and then as *Kentia minor* by Mueller (1878). Also around this time Mueller transferred these two species to *Bacularia*, an imprecise and obscure genus, which he erected to account for the Australian taxa in *Linospadix*. Refined and expanded descriptions of both *Linospadix* and *Bacularia* were subsequently published by Hooker (1883), with differences between the genera based on stamen number (6–12 for *Bacularia* and 6–9 for *Linospadix*), anther attachment (either basi- or dorsifixed), and geographical location (*Bacularia* in Australia and *Linospadix* in New Guinea). The name *Bacularia* was first used by Mueller (1870) who suggested it as an alternative generic name in discussion under *Kentia monostachya*. Also under *Bacularia minor*, Mueller (1878) suggested that a possible correct name for this species was indeed *Linospadix minor*, though he never published this combination. The basis of separation between *Linospadix* and *Bacularia* was not made clear by Mueller and the characters used by Hooker to define the two genera are now considered to be variable and inconsistent.

Subsequently, Bailey (1889) described *L. palmeriana* (as *B. palmeriana*) from Bellenden-Ker; *L. aequisegmentosa* (now a synonym of *L. palmeriana*) and *L. microcarya* were also described from this area by Domin (1915) (as *B. aequisegmentosa* and *B. microcarya*, respectively). Beccari (1934) described *B. sessilifolia* (= *L. microcarya*), which was collected from near the type locality of *L. microcarya*, and White (1936) described *L. intermedia* (as *B. intermedia*), which is now a synonym of *L. minor*. *Linospadix apetiolata* has been recognized as a distinct species for some time, with Jones (1996) listing it as *L. sp.* Mt. Lewis and Queensland Herbarium (1994) noting it as *L. sp.* (Mt. Lewis K. A. Williams 82194).

The most recent revision of *Linospadix* was prepared by Burret (1935) in which he transferred all

the Australian species described at that time (and some New Guinea taxa) of *Bacularia* to *Linospadix*.

Materials and Methods

Extensive field collections and studies have been made since the early 1970s by AKI and since the early 1990s by JLD. Herbarium research has been undertaken by both authors at BRI, NSW, and QRS, while loans and assistance were received from B, BM, FI, and MEL.

Taxonomic Treatment

Linospadix H. Wendl., *Linnaea* 39: 177, 188, 198, T. 2, figure 2. 1875; Beccari, *Malesia* 1: 62. 1877 [*non* H. Wendl. = *Paralinospadix*]; Hooker f. in Benth. & Hooker f., *Gen. Pl.* 3: 870, 903. 1883; Burret, *Notizbl. Bot. Gart. Mus. Berlin-Dahlem* 12: 330. 1935; Beccari & Pichi-Sermolli, *Webbia* 11: 56. 1955; Burret & Potz-tal, *Willdenowia* 1: 354. 1956; Stanley & Ross, *Fl. southeastern Queensl.* 3: 270. 1989; Uhl & Dransfield, *Genera Palmarum* 383. 1987. Type: *Linospadix monostachya* (Mart.) H. Wendl. (*Areca monostachya* Mart.)

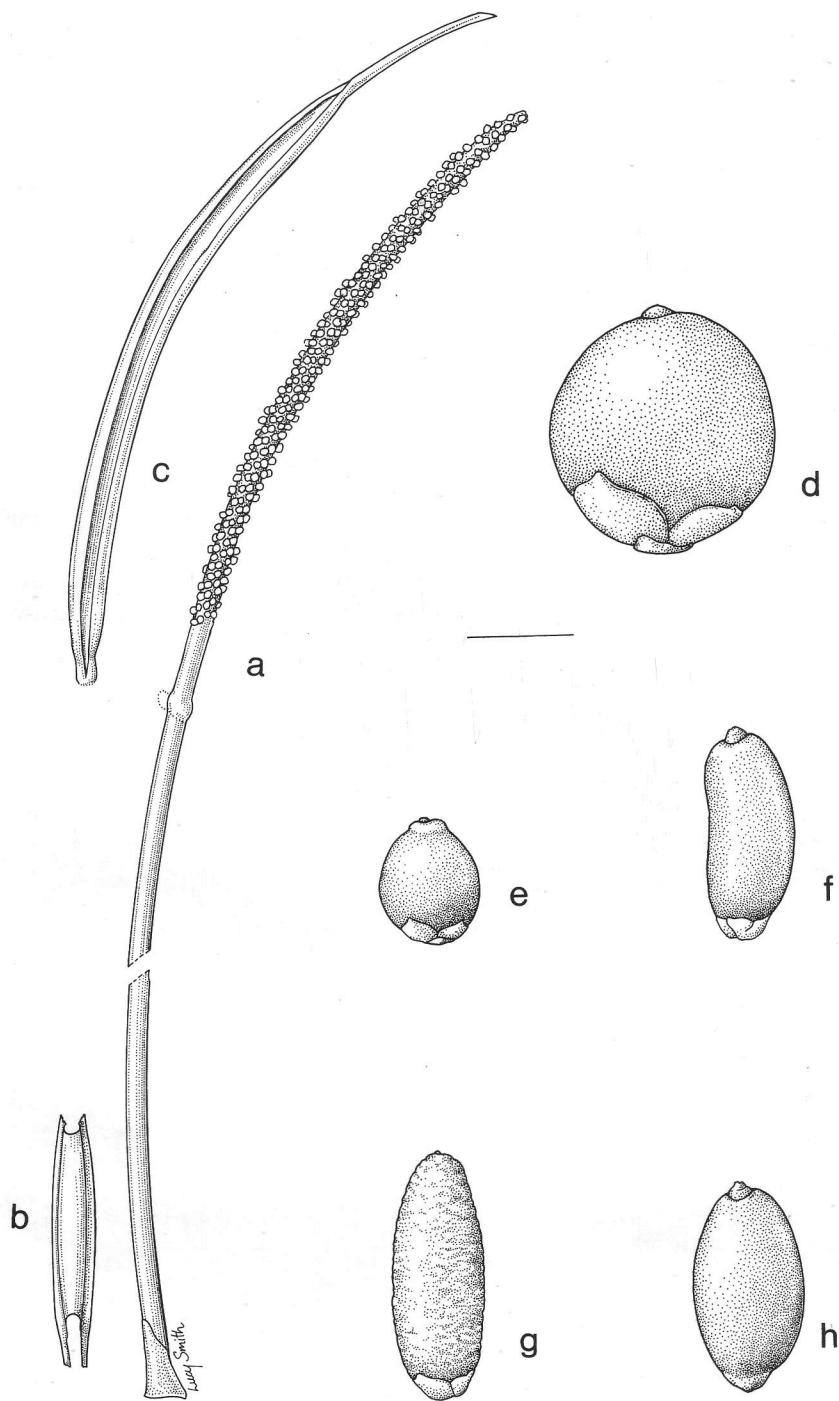
Bacularia F. Muell., *Fragm.* 7: 103. 1870 [*nomen*]; *Fragm.* 11: 58. 1878; Hooker f., *Bot. Mag.* 108: T. 6644. 1882; Hooker f. in Benth. & Hooker f., *Gen. Pl.* 3: 870, 903. 1883; F. M. Bailey, *Queensl. fl.* 5: 1679. 1902. Type: *Bacularia monostachya* (Mart.) F. Muell.

[*Kentia* Bl. (in part to include *Bacularia* and *Linospadix*), *Benth. Fl. Austral.* 7: 135. 1878.]

Small to moderate, solitary or clustering, monoecious, protandrous palms. Stems very thin to moderately thick, clustering at the base or infrequently aerially branched. Leaves few to many, either simply bifid, irregularly paripinnate with single or united pinnae, or evenly and finely paripinnate with single pinnae; leaf sheaths not forming a distinct crownshaft, splitting opposite the

3–6. (page 194) 3. *Linospadix monostachya* in habitat, 300 m alt., Mt. Warning, New South Wales. 4. Fruit of *L. monostachya*. 5. Broadly segmented leaf form of *L. microcarya*, Josephine Creek, Mt. Bartle Frere, Queensland. 6. Finely segmented leaf form of *L. microcarya*, Crawfords Lookout, west of Innisfail, Queensland.

7–10. (page 195) 7. Fruit of *L. palmeriana*. 8. Large form of *L. minor*, Olivers Creek, Cape Tribulation National Park, Queensland. 9. Fruit of *L. minor* (yellow form). 10. *Linospadix apetiolata* in habitat, 1250 m alt., Mt. Lewis, Queensland.



2. Inflorescence and fruit of *Linospadix*. Inflorescence. a: spike (in bud) with bracts removed (composite). b: Prophyll. c: Peduncular bract. Fruit. d: *L. monostachya*. e: *L. microcarya*. f: *L. palmeriana*. g: *L. minor*. h: *L. apetiolata*. Scale bar: d-h = 6 mm. Drawing by Lucy Smith.

(Continued from p. 197)

petiole with margins moderately fibrous; petiole short to long or completely lacking; pinnae 2–30 per leaf, terminal pinnae usually broader than lateral pinnae. Inflorescence spicate, interfoliar; peduncle with an extended bare portion between the apex of the prophyll and attachment of peduncular bract; prophyll short, dorsiventrally compressed, persistent, partially concealed within the leaf sheath; peduncular bract long and tubular, attached in the distal portion of the peduncle immediately below the rachis, and completely enclosing it, eventually splitting longitudinally, withering to a papery texture and deciduous; rachis from one-half to one-quarter the peduncle length. Flowers sessile, spirally arranged, triads in the proximal portion, with paired or solitary staminate flowers in the distal portion. Staminate flowers globose, bullet-shaped, or angled/pyramidal in bud, petals valvate, partially or widely opening at anthesis; petals much longer than sepals; stamens 4–20, arising from a staminal ring at the base of the pistillode (when present), shorter than the petals, remaining compactly grouped at anthesis; filaments very short; anthers dorsifixed or approaching basifixed; pistillode absent or small, wide with longitudinal ribs, apex trifid. Pistillate flower globose, about same size as, or smaller than, the staminate flower; sepals imbricate; petals apically valvate; stigma trifid. Fruit globose, turbinate, elongate/cylindrical, yellow, pink, or red at maturity; epicarp smooth, irregularly rugose, or with shallow longitudinal striations; mesocarp soft, moist, and succulent, with a single layer of fibers appressed to the endocarp, undivided, parallel, extending for length of fruit; endocarp thin, crustaceous, adhering to the seed. Seed globose, ovoid, or elongate/ellipsoid; hilum lateral; endosperm homogeneous; embryo basal. Eophyll bifid.

Distribution. Australia (5 spp.) and New Guinea (3–5 spp.), in moist closed forests (rain forest) from sea level to over 2000 m elevation. In Australia up to 1600 m elevation, mostly confined to within 35 km of the coast, but up to 110 km inland in isolated upland locations in southern Queensland and northern New South Wales. In Queensland distributed in southern McIlwraith Range, then continuously and commonly from about 25 km south of Cooktown to Mission Beach though absent from Atherton Tableland west of Tarzali and Jaggan. A large disjunct occurs south of Mission Beach until just north of Gympie (southeast Queensland) from where it occurs more or less

continuously to John's Mt., near Hastings River just north of Taree in New South Wales.

Habitats and Phenology. Occurring in coastal lowland and upland moist closed forest, in Complex Mesophyll Vine Forest to Simple Microphyll Vine-fern Thicket, but absent from Semi-deciduous Mesophyll Vine Thicket and Complex Notophyll Vine Forest, which are seasonally drier forests with higher light on the forest floor. Flowering occurs throughout the year but with fruiting in two distinct periods: January to March and May to August.

Etymology. Though Wendland did not specifically mention the derivation of the name *Linospadix*, it may be inferred that he was referring to the very thin inflorescence: *line*—an early botanical measurement of about 2 mm (one-twelfth of an inch) and *spadix*—a fleshy axis bearing sessile flowers.

Key to Species of *Linospadix* in Australia

1. Habit solitary: moderately tall understory palms; staminate flowers angled/pyramidal; fruit globose or elongate/cylindrical (Gympie, S.E. Qld to John's Mt., Central NSW) 1. *L. monostachya*
1. Habit clustering: small understory palms (if solitary the result of damage to basal growths or basal growths still to develop); staminate flowers rounded, either elongate or globose; fruit globose/turbinate or elongate/cylindrical.
 2. Fruit globose/turbinate, yellow or pink to red at maturity (Mt. Spurgeon, Mt. Lewis, Mt. Bellenden-Ker, Malbon Thompson Ra. and Mt. Bartle Frere) 2. *L. microcarya*
 2. Fruit elongate/cylindrical: yellow or red at maturity.
 3. Petiole present approximately one-quarter length of leaf
 4. Leaf segments usually two per side but also evenly pinnate forms with up to 24 pinnae; palms less than 2 m tall, leaf lamina rigid, secondary ribs prominent on both surfaces of leaf (Mt. Bellenden-Ker and Mt. Bartle Frere) 3. *L. palmeriana*
 4. Leaf segments more than three per side but also evenly pinnate forms with up to 24 pinnae; palms usually over 2 m tall, leaf lamina lax, chartaceous, veins prominent only on upper leaf surface (S. McIlwraith Range, and Mt. Amos to Mission Beach) 4. *L. minor*
 3. Petiole absent or very short; leaf bifid, or infrequently partially segmented or pinnate (Mt. Spurgeon and Mt. Lewis) 5. *L. apetiolata*

Key to Species of *Linospadix* in Australia based on leaf material at 10× magnification

1. Lamina with few to numerous scattered elongate clear "cells" parallel to midrib and veins 2. *L. microcarya*
1. Lamina without elongate clear "cells," but with few to

- numerous small or large circular clear "cells" in rows parallel to midribs and veins
2. Circular clear "cells" large and scattered, with secondary veins thin and not (or very infrequently) raised on the abaxial surface; interveinal septa not well defined 4. *L. minor*
 2. Circular clear "cells" small and densely arranged; secondary veins prominent on both surfaces of leaf; interveinal septa well defined
 3. Secondary veins regularly and closely spaced, more or less uniform in thickness
 4. Interveinal septa thin, most often connecting only few veins, some secondary veins as thick or nearly as thick as midrib ... 3. *L. palmeriana*
 4. Interveinal septa thick, most often crossing over many veins; secondary veins much thinner than midrib 1. *L. monostachya*
 3. Secondary veins irregularly and distantly placed, of variable thickness 5. *L. apetiolata*

Morphological characters used to differentiate species are listed in Table 1.

Table 1. Morphological characters used to differentiate species of *Linospadix* in Australia.

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1. Habit: clustering or solitary
 2. Stem: thin or thick
 3. Segmentation pattern of leaf: unsegmented, unevenly or evenly segmented
 4. Structure of leaf lamina: with or without elongate clear "cells," ribs and veins strong or weak; veins prominent on only one surface or on both surfaces
 5. Inflorescence: length
 6. Flower shape: globose, bullet-shaped, or angled/pyramidal
 7. Number of stamens: 4–20
 8. Petal spread of staminate flower at anthesis: narrow or wide
 9. Fruit: globose/turbinate or elongate/cylindrical; colored either yellow or red or only red
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1. *Linospadix monostachya* (Mart.) H. Wendl., *Linnaea* 39: 199. 1875 [as *L. monostachyos*]. *Areca monostachya* Mart., *Hist. Nat. Palm.* 3: 178. 1837; F. Muell., *Fragm.* 5: 49. 1865. *Kentia monostachya* F. Muell., *Fragm.* 7: 82, 103. 1870; 8: 235. 1874; Bentham, *Fl. Austral.* 7: 136. 1874. *Bacularia monostachya* (Mart.) F. Muell., *Fragm.* 7: 103. 1870; F. M. Bailey, *Queensl. fl.* 5: 1679. 1902; Domin, *Biblioth. Bot.* 20(85): 499. 1915; Evans & Johnson, *Contrib. NSW Herb.* 21: 6. 1962; Stanley & Ross, *Fl. South-east Queensl.* 3: 270. 1989. Lectotype (here designated): Mart., *Hist. Nat. Palm.* 3: T. 155. figure 4. 1837.

Solitary small to moderate palm. Stem 1.3–6 m tall, 2–5 cm diam.; internodes elongate, green to grey with age; crown with 5–10 leaves; leaf bases persistent immediately below crown. Leaves to

130 cm long, irregularly segmented with united or single pinnae, or regularly pinnate with single pinnae; petiole 24–80 cm long, 5.5–8 mm wide; pinnae 10–30 per leaf, to 30 cm long, 5–200 mm wide, glossy mid- to dark green above, lighter green below, truncate with toothed apices; midrib and veins prominent on both surfaces; lamina, when backlit under 10× magnification, has numerous circular clear "cells" to 0.1 mm wide, linearly parallel to midrib and veins. Inflorescence to 100 cm long; peduncle 30–60 cm long; prophyll 20–30 cm long; rachis to 50 cm long. Staminate flowers pointed in bud, angular/pyramidal, 6–13 mm long; petals rigid, apically pointed, acutely heeled, green at anthesis, not widely opening at anthesis, 6–13 × 7–10 mm, with deep longitudinal striations in the dried state; stamens 8–12; connective apiculate and extending beyond attachment of anthers; anthers subulate. Fruit globose to ovoid to elongate/cylindrical, 12–15 × 5–10 mm, red at maturity; epicarp smooth. Seed elongate/ellipsoid (Figs. 3, 4).

Distribution. From just north of Gympie (Qld)—Home Logging area—at 26°05'S to John's Mt. just north of Taree (NSW) at 31°30'S, in rain forest from sea level to 1200 m elevation, primarily on basalt soils, less common on metamorphics and alluvial soils.

Etymology. In reference to the inflorescence being a single spike.

Common name and uses. Walking-stick palm; stem once used for walking-sticks and umbrella handles.

Phenology. Fruiting December to June.

Conservation. Not threatened or rare.

Representative specimens. QUEENSLAND: Wide Bay. Home Logging Area, SF 502, N of Gympie, 26°05'S, 152°43'E, 170 m alt., 5 Oct 1993, *Bean 6681* (BRI); Moreton. Mooloolah R., Jowarra Reserve, on Track #1, 1 km from start, 26°50'S, 152°55'E, 20 m alt., 1 Apr 1996, *Dowe 0305* (BRI); Main Range NP, SW side of Mt. Bell, Terriot Brook, 28°13'S, 152°29'E, 880 m alt. 9 Aug 1995, *Forster 17409* (BRI); Mt. Barney, saddle between peaks, 28°17'S, 152°41'E, 1100 m alt., 7 Oct 1992, *Forster 11909* (BRI).

NEW SOUTH WALES: Mt. Warning, SE slopes, on track to summit, 28°25'S, 153°20'E, 600 m alt., 31 Mar 1996, *Dowe 0302* (BRI, FTG); Mt. Warning, SE slopes, on track to summit, 28°25'S, 153°20'E, 850 m alt., 31 Mar 1996, *Dowe 0303* (BRI, FTG); Whian Whian SF, 1953–

58, *Webb & Tracey s.n.* (BRI); Byron Bay, 28°30'S, 153°30'E, 30 Nov 1970, *Bell 311* (BRI); Brunswick R., main arm, 27 Aug 1936, *White 10516* (BRI); Dorrigo SF, 830 m alt., 4 Oct 1930, *White 7472* (BRI); John's R., Jul 1915, *Boorman s.n.* (NSW [47061]).

Martius' (1837) protologue for *L. monostachya* (as *Areca monostachya*) refers to an unnumbered A. Cunningham collection from the Hastings River, New South Wales. This collection appears to be no longer extant, and therefore Martius' illustration Tab. 155. figure 4 has been designated here as the lectotype. *Linospadix monostachya* is a common species occurring in the rain forests of southern Queensland and northern New South Wales. It is the largest species of the genus in Australia, and is distinguished by pointed angular/pyramidal staminate buds, mature flowers that are approximately twice the size as those in other species, globose fruit, and solitary habit.

2. *Linospadix microcarya* (Domin) Burret, Notizbl. Bot. Gart. Mus. Berlin-Dahlem 12: 331. 1935. *Bacularia microcarya* Domin, Biblioth. Bot. 85: 499. 1915. Type: Australia, Queensland, Harvey's Ck., 1889, *Bailey s.n.* (holotype: BRI[AQ75431]).

Bacularia sessilifolia Becc., Atti Soc. Tosc. Sc. Nat. Pisa Mem. 44: 133. 1934: Type: Australia, Queensland, Cook District, Russell R., 1886, *Sayer s.n.* (FI).

[*Bacularia sessilifolia* var. *multisecta* Becc., nom. invalid, in Martelli, Nuovo Giorn. Bot. Ital. 42: 30. 1935. (Mss in Herb.). Type: not designated.]

[*Linospadix microcarya* var. *multisecta* (Becc.) Burret, nom. invalid, Notizbl. Bot. Gart. Mus. Berlin-Dahlem 12: 331. 1935. Type: not designated.]

Clustering small palm. Stems 1–6, to 3 m tall, 7–25 mm diam., internodes elongate, green; crown with 5–9 leaves. Leaves 28–70 cm long, irregularly segmented with united pinnae, segments with broad bases, or regularly pinnate; petiole 1–23 cm long, 3–6 mm wide; pinnae 3–23 per leaf, 11–36.5 cm long, by 0.9–7.4 cm wide, semiglossy, lettuce to mid-green above, sometimes dark green when in deep shade, lighter green below; midrib and secondary veins prominent on both surfaces; terminal pair broader than adjacent laterals and often basal pair broader than laterals; lamina, when backlit under 10× magnification, with numerous

scattered clear elongate "cells" 0.5–1 mm long linearly parallel to midrib and veins. Inflorescence to 80 cm long. Staminate flowers globose to squatly bullet-shaped in bud, 2–5 mm long; petals three times the length of sepals, apically rounded, without longitudinal striations, cream/dull yellow at anthesis, not widely opening; stamens 8–12; connective not extending beyond the anther. Fruit globose to turbinate, 5–9 × 5–8 mm, yellow-orange, or pink to red at maturity; epicarp smooth. Seed subglobose (Figs. 5, 6).

Distribution. From Mts. Spurgeon and Lewis to just south of Innisfail, most common on the lower slopes of Mts. Bartle Frere and Bellenden-Ker, and the Malbon Thompson Range, from near sea level to 1600 m elevation, in rain forest on granite, or occasionally on basalt and metamorphics.

Etymology. In reference to the small fruit.

Conservation. Rare (Queensland Herbarium 1994). This designation could be revised to Common: distribution covers an area of approximately 120 km in length and the species is common throughout this range.

Representative specimens. QUEENSLAND: Cook District, Mt. Spurgeon, Platypus Ck., 20 Sep 1936, *White s.n.* (BRI, QRS); Summit of Mt. Spurgeon, 1300 m, 12 Aug 1971, *Stocker 780* (BRI, QRS); TR 140, Cow LA., 16°30'S, 145°10'E, 1150 m, 27 Sep 1973, *Irvine 654* (QRS); Mt. Lewis, SFR 143, North Mary LA., 1000 m, 16°30'S, 145°16'E, 4 Oct 1973, *Irvine 662* (QRS); Mt. Lewis, 15 km N of Rex Hwy., 16°30'S, 145°15'E, 900 m alt., 13 Feb 1996, *Dowe 0260* (BRI, FTG); Mt. Lewis, 9 km from Rex Hwy., on Mt. Lewis Rd., 16°35'S, 145°16'E, 350 m alt., 5 Apr 1996, *Dowe 0319* (BRI, FTG); Harvey's Ck., 17°15'S, 145°55'E, 100 m, 31 Oct 1974, *Irvine 1033* (BRI, QRS); Boonjee SFR 1230, 17°25'S, 145°45'E, 720 m, 23 Jan 1973, *Irvine 445* (QRS). North Kennedy, head of Culla Ck., 1.4 km S of Cooroo Peak, 14 km NW of South Johnstone, 17°31'S, 145°53'E, 60 m alt., Oct 1988, *Jessup GJM2559*, *Guymer & McDonald* (BRI).

Bailey's 1889 collection from Harvey's Creek (BRI [AQ75431]), cited by Domin in his 1915 protologue, is the type specimen for *Linospadix microcarya*. This species is the most common *Linospadix* in the Mt. Bellenden-Ker and Mt. Bartle Frere area. *Linospadix microcarya* stands apart from the other species due to some unique features: the leaf lamina contains elongate clear "cells" that are visible under 10× magnification, fruit is turbinate

(infrequently globose), and staminate flowers do not open widely at anthesis.

3. *Linospadix palmeriana* (F. M. Bailey) Burret, Notizbl. Bot. Gart. Mus. Berlin-Dahlem 12: 331. 1935. *Bacularia palmeriana* F. M. Bailey, Report on a Government Scientific Expedition to Bellenden-Ker 67. 1889; Synop. Queensl. Fl., 3rd Supplement 77. 1890; Queensl. fl. 5: 1680. 1902; Comp. Cat. Queensl. Pl. 573, figure 554. 1913. Lectotype (here designated): Australia, Queensland, Mt. Bellenden-Ker, 700 m, 1889, *Bailey s.n.*, (BRI [AQ77548]).

Linospadix aequisegmentosa (Domin) Burret, Notizbl. Bot. Gart. Mus. Berlin-Dahlem 12: 331. 1935. *Bacularia aequisegmentosa* Domin, Biblioth. Bot. 85: 500. 1915. Lectotype (here designated): Domin, Biblioth. Bot. 85: T. 18. figures 1–8. 1915.

Clustering small palm. Stems 1–6, to 2 m tall, 8–20 mm diam.; internodes elongate, green; crown with 8–12 leaves. Leaves regularly segmented with united pinnae, most often with two segments either side of rachis, infrequently simply bifid, segments with broad bases, or regularly and finely pinnate; petiole 5.5–13 cm long; pinnae 2–24 per leaf, dull to semiglossy dark green above, lighter green below; midrib prominent on both surfaces, veins numerous and prominent on both surfaces, terminal pinnae broader than laterals; lamina, when backlit under 10× magnification, with numerous circular clear “cells” to 0.1 mm wide, linearly parallel to midrib and veins. Inflorescence to 60 cm long. Staminate flowers squatly bullet-shaped in bud, glabrous, to 3 × 2 mm; petals apically rounded, green at anthesis, not widely opening, deeply striated in the dried state; stamens 6–9; connective not extending beyond the anthers; anthers oblong. Fruit elongate/cylindrical, 10–15 cm × 5–7 mm, yellow or red at maturity; epicarp smooth or with barely discernible rugose appearance. Seed elongate/ellipsoid (Fig. 7).

Distribution. Confined to Mts. Bartle Frere and Bellenden-Ker, in rain forest, on granite, metamorphics, and occasionally on shallow basalts overlying metamorphics, from 300 to 1600 m elevation.

Etymology. Named for Edward Palmer, M. L. A., of whom Bailey wrote “indebted for much useful information as to the uses made by the aboriginals of our indigenous plants.”

Conservation. Rare (Queensland Herbarium 1994).

Representative Specimens. QUEENSLAND: Cook District. Mt. Bellenden Ker, ridge between cableway and north peak, 17°15'S, 145°51'E, 1500 m alt., 3 Sep 1986, *Clarkson 6569* (MBA, QRS); Mt. Bellenden-Ker, 17°16'S, 145°52'E, 1500 m, 20 Dec 1994, *Gray 5873* (QRS); Summit of Bellenden-Ker, Centre Peak, 1400 m, undated, *Webb & Tracey 13688* (QRS); Mt. Bartle Frere, from the base of the mountain, undated (1889?), *Bailey s.n.* (MEL); Mt. Bartle Frere summit walking track, 17°22'S, 145°45'E, 750 m alt., 15 Feb 1996, *Dowe 0276* (BRI, FTG); 25 Aug 1996, *Dowe 0370 & Smith* (BRI); Boonjee, SFR 755, 17°30'S, 145°40'E, 680 m, 8 Jul 1971, *Dockrill 189* (QRS).

In the protologue for this species, Bailey refers to the distribution of this species on Mt. Bartle Frere “. . . the base of the leading spur, at about 2000 feet, and from that to the summit of the south peak, an altitude of over 5000 feet.” Of what were possibly many specimens collected from this area, at least two are extant: BRI [AQ75548] from Meston's Spur at high elevation and MEL [unnumbered] from “the base of the mountain” to quote Bailey's hand-written notes attached to this collection. The former is chosen here as the lectotype as it best represents the taxon as interpreted in this work.

4. *Linospadix minor* (W. Hill) F. Muell., *Fragm.* 11: 58. 1878. *Areca minor* W. Hill, Report on Brisbane Botanic Gardens 1874 6. 1874. *Kentia minor* F. Muell., *Fragm.* 8: 235. 1874; 9: 195. 1875; 10: 121. 1877; Bentham, *Fl. Austral.* 7: 137. 1878. *Bacularia minor* F. Muell., *Fragm.* 11: 58. 1878; F. M. Bailey, Queensl. fl. 5: 1679. 1902. Lectotype (here designated): Australia, Queensland, Bellenden-Ker Ranges, undated, *Hill s.n.* (MEL [79769]).

Bacularia intermedia C. T. White, Proc. Royal Soc. Queensl. 47(5): 83. 1936. Type: Australia, Queensland, Mowbray R., 21 Jan 1932, *Brass 1975* (holo: BRI [AQ24160]).

Clustering small palm. Stems 1–5 m tall, 7–20 mm diam.; internodes elongate, green; crown with 7–12 leaves. Leaves to 110 cm long, irregularly segmented with united pinnae, segments with broad bases, or regularly pinnate with narrow pinnae; petiole 3.6–51 cm long, 1–4 mm wide; pinnae 3–24 per leaf, semiglossy dark green above, lighter green below, midrib prominent on both sur-

faces, veins not prominent on lower surface; lamina chartaceous, irregularly corrugated, when backlit under 10 \times magnification, with scattered, circular clear "cells" to 0.1 mm wide linearly parallel to midrib and veins. Inflorescence to 80 cm long. Staminate flowers squatly bullet-shaped in bud, to 3 \times 2 mm wide; petals apically rounded, with conspicuous longitudinal striations, green at anthesis, not widely opening; stamens 7–20, attached at different levels in the staminal cluster; connective not extending beyond the anther; anther lobes irregular or uneven. Fruit elongate/cylindrical, 8–18 \times 3–8 mm, yellow or red at maturity, epicarp irregularly rugose when fruit is fully mature. Seed elongate/ellipsoid (Figs. 8, 9).

Distribution. Recorded from the southern McIlwraith Range where it has limited distribution, and abundantly from just south of Cooktown (Mt. Amos area) to Mission Beach (Licuala State Forest) and as far inland as Windsor Tableland, from sea level to 1200 m elevation, in rain forest on basalt, granite, and metamorphics. Reported in New Guinea, but identification is not certain.

Etymology. Named for its smaller stature as compared to *L. monostachya*, the only other species known at the time of its description.

Conservation. Not threatened.

Representative Specimens. QUEENSLAND: Cook District. Leo Ck., upper Nesbit R., 420 m alt., 16 Aug 1948, *Brass 19868* (BRI); Upper Nesbit R., 13 $^{\circ}$ 26'S, 143 $^{\circ}$ 10'E, 400 m, Sep 1974, *Webb & Tracey 13472* (BRI, QRS); TR 14, 13 $^{\circ}$ 40'S, 143 $^{\circ}$ 20'E, 450 m, 21 Sep 1972, *Irvine 364* (QRS); Leo Ck., TR14, 13 $^{\circ}$ 44'S, 143 $^{\circ}$ 23'E, 360 m alt., 19 Jun 1995, *Forster 16845* (BRI); McIlwraith Range, head of Lankelly Ck., 13 $^{\circ}$ 52'S, 143 $^{\circ}$ 20'E, 600 m alt., Oct 1969, *Webb & Tracey 9527A* (BRI); Annan R., upper Parrot Ck., 400 m alt., 17 Sep 1948, *Brass 20271* (BRI); TR 146, Tableland LA., 15 $^{\circ}$ 45'S, 145 $^{\circ}$ 15'E, 700 m, 8 Jul 1975, *Irvine 1488* (QRS); Daintree NP, Olivers Ck., 50 m alt., 13 Feb 1996, *Dowe 0256* (FTG); TR 55, Whyanbeel, 16 $^{\circ}$ 20'S, 145 $^{\circ}$ 20'E, 220 m, 25 Jul 1975, *Irvine 1458* (QRS); Mt. Lewis, 15 km from Rex Hwy., 16 $^{\circ}$ 35'S, 145 $^{\circ}$ 15'E, 900 m alt., 13 Feb 1996, *Dowe 0263* (FTG); SFR 143, Little Mossman LA., 16 $^{\circ}$ 35'S, 145 $^{\circ}$ 20'E, 350 m, 15 Apr 1975, *Irvine 1324* (QRS); SFR 1137, Jurs Ck., 17 $^{\circ}$ 55'S, 146 $^{\circ}$ 05'E, 15 m, 31 Oct 1974, *Irvine 1045* (QRS); Licuala SF, Licuala Forest Drive, 1 km from Tully/Mission Beach Rd., 17 $^{\circ}$ 56'S,

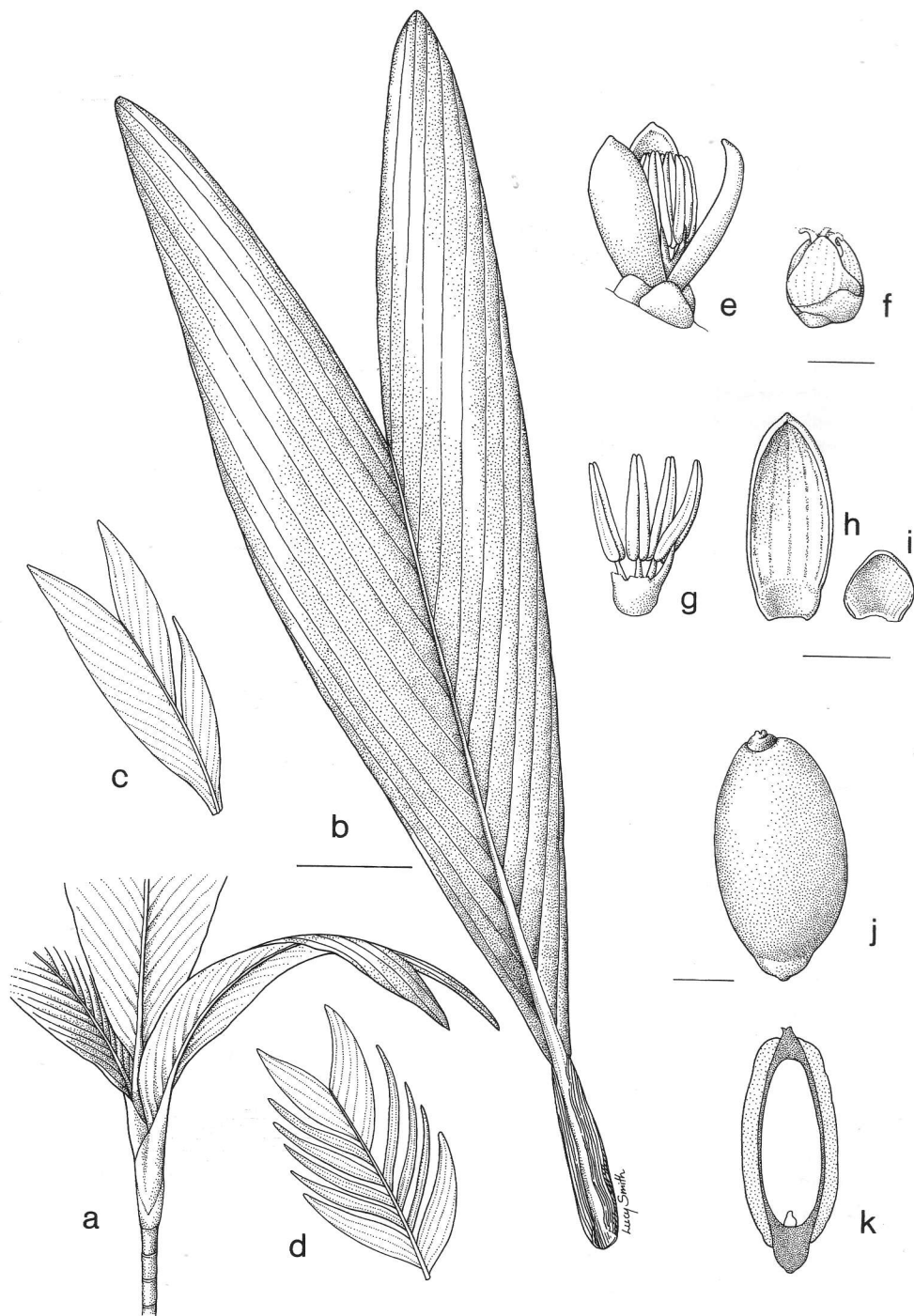
146 $^{\circ}$ 03'E, 40 m alt., 16 Feb 1996, *Dowe 0283* (BRI, FTG).

Although Hill (1874) did not mention a specific collection in his protologue, his collection from Bellenden-Ker (MEL [79769]) is here chosen as the lectotype. *Linospadix minor* is the most vegetatively variable species in the genus. Plants may be sparsely or densely clustered, and leaves may be small to large with few to many segments.

5. *Linospadix apetiolata* Dowe & A. K. Irvine **sp. nov.** (Figs. 10, 11).

*Palma parva caespitosa a speciebus affinis petiolo semper carenti et habendo basi folia surcularia magna bifida differt; aliquot formae ubi adultae retinent folia magna bifida vel alioquin folia partim secescerunt sed apice magno bifido praedita; perianthium segmentis viridibus; flores staminati sub anthesi late aperientes 9–12 staminibus praediti; fructus cylindrici flavi rubrivi sub maturitate. Typus: Australia. Queensland. Cook District. Mt. Lewis, off forestry road 27 km from Rex Hwy., 100 m E of Ranger's hut, 16 $^{\circ}$ 28'S, 145 $^{\circ}$ 16'E, 1220 m, 24 Aug 1996, *Dowe 0369*, *Ferrero & Smith* (holotypus BRI; isotypi K, QRS).*

Clustering small palm. Stems 1–6, 2–5 m tall, 15–25 mm diam.; internodes elongate, green; vegetative aerial growths from nodes common; crown with 6–14 leaves. Leaves 30–90 cm long by 10–20 cm wide, simply bifid or with broad bilobed terminals and evenly segmented laterals on both sides of midrib and broader pinnae or with one lobe entire and running the length of the rachis and the other lobe segmented into pinnae; dull or semiglossy light green above, lighter green below, with a metallic sheen on both surfaces; midrib very prominent on both surfaces; secondary veins prominent on both surfaces; petiole absent or rarely very short to 3 cm long; lamina thick, opaque to partially translucent, when backlit under 10 \times magnification, with scattered, circular clear "cells" to 0.1 mm wide linearly parallel to midrib and veins. Inflorescence to 80 cm long. Staminate flowers squatly bullet-shaped in bud, 2.8–4 mm long; petals with conspicuous longitudinal striations, apex shortly acute to rounded, green at anthesis, widely opening at anthesis; stamens 4–7; connective not extending beyond the anthers; pistillode lacking. Fruit elongate/cylindrical, 10–15 \times 5–6 mm, yellow or red at maturity; epicarp moderately rugose when fully mature. Seed elongate/ellipsoid, 9–10 \times 3–4 mm.



11. *Linospadix apetiolata*. a: Crown, showing leaf attachment and lack of petiole. b: Leaf (bifid form). c: Leaf (partially segmented form). d: Leaf (segmented form). e: Staminate flower. f: Pistillate flower. g: Stamens. h: Petal of staminate flower. i: Sepal of staminate flower. j: Fruit. k: Fruit in longitudinal section with position of embryo indicated. b from *Dowe 0323* (BRI); e, g-i from *Irvine 639* (QRS); j-k from *Gray 5934* (spirit #11980) (QRS). Scale bars: b = 55 mm. e-f = 2 mm. g-i = 2 mm. j-k = 3 mm. Drawing by Lucy Smith.

Distribution. Confined to Mts. Spurgeon and Lewis, above 800 m elevation, on soils derived from granite in Simple Microphyll Vine forest.

Etymology. In reference to the lack of a petiole on the leaf.

Conservation. Listed as K (Queensland Herbarium 1994) but here proposed as rare.

Representative Specimens: QUEENSLAND: Cook District. Mt. Spurgeon, rock site N side of junction of Platypus Ck. and Mossman R., 16°30'S, 145°15'E, 1300 m, 9 Dec 1972, *Webb & Tracey 11328* (QRS); Mt. Spurgeon, near Christensen's Clearing, Zarda LA, TR 142, 16°30'S, 145°10'E, 1150 m alt., 24 Sept, *Irvine 639* (QRS); Mt. Lewis, SFR 143, North Mary LA., 16°30'S, 145°15'E, 1000 m, 12 Feb 1975, *Irvine 1158* (QRS); Mt. Lewis, Carbine LA, SFR 143, 16°29'S, 145°15'E, 1200 m alt., 25 Jan 1995, *Gray 5934* [spirit No 11980] (QRS); Mt. Lewis, 15 km from Rex Hwy., 16°35'S, 145°15'E, 900 m alt., 13 Feb 1996, *Dowe 0262, 0264 & 0270* (BRI, FTG).

The type specimen for *L. apetiolata* is *Dowe 0369*, *Ferrero & Smith* collected from Mt. Lewis, at 1220 m elevation. It represents some of the variation that occurs in the species, particularly those forms in which the leaves are bifid, with one lobe entire and running the full length of the rachis, the other lobe segmented into pinnae. Some forms retain the bifid leaf into maturity while others have leaves which are evenly pinnate though with the apical segments united to remain strongly bilobed, and the basal pinnae either slightly broader or much broader than the laterals.

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