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Austrostipa, a new genus, and new names for Australasian species formerly included in *Stipa* (Gramineae)

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Abstract

Jacobs, S.W.L., and Everett, J. (Royal Botanic Gardens, Sydney, Australia, 2000) 1996. Austrostipa, *a new genus, and new names for species in Australasia formerly included in* Stipa *(Gramineae).* Telopea *6(4): 579–595.* The genus **Austrostipa** is described to include all of the native Australian species formerly included in *Stipa*, all relevant new combinations are provided, and a new species, **Austrostipa geoffreyi**, is described. *Austrostipa* is divided into 13 subgenera. The generic placements of the species introduced to Australia in either *Nassella* or *Achnatherum* are confirmed, new combinations are provided for the New Zealand **Achnatherum petriei** and the introduced **Achnatherum caudatum**, and the genus *Anemanthele* is retained. Keys are provided to genera of the Stipeae and to the subgenera of *Austrostipa*.

Introduction

The tribe Stipeae has been defined in several ways (Clifford & Watson 1977, Clayton & Renvoize 1986) relying on anatomical, micromorphological and floral characters. The shared derived character that so far best defines the tribe is the Stipoid embryo, a modified Pooid embryo that is small relative to the endosperm, has (i) the scutellum and embryonic leaf traces diverging from the same point with no internode, (ii) an epiblast, (iii) the scutellum and coleorrhiza fused, (iv) the embryonic leaf margins not overlapping, and (v) the primary root bent at a sharp angle from the main axis of the embryo (Reeder 1957). Correlated with this, but not exclusive to the Stipeae, are single-flowered spikelets, disarticulation above the glumes, and absence of a rhachilla extension. Current work on rDNA (ITS) in the Stipeae is confirming that the tribe is monophyletic (Hsiao et al. 1995, Hsiao pers. comm.).

We (Vickery et al. 1986, Jacobs et al. 1989) suggested that 61 endemic Australian, one endemic New Zealand and five introduced species were congeneric with *Stipa* L. but that a broader study would be needed to clarify the relationships. To date we recognise one species of *Anemanthele* endemic to New Zealand, one introduced species of *Nassella* (*N. trichotoma*) and one introduced species of *Piptatherum* (*P. miliaceum*) (Jacobs & Everett 1993).

Since our statements on the generic relationships Barkworth & Everett (1987), Everett (1990) and Barkworth (1990, 1993) have presented results from cladistic analyses of the species and genera of the tribe. Hsiao (pers. comm.) and Hsiao et al. (1995) have also been analysing nuclear rDNA (ITS) sequences. As a result of the earlier studies Barkworth (1990) made 68 new combinations in *Nassella*, and (Barkworth 1993) 36 new combinations and one new species in *Achnatherum*, and five new combinations in *Hesperostipa*. Barkworth (1993) recognised nine genera in the 'core' or traditional part of the tribe Stipeae, *Achnatherum*, *Piptatherum*, *Oryzopsis*, *Ptilagrostis*, *Piptochaetium*, *Nassella*, *Hesperostipa*, *Stipa* and *Anemanthele*. She also acknowledged that the Australian species may not fit into any of these genera.

Everett (1990) analysed 30 morphological and anatomical characters from 37 taxa. The results are summarised in Fig. 1 being the strict consensus tree from PAUP 2.4 (Swofford 1985). The taxa are: *Achnatherum*, 'Boreobtusae' and 'Obtusae' (Barkworth & Everett 1987), *Nassella*, *Oryzopsis*, *Piptatherum* sections Piptatherum, Miliacea (included with Piptatherum in Fig. 1) and Virescentia, *Piptochaetium*, *Ptilagrostis*, *Hesperostipa*, *Stipa* s.s., *Stipa* sections Podopogon (included in *Piptochaetium* in Fig. 1) and Stephanostipa (included in *Nassella* in Fig. 1), and 23 groups obtained from an analysis of Australian taxa (Everett 1990). *Nardus* and *Joinvillea* were used as outgroups. The 23 Australian groups were obtained by grouping the species into minimum unequivocal monophyletic units. This confirmed that the Australian species represented a monophyletic group (*Austrostipa* in Fig. 1), a sister group to *Achnatherum* and *Ptilagrostis* (Fig. 1), supporting a similar more tentative conclusion reached by Barkworth and Everett (1987). The rDNA study so far is indicating that the Australian species are more closely related to *Nassella* than to *Achnatherum* (Hsiao pers. comm.). If segregate genera are to be recognised then it is evident that the Australian species can no longer remain in *Stipa* s.s. Given that there is some conflict as to the closest relatives of the Australian species, and that all studies to date indicate that they are all more closely related to each other than any are to any non-Australian species, the best option is to place them in a new genus, here described as *Austrostipa*.

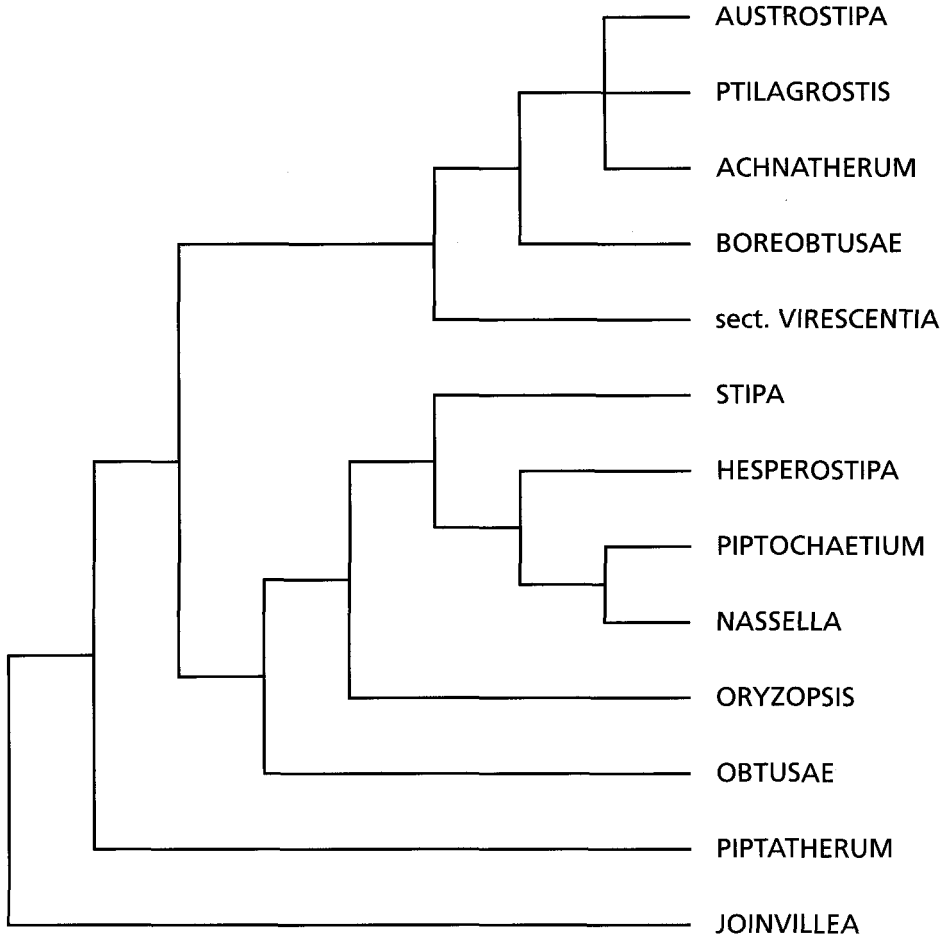

Fig. 1. A cladogram indicating relationships in the Stipeae, based on morphological and anatomical data, simplified (several groups removed) and redrawn from the consensus tree in Everett (1990).

Key to genera (modified after Barkworth 1993).

1 Stamen 1; hilum elliptic; lemma nerves 3 ..... **Anemanthele**

1* Stamens 3; hilum linear; lemma nerves 3 or more 2

2 Palea longitudinally grooved, longer than the lemma and protruding from between the lemma margins at the lemma apex; lemma margins involute, fitting into the paleal groove; lemma epidermis with very long fundamental cells with thickened sidewalls such that the surface appears longitudinally finely ridged; silica cells absent from lemma epidermis ..... **Piptochaetium**

2 Palea flat, shorter than or equalling the lemma, lemma margins flat, rarely palea grooved and then lemma margins involute, but then palea scarcely protruding at the lemma apex (two native Australian spp.); lemma surface smooth or tuberculate, not longitudinally ridged; lemma epidermal silica cells present or absent 3

3 Silica bodies in lemma epidermis square or rectangular ..... **Stipa s.s.**

3* Silica bodies in lemma epidermis round, oval or absent 4

4 Palea < 30% lemma length; lemma heavily silicified, tough, margins tightly overlapping; fundamental cells of lemma epidermis very short, much shorter than wide ..... **Nassella**

4* Palea usually > 30% lemma length, rarely shorter; lemma membranous, leathery or sometimes tough, the margins open, loosely or more or less tightly overlapping; fundamental cells of lemma epidermis usually much longer than wide 5

5 Palea coriaceous, not indurate; lemma pale, the margins scarcely enclosing the palea; floret terete or slightly dorsally compressed; callus very short and blunt; awn weak 6

5* Palea indurate; lemma pale or dark; lemma margins enclosing the palea; callus often pungent; awn robust 9

6 Leaf blades filiform, < 0.5 mm wide; plants of boggy alpine and subalpine habitats ..... **Ptilagrostis**

6* Leaf blades not filiform, usually > 0.5 mm wide; plants of various habitats 7

7 Palea pubescent, shorter than or equal to the lemma but not prow-tipped ..... **Achnatherum**

7* Palea glabrous, prow-tipped, as long as the lemma 8

8 Florets dorsally compressed; lemma margins not overlapping, the palea exposed, at least in part ..... **Piptatherum**

8* Florets terete or laterally compressed; lemma margins often overlapping, concealing the palea ..... **Oryzopsis**

9 Lemma white, yellow, brown, red-brown, purple or black at maturity, often with brownish hairs; florets 2–12 mm long; awn 1.4–20 cm long; lemma epidermis always with round to oval silica bodies ..... **Austrostipa**

9* Lemma white or cream-coloured, with sparse white hairs; florets > 7.5 mm long; awn > 8 cm long; lemma epidermis without silica bodies ..... **Hesperostipa**

As well as the 62 Australian species of *Austrostipa* (including one new species described here) there are (Jacobs et al. 1995) three species of *Achnatherum* (one new combination

provided below) introduced to Australia, five species of *Nassella*, and one species of *Piptochaetium* (*P. montevidense*) recorded from Victoria (Walsh 1994). After further examination there is still justification for maintaining *Anemanthele*, the stamen number of one (three in the rest of the tribe) reinforcing the other characters listed by Barkworth & Everett (1987). *Anemanthele* is more closely related to *Achnatherum* than to *Austrostipa*. *Stipa petriei* from New Zealand has the diagnostic characters of ***Achnatherum*** and is here included in that genus (new combination provided below).

Achnatherum

Achnatherum P. Beauvois (1812: 146).
LECTOTYPE (Niles and Chase 1925): *Achnatherum calamagrostis* (L.) P. Beauvois.

Achnatherum brachychaetum (Godr.) Barkworth (1993: 6).

Achnatherum caudatum *(Trin.) S.W.L. Jacobs & J. Everett*, **comb. nov.**
Basionym: *Stipa caudata* Trinius, Mém. Acad. Imp.Sci.— St Pétersbourg Sér. 6, Sci. Math 1: 75 (1830); Vickery, Jacobs & Everett (1986: 38–39).

Achnatherum papposum (Nees) Barkworth (1993:11).
Although currently included in *Achnatherum*, there is some doubt as to whether this and related species best belong here.

Achnatherum petriei *(Buchanan) S.W.L. Jacobs & J. Everett*, **comb. nov.**
Basionym: *Stipa petriei* Buchanan, Indigenous Grasses N.Z. t. 17: 2 (1880); Jacobs et al. (1989).

Austrostipa

Vickery et al. (1986) recognised 10 informal groups in what is here described as *Austrostipa*, with a few species belonging to more than one group. Although Everett (1990) produced 23 unequivocal monophyletic groups, these can be rationalised to 13 groups (Fig. 2). Although some of these groups are not well supported by Everett's cladistic analyses, this is mainly because of poor resolution in parts of the cladogram. The cladogram produces a strong congruence with the groups suggested by Vickery et al. (1986), with some groups in that publication split (groups D, H and I), some fully supported (e.g. subgenera *Tuberculatae* and *Petaurista* of this paper, equivalent to groups K and C in Vickery et al. 1986) and others at least not contradicted if not supported (e.g. subgenera *Austrostipa, Lobatae* and *Falcatae* of this paper, equivalent to groups J, G and L in Vickery et al. 1986). We have recognised as subgenera our informal groups (Vickery et al. 1986) except where the cladograms (Everett 1990) supported such groups being split. The groups now split include subg. *Bambusina* being separated from what is here described as subg. *Arbuscula* (both previously group D), subg. *Eremophilae* being separated from what is here described as subg. *Lancea* (both previously group I), and subg. *Aulax* being separated from what is here described as subg. *Ceres* (both previously group H).

The 13 groups we recognise in *Austrostipa* are here formally described as subgenera.

Austrostipa *S.W.L. Jacobs & J. Everett*, **gen. nov.** Ex affinitate *Achnatheri* sed flosculis maturis fuscioribus tenacioribusque, marginis lemmatum plerumque imbricatis, callo grandiore, differt.

Caespitose or spreading, often rhizomatous facultative perennials. Leaves and branches either basal or cauline, sometimes forming intricate shrubby growth. Spikelets superficially all alike, 1-flowered, with the rhachilla not produced beyond the floret, hermaphrodite. Glumes persistent, hyaline to chartaceous, narrow, more

or less keeled, often acute or acuminate, rarely muticous or mucronate, 1–5(–7)-nerved, equal or unequal, usually longer than the floret (excluding awn). Floret disarticulating above the glumes, several times longer than wide, cylindrical, fusiform, pyriform or turbinate, rarely slightly gibbous, with a long, oblique, bearded, usually pungent-pointed (or rarely short and obtuse) callus. Lemma coriaceous, indurated, with convolute (or rarely involute) margins usually enclosing the palea and flower, 3–5(–7)-nerved, tapering at the tip and sometimes, though often only minutely, 1- or 2-lobed, awned from the tip or between the lobes. Awn flexuose or once or twice geniculate, with a twisted column (when mature) and a straight or curved bristle, variously glabrous to plumose. Palea membranous, hyaline or somewhat indurated, nerveless or 2-nerved, subequal to or shorter than the lemma. Lodicules 3 or 2, membranous, glabrous, lanceolate to spathulate, non-vascular. Stamens 3, frequently penicillate. Ovary glabrous; styles 2, free; stigmas plumose, tips exserted. Caryopsis

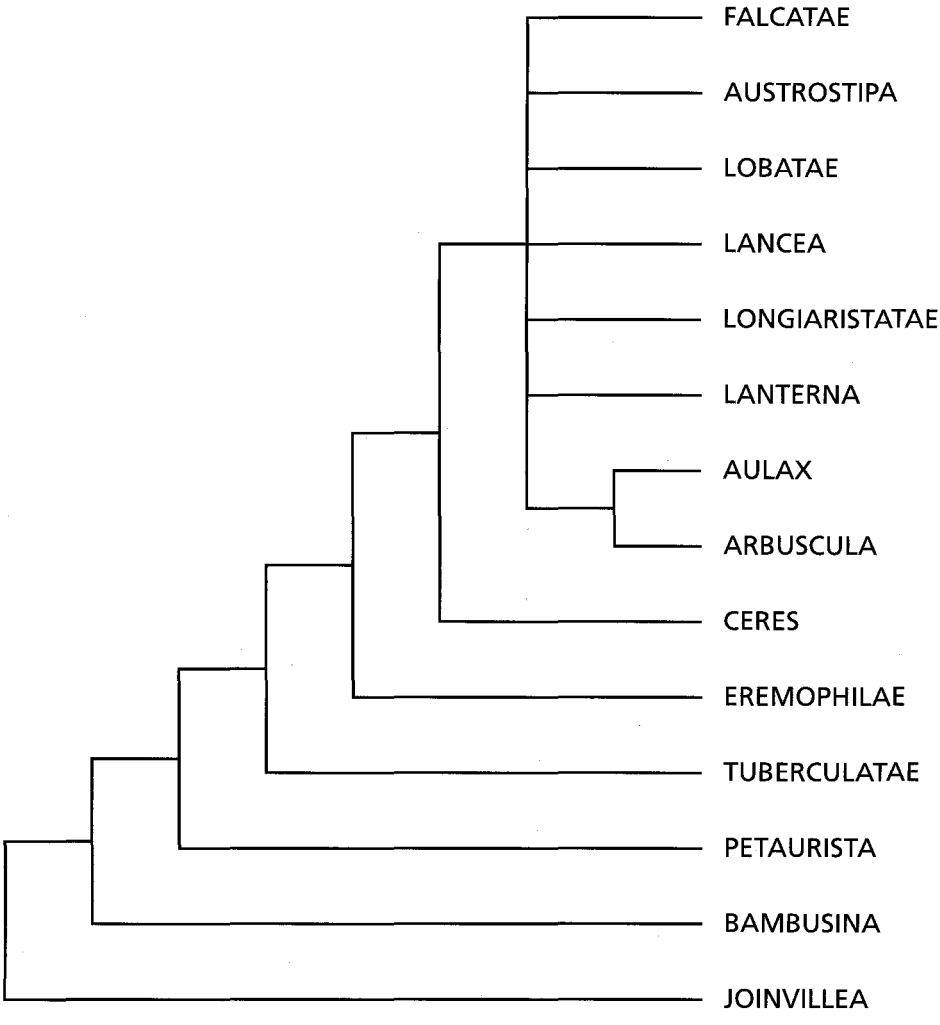

Fig. 2. Relationships of the subgenera of *Austrostipa*, based on a consensus cladogram from Everett (1990) but manually redrawn with some extra characters interpolated, some corrections to character scoring, and some simplification. *Joinvillea* is the outgroup.

fusiform-terete, tightly enclosed by the lemma and palea; the embryo about 20–35% the length of the grain; the hilum linear, nearly as long as the grain.

Type species: *Austrostipa mollis* (R. Br.) S.W.L. Jacobs & J. Everett.

Austrostipa is closest to *Achnatherum* (Barkworth and Everett 1986; Everett 1990; Barkworth 1993) but differs from that genus in having the mature florets generally darker and tougher in texture, the lemma margins overlapping, and the callus longer, tougher and usually more pungent. Not all species of *Austrostipa* have all of these characteristics, but any one species has most of them. *Austrostipa* has very variable lemma epidermal characteristics.

Stipa s. str. is characterised by large (often > 1 cm long) chartaceous spikelets with a long (frequently > 10 cm long) plumose terminal awn and a comparatively short callus, and lemma epidermal silica bodies square, rectangular or, rarely, oval.

Austrostipa acrociliata *(Reader) S.W.L. Jacobs & J. Everett*, **comb. nov.**
Basionym: *Stipa acrociliata* Reader, Victorian Naturalist 13: 167 (1897); Vickery, Jacobs & Everett (1986: 25).

Austrostipa aphylla *(Rodway) S.W.L. Jacobs & J. Everett*, **comb. nov.**
Basionym: *Stipa pubescens* var. *aphylla* Rodway, Tasmanian Fl.: 262 (1903).
Stipa aphylla (Rodway) Townrow (1970: 85); Vickery, Jacobs & Everett (1986: 26–27).

Austrostipa aquarii *(Vickery, S.W.L. Jacobs & J. Everett) S.W.L. Jacobs & J. Everett*, **comb. nov.**
Basionym: *Stipa aquarii* Vickery, S.W.L. Jacobs & J. Everett, Telopea 3: 27–28 (1986).

Austrostipa aristiglumis *(F. Muell.) S.W.L. Jacobs & J. Everett*, **comb. nov.**
Basionym: *Stipa aristiglumis* F. Mueller, Trans. & Proc. Victorian Inst. Advancem. Sci.: 43 (1855); Vickery, Jacobs & Everett (1986: 28–29).

Austrostipa bigeniculata *(Hughes) S.W.L. Jacobs & J. Everett*, **comb. nov.**
Basionym: *Stipa bigeniculata* Hughes, Kew Bull. 1922: 20 (1922); Vickery, Jacobs & Everett (1986: 30–31).

Austrostipa blackii *(C.E. Hubb.) S.W.L. Jacobs & J. Everett*, **comb. nov.**
Basionym: *Stipa blackii* C.E. Hubbard, Kew Bull. 1925: 431 (1925); Vickery, Jacobs & Everett (1986: 32–33).

Austrostipa blakei *(Vickery, S.W.L. Jacobs & J. Everett) S.W.L. Jacobs & J. Everett*, **comb. nov.**
Basionym: *Stipa blakei* Vickery, S.W.L. Jacobs & J. Everett, Telopea 3: 34–35 (1986).

Austrostipa breviglumis *(J.M. Black) S.W.L. Jacobs & J. Everett*, **comb. nov.**
Basionym: *Stipa breviglumis* J.M. Black, Trans. & Proc. Roy. Soc. S. Austral. 65: 33 (1941); Vickery, Jacobs & Everett (1986: 35–36).

Austrostipa campylachne *(Nees) S.W.L. Jacobs& J. Everett*, **comb. nov.**
Basionym: *Stipa campylachne* Nees in Lehmann, Pl. Preiss. 2: 99 (1846); Vickery, Jacobs & Everett (1986: 36–37).

Austrostipa centralis *(Vickery, S.W.L. Jacobs & J. Everett) S.W.L. Jacobs & J. Everett*, **comb. nov.**
Basionym: *Stipa centralis* Vickery, S.W.L. Jacobs & J. Everett, Telopea 3: 39–40 (1986).

Austrostipa compressa *(R. Br.) S.W.L. Jacobs & J. Everett*, **comb. nov.**
Basionym: *Stipa compressa* R. Brown, Prodr.: 175 (1810); Vickery, Jacobs & Everett (1986: 40–41).

Austrostipa crinita *(Gaudich.) S.W.L. Jacobs & J. Everett*, **comb. nov.**
Basionym: *Stipa crinita* Gaudichaud in Freycinet, Voy. Uranie Bot.: 407 (1830); Vickery, Jacobs & Everett (1986: 41–42).

Austrostipa curticoma *(Vickery) S.W.L. Jacobs & J. Everett*, **comb. nov.**
Basionym: *Stipa curticoma* Vickery, Telopea 2: 11 (1980); Vickery, Jacobs & Everett (1986: 42–43).

Austrostipa densiflora *(Hughes) S.W.L. Jacobs & J. Everett*, **comb. nov.**
Basionym: *Stipa densiflora* Hughes, Kew Bull. 1921: 18 (1921); Vickery, Jacobs & Everett (1986: 44–45).

Austrostipa dongicola *(Vickery, S.W.L. Jacobs & J. Everett) S.W.L. Jacobs & J. Everett*, **comb. nov.**
Basionym: *Stipa dongicola* Vickery, S.W.L. Jacobs & J. Everett, Telopea 3: 46 (1986).

Austrostipa drummondii *(Steud.) S.W.L. Jacobs & J. Everett*, **comb. nov.**
Basionym: *Stipa drummondii* Steudel, Syn. Pl. Glum. 1: 128 (1854); Vickery, Jacobs & Everett (1986: 47–48).

Austrostipa echinata *(Vickery, S.W.L. Jacobs & J. Everett) S.W.L. Jacobs & J. Everett*, **comb. nov.**
Basionym: *Stipa echinata* Vickery, S.W.L. Jacobs & J. Everett, Telopea 3: 50 (1986).

Austrostipa elegantissima *(Labill.) S.W.L. Jacobs & J. Everett*, **comb. nov.**
Basionym: *Stipa elegantissima* Labillardiäre, Nov. Holl. Pl. 1: 23 (1804); Vickery, Jacobs & Everett (1986: 51–53).

Austrostipa eremophila *(Reader) S.W.L. Jacobs & J. Everett*, **comb. nov.**
Basionym: *Stipa eremophila* Reader, Victorian Naturalist 17: 154 (1901); Vickery, Jacobs & Everett (1986: 53–55).

Austrostipa exilis *(Vickery) S.W.L. Jacobs & J. Everett*, **comb. nov.**
Basionym: *Stipa exilis* Vickery, Telopea 2: 13 (1980); Vickery, Jacobs & Everett (1986: 56–57).

Austrostipa feresetacea *(Vickery, S.W.L. Jacobs & J. Everett) S.W.L. Jacobs & J. Everett*, **comb. nov.**
Basionym: *Stipa feresetacea* Vickery, S.W.L. Jacobs & J. Everett, Telopea 3: 58 (1986).

Austrostipa flavescens *(Labill.) S.W.L. Jacobs & J. Everett*, **comb. nov.**
Basionym: *Stipa flavescens* Labillardiäre, Nov. Holl. Pl. 1: 24, pl. 30 (1804); Vickery, Jacobs & Everett (1986: 59–61).

Austrostipa geoffreyi *S.W.L. Jacobs & J. Everett*, **sp. nov.** *A. juncifoliae* affinis, sed habitu valde robustiore, vaginis folii latioribus, foliis longioribus, inflorescentia densiore, arista ad 7 cm longa, omnibus partibus floralibus grandioribus, differt.
Holotype: Western Australia: Lake King, 33°05"26'S 119°33"37'E, *S.W.L. Jacobs 7030*, 2.12.1993. Gypsaceous islands connected by causeway. Islands with samphires and *Frankenia*. (NSW 293105; duplicate PERTH).
Caespitose perennial to 1.8 metres tall, with short rhizomes, without a basal tuft of leaves. Culms erect, terete, 2–4 mm wide near the base, + compressible, ribbed about the nodes, glabrous; nodes c. 3, exserted, to twice the width of adjacent internodes. Leaf sheaths loose, moderately ribbed; basal sheath 8–14 mm wide, shortly puberulous with hairs < 0.3 mm long between the ribs; upper sheath 5–10 mm wide, shortly puberulous between the ribs; margins glabrous. Ligule membranous, acute, 6–12 mm long, shortly puberulous with hairs < 0.1 mm long. Leaf blade rolled, 1–2 mm in diameter, to 1 metre long; abaxial surface smooth and glabrous; adaxial surface

densely scaberulous with minute siliceous prickles; margins glabrous. Panicle 30–40 cm long, exserted, with fascicles of unequal, few-flowered compound branches, barely spreading, 3–5 cm wide (excluding awns); axis terete, glabrous; branches to 12 cm long, slightly flattened, the lower 1–2 cm shortly puberulous on the adaxial surface; pedicels 3–13 mm long, terete, glabrous. Spikelets 10–16 mm long (excluding awn). Glumes subequal, acute to acuminate, straw-coloured; lower glume 12–15 mm long, lower 50% 3-nerved; upper glume 12–16 mm long, lower 60% 3-nerved. Floret cylindrical, without a neck, 9–12 mm long (including callus). Lemma smooth, sericeous with white hairs 1–1.5 mm long; lobes 2.5 mm long; coma 3 mm long. Callus 2–3 mm long, weakly bent at the tip; sericeous with white hairs 0.75 mm long. Awn 5–8 cm long, twice bent, 0.25–0.3 mm wide near the base; column 10–20 mm long, 5–10 mm to the first bend, scabrous with hairs 0.1–0.2 mm long; bristle darker than the column, scabrous with hairs 0.1–0.15 mm long. Palea equal to the lemma, 3(–4)-toothed, slightly depressed between the nerves, surface smooth, sericeous along the centre back with hairs 0.5–1.5 mm long, margins glabrous. Lodicules 2, abaxial, membranous, obtuse, 1–2 mm long. Anthers not seen. Immature caryopsis 6 mm long, hilum 75% the length, embryo 50% the length.

Similar to *Stipa juncifolia* but differs in being considerably more robust with wider sheaths, longer leaves, a denser inflorescence, an awn to 7 cm long, and larger in its floral parts.

This species is named after Geoffrey Thomas Jacobs, son of SWLJ, who has helped on many field trips and was present when the Type was collected.

Distribution: Only known from the islands of, and the causeway across, Lake King, a salt lake in southern Western Australia.

Specimens examined: Western Australia: **Roe:** Lake King, *George 10466,* 11.11.1970 (PERTH, NSW); *Jacobs 5854 & P. Wilson,* 11.6.1988 (NSW, UTC).

Vickery et al. (1986) noted that a specimen of *Austrostipa juncifolia* (as *Stipa juncifolia*) from Lake King was considerably more robust than others of the same species even from the same locality. We have since been able to study both taxa in the field and under cultivation. At Lake King, *Austrostipa juncifolia* grows around the lake behind the highest strand line; the more robust *Austrostipa geoffreyi* grows on the islands and along the causeway across the lake — they do not appear to grow as mixed populations. Under cultivation, all of the observed distinctions between the two taxa are maintained, with the additional observation that *A. geoffreyi* is much more difficult to maintain in cultivation than *A. juncifolia.* After collecting more material and examining the taxa in the field and under cultivation we consider that *A. geoffreyi* warrants recognition at the species level.

Austrostipa gibbosa *(Vickery) S.W.L. Jacobs & J. Everett,* **comb. nov.**
Basionym: *Stipa gibbosa* Vickery, Telopea 2: 14 (1980); Vickery, Jacobs & Everett (1986: 62–63).

Austrostipa hemipogon *(Benth.) S.W.L. Jacobs & J. Everett,* **comb. nov.**
Basionym: *Stipa hemipogon* Bentham, Fl. Austral. 7: 569 (1878); Vickery, Jacobs & Everett (1986: 63–65).

Austrostipa juncifolia *(Hughes) S.W.L. Jacobs & J. Everett,* **comb. nov.**
Basionym: *Stipa juncifolia* Hughes, Kew Bull. 1921: 11 (1921); Vickery, Jacobs & Everett (1986: 66–67).

Austrostipa lanata *(Vickery, S.W.L. Jacobs & J. Everett) S.W.L. Jacobs & J. Everett,* **comb. nov.**
Basionym: *Stipa lanata* Vickery, S.W.L. Jacobs & J. Everett, Telopea 3: 68–69 (1986).

Austrostipa macalpinei *(Reader) S.W.L. Jacobs & J. Everett*, **comb. nov.**
Basionym: *Stipa macalpinei* Reader, Victorian Naturalist 15: 143 (1899); Vickery, Jacobs & Everett (1986: 70–71).

Austrostipa metatoris *(J. Everett & S.W.L. Jacobs) S.W.L. Jacobs & J. Everett*, **comb. nov.**
Basionym: *Stipa metatoris* J. Everett & S.W.L. Jacobs, Telopea 2: 399 (1983); Vickery, Jacobs & Everett (1986: 73–74).

Austrostipa mollis *(R. Br.) S.W.L. Jacobs & J. Everett*, **comb. nov.**
Basionym: *Stipa mollis* R. Brown, Prodr.: 174 (1810); Vickery, Jacobs & Everett (1986: 74–75).

Austrostipa muelleri *(Tate) S.W.L. Jacobs & J. Everett*, **comb. nov.**
Basionym: *Stipa muelleri* Tate, Trans. & Proc. Roy. Soc. South Austr. 7: 70 (1885); Vickery, Jacobs & Everett (1986: 77–78).

Austrostipa multispiculis *(J.M. Black) S.W.L. Jacobs & J. Everett*, **comb. nov.**
Basionym: *Stipa multispiculis* J.M. Black, Trans. & Proc. Roy. Soc. South Austr. 65: 333 (1941); Vickery, Jacobs & Everett (1986: 78–79).

Austrostipa mundula *(J.M. Black) S.W.L. Jacobs & J. Everett*, **comb. nov.**
Basionym: *Stipa mundula* J.M. Black, Trans. & Proc. Roy. Soc. South Austr. 65: 333 (1941); Vickery, Jacobs & Everett (1986: 79–80).

Austrostipa nitida *(Summerhayes & C.E. Hubb.) S.W.L. Jacobs & J. Everett*, **comb. nov.**
Basionym: *Stipa nitida* Summerhayes & C.E. Hubbard, Kew Bull. 1927: 80 (1927); Vickery, Jacobs & Everett (1986: 82–84).

Austrostipa nivicola *(J.H. Willis) S.W.L. Jacobs & J. Everett*, **comb. nov.**
Basionym: *Stipa nivicola* J.H. Willis, Victorian Naturalist 73: 149 (1957); Vickery, Jacobs & Everett (1986: 85–86).

Austrostipa nodosa *(S.T. Blake) S.W.L. Jacobs & J. Everett*, **comb. nov.**
Basionym: *Stipa nodosa* S.T. Blake, Proc. Roy. Soc. Queensland 62: 89 (1952); Vickery, Jacobs & Everett (1986: 86–87).

Austrostipa nullarborensis *(Vickery, S.W.L. Jacobs & J. Everett) S.W.L. Jacobs & J. Everett*, **comb. nov.**
Basionym: *Stipa nullarborensis* Vickery, S.W.L. Jacobs & J. Everett, Telopea 3: 88–89 (1986).

Austrostipa nullanulla *(J. Everett & S.W.L. Jacobs) S.W.L. Jacobs & J. Everett*, **comb. nov.**
Basionym: *Stipa nullanulla* J. Everett & S.W.L. Jacobs, Telopea 2: 398 (1983); Vickery, Jacobs & Everett (1986: 89–90).

Austrostipa oligostachya *(Hughes) S.W.L. Jacobs & J. Everett*, **comb. nov.**
Basionym: *Stipa oligostachya* Hughes, Kew Bull. 1921: 12 (1921); Vickery, Jacobs & Everett (1986: 90–91).

Austrostipa petraea *(Vickery) S.W.L. Jacobs & J. Everett*, **comb. nov.**
Basionym: *Stipa petraea* Vickery, Telopea 2: 15 (1980); Vickery, Jacobs & Everett (1986: 91–92).

Austrostipa pilata *(S.W.L Jacobs & J. Everett) S.W.L. Jacobs & J. Everett*, **comb. nov.**
Basionym: *Stipa pilata* S.W.L. Jacobs & J. Everett in Vickery, S.W.L. Jacobs & J. Everett, Telopea 3: 92–93 (1986).

Austrostipa platychaeta *(Hughes) S.W.L. Jacobs & J. Everett*, **comb. nov.**
Basionym: *Stipa platychaeta* Hughes, Kew Bull. 1921: 16 (1921); Vickery, Jacobs & Everett (1986: 93–94).

Austrostipa plumigera *(Hughes) S.W.L. Jacobs & J. Everett*, **comb. nov.**
Basionym: *Stipa plumigera* Hughes, Kew Bull. 1921: 20 (1921); Vickery, Jacobs & Everett (1986: 94–95).

Austrostipa puberula *(Steud.) S.W.L. Jacobs & J. Everett*, **comb. nov.**
Basionym: *Stipa puberula* Steudel, Syn. Pl. Glum. 1: 128 (1854); Vickery, Jacobs & Everett (1986: 95–96).

Austrostipa pubescens *(R. Br.) S.W.L. Jacobs & J. Everett*, **comb. nov.**
Basionym: *Stipa pubescens* R. Brown, Prodr.: 174 (1810); Vickery, Jacobs & Everett (1986: 97–98).

Austrostipa pubinodis *(Trin. & Rupr.) S.W.L. Jacobs & J. Everett*, **comb. nov.**
Basionym: *Stipa pubinodis* Trinius & Ruprecht, Mém. Acad. Imp. Sci. St Pétersbourg, Ser. 6, Sci. Math., Seconde Pt Sci. Nat. 5: 50 (1842); Vickery, Jacobs & Everett (1986: 99–100).

Austrostipa pycnostachya *(Benth.) S.W.L. Jacobs & J. Everett*, **comb. nov.**
Basionym: *Stipa pycnostachya* Bentham, Fl. Austr. 7: 568 (1878); Vickery, Jacobs & Everett (1986: 100–101).

Austrostipa ramosissima *(Trin.) S.W.L. Jacobs & J. Everett*, **comb. nov.**
Basionym: *Urachne ramosissima* Trinius, Gram. Unifl.: 173 (1824).
Synonym: *Stipa ramosissima* (Trinius) Trinius (1830: 74); Vickery, Jacobs & Everett (1986: 101–103).

Austrostipa rudis *(Spreng.) S.W.L. Jacobs & J. Everett*, **comb. nov.**
Basionym: *Stipa rudis* Sprengel, Syst. Veg. Cur. Post. 4: 31 (1827); Vickery, Jacobs & Everett (1986: 103–106).

Austrostipa rudis subspecies **rudis** (autonym)
Synonyms: *Stipa nervosa* var. *neutralis* Vickery (1951: 335).
Stipa rudis subspecies *rudis* (Everett & Jacobs 1983: 396).

Austrostipa rudis subspecies **australis** *(J. Everett & S.W.L. Jacobs) S.W.L. Jacobs & J. Everett*, **comb. nov.**
Basionym: *Stipa rudis* subspecies *australis* J. Everett & S.W.L. Jacobs, Telopea 2: 396 (1983); Vickery, Jacobs & Everett (1986: 105–106).

Austrostipa rudis subspecies **nervosa** *(Vickery) S.W.L. Jacobs & J. Everett*, **comb. nov.**
Basionym: *Stipa nervosa* var. *nervosa* Vickery, Contrib. N.S.W. Natl. Herb. 1: 335 (1951).
Synonym: *Stipa rudis* subspecies *nervosa* (Vickery) J. Everett & S.W.L. Jacobs (1983: 396); Vickery, Jacobs & Everett (1986: 106).

Austrostipa scabra *(Lindl.) S.W.L. Jacobs & J. Everett*, **comb. nov.**
Basionym: *Stipa scabra* Lindley in Mitchell, Journ. Trop. Austr.: 31 (1848); Vickery, Jacobs & Everett (1986: 107–111).

Austrostipa scabra subspecies **scabra** (autonym)
Synonym: *Stipa scabra* subspecies *scabra* (Vickery, Jacobs & Everett 1986: 108–109).

Austrostipa scabra subspecies **falcata** *(Hughes) S.W.L. Jacobs & J. Everett*, **comb. nov.**
Basionym: *Stipa falcata* Hughes, Kew Bull. 1921: 14 (1921).
Synonym: *Stipa scabra* subspecies *falcata* (Hughes) Vickery, S.W.L. Jacobs & J. Everett (1986: 110–111).

Austrostipa semibarbata *(R. Br.) S.W.L. Jacobs & J. Everett*, **comb. nov.**
Basionym: *Stipa semibarbata* R. Brown, Prodr.: 174 (1810); Vickery, Jacobs & Everett (1986: 111–113).

Austrostipa setacea *(R. Br.) S.W.L. Jacobs & J. Everett*, **comb. nov.**
Basionym: *Stipa setacea* R. Brown, Prodr.: 174 (1810); Vickery, Jacobs & Everett (1986: 113–115).

Austrostipa stipoides *(Hook. f.) S.W.L. Jacobs & J. Everett*, **comb. nov.**
Basionym: *Dichelachne stipoides* Hooker f., Fl. Nov.-Zel. 1: 294, t. 66 (1853).
Synonym: *Stipa stipoides* (Hook. f.) Veldkamp (1974: 11); Vickery, Jacobs & Everett (1986: 116–117).

Austrostipa stuposa *(Hughes) S.W.L. Jacobs & J. Everett*, **comb. nov.**
Basionym: *Stipa stuposa* Hughes, Kew Bull. 1921: 20 (1921); Vickery, Jacobs & Everett (1986: 117–118).

Austrostipa tenuifolia *(Steud.) S.W.L. Jacobs & J. Everett*, **comb. nov.**
Basionym: *Stipa tenuifolia* Steudel, Syn. Pl. Glum. 1: 128 (1854); Vickery, Jacobs & Everett (1986: 119–120).

Austrostipa trichophylla *(Benth.) S.W.L. Jacobs & J. Everett*, **comb. nov.**
Basionym: *Stipa trichophylla* Bentham, Fl. Austr. 7: 570 (1878); Vickery, Jacobs & Everett (1986: 121–122).

Austrostipa tuckeri *(F. Muell.) S.W.L. Jacobs & J. Everett*, **comb. nov.**
Basionym: *Stipa tuckeri* F. Mueller, Fragm. 9: 129 (1881); Vickery, Jacobs & Everett (1986: 123).

Austrostipa variabilis *(Hughes) S.W.L. Jacobs & J. Everett*, **comb. nov.**
Basionym: *Stipa variabilis* Hughes, Kew Bull. 1921: 15 (1921); Vickery, Jacobs & Everett (1986: 124–125).

Austrostipa velutina *(Vickery, S.W.L. Jacobs & J. Everett) S.W.L. Jacobs & J. Everett*, **comb. nov.**
Basionym: *Stipa velutina* Vickery, S.W.L. Jacobs & J. Everett, Telopea 3: 126 (1986).

Austrostipa verticillata *(Nees ex Spreng.) S.W.L. Jacobs & J. Everett*, **comb. nov.**
Basionym: *Stipa verticillata* Nees ex Sprengel, Syst. Veg. Cur. Post. 4: 30 (1827); Vickery, Jacobs & Everett (1986: 127–128).

Austrostipa vickeryana *(J. Everett & S.W.L. Jacobs) S.W.L. Jacobs & J. Everett*, **comb. nov.**
Basionym: *Stipa vickeryana* J. Everett & S.W.L. Jacobs, Telopea 2: 397 (1983); Vickery, Jacobs & Everett (1986: 128–129).

Austrostipa wakoolica *(Vickery, S.W.L. Jacobs & J. Everett) S.W.L. Jacobs & J. Everett*, **comb. nov.**
Basionym: *Stipa wakoolica* Vickery, S.W.L. Jacobs & J. Everett, Telopea 3: 129–130 (1986).

Key to the subgenera

1 Plants branched at the nodes, often almost shrubby 2

1* Plants caespitose, culms only branched in the inflorescence 4

2 The whole panicle acting as the diaspore, wind-dispersed; panicle branches plumose ..... **subgen. Petaurista**

2* The floret acting as the diaspore; panicle branches scabrous or glabrous 3

3 Culms with simple branches; spikelets mostly > 4 mm long ..... **subgen. Arbuscula**

3* Culms with whorled branches; spikelets < 4 mm long ..... **subgen. Bambusina**

4 Lemma glabrous for varying distances below the apex 5

4* Lemma hairy all over, though hairs may be of different lengths 6

5 The lemma glabrous or almost so, the surface shining ..... **subgen. Lanterna**

5* Lemma glabrous only in the top half, the glabrous portion rough, tuberculate or 'crystalline' (with individual small bumps or ridges of translucent silica) ..... **subgen. Tuberculatae**

6 Lemma with 2 membranous lobes usually > 1 mm long ..... **subgen. Lobatae**

6* Lemma with 0–1 lobes or, if 2 present, then < 1 mm long 7

7 Bristle of the awn falcate; lemma narrow, often evenly covered with comparatively sparse, short, white hairs ..... **subgen. Falcatae**

7* Bristle usually straight or only slightly curved, if falcate then the lemma not evenly covered with comparatively sparse, short, white hairs 8

8 Column of the awn plumose or long-pubescent; lemma never covered with brown hairs ..... **subgen. Austrostipa**

8* Column of the awn scabrous or glabrous, if plumose then the mature lemma covered with brown hairs 9

9 Palea with an adaxial groove, the lemma margins fitting into the groove and not overlapping ..... **subgen. Aulax**

9* Palea entire; lemma margins overlapping 10

10 Glumes broad and inflated around the floret; lemma with a coma and a short callus at an angle to the long axis of the floret; panicle usually open and spreading ..... **subgen. Ceres**

10* Glumes narrow, close around the floret; lemma usually with a coma and a long, fine, straight callus aligned with the long axis of the floret; panicle often contracted with short branches 11

11 Plants perennial but with very short and narrow leaves in a small tussock, inflorescence many times longer than these small basal leaves (often missing from specimens) and often mistaken as being from annual plants; awns usually > 7 cm long ..... **subgen. Longiaristatae**

11* Plants perennial and caespitose, the inflorescence never more than 2–3 times as long as the basal leaves (unless grazed); awns usually < 7 cm long 12

12 Lemma hairs often becoming dark reddish brown at maturity; sometimes a patch of shorter hairs present below the apex; awn comparatively long; more commonly plants of inland red sandy or rocky soils ..... **subgen. Eremophilae**

12* Lemma hairs unchanging or becoming yellow at maturity, but never dark reddish brown; patches of shorter hairs never present; awn comparatively short; more commonly plants near the coast or on light-coloured sandy soils ..... **subgen. Lancea**

Austrostipa subgenus **Austrostipa** (autonym)

A. mollis (Type), *A. hemipogon, A. densiflora, A. campylachne, A. stuposa, A. semibarbata, A. aquarii.*

Column of the awn plumose or long-pubescent. Lemma usually without a coma.

Austrostipa subgenus **Arbuscula** S.W.L. Jacobs & J. Everett, **subgen.nov.**

A. acrociliata (Type), *A. breviglumis, A. nullarborensis, A. platychaeta, A. pycnostachya.*

Culmi plerumque ramosi sed ramis non verticillatis. Ligula folii longa. Paniculae grandes, sparsae, effusae.

Culms usually branched though the branches not whorled. Leaves with long ligules. Panicles large, sparse and spreading.

The epithet is Latin for small tree or shrub in reference to the shrubby growth form of these species.

Austrostipa subgenus **Longiaristatae** S.W.L. Jacobs & J. Everett, **subgen. nov.**

A. compressa (Type), *A. macalpinei.*

Caespites minutos perennesque formans, culmis florentibus grandis quotannis praesentibus. Lemma pallidum, arista longa paene recta.

Forming minute perennial tufts with large flowering culms produced annually. Lemma pale with a long, almost straight awn.

The epithet refers to the long awns characteristic of these species.

Austrostipa subgenus **Aulax** S.W.L. Jacobs & J. Everett, **subgen. nov.**

A. setacea (Type), *A. feresetacea.*

Palea adaxialiter profunde sulcata. Ligula folii longa (ad 2 mm).

Palea with a deep adaxial groove. Ligule long (> 2 mm).

The epithet is Latin for 'furrow' or 'groove', referring to the adaxial groove on the palea.

Austrostipa subgenus **Lanterna** S.W.L. Jacobs & J. Everett, **subgen. nov.**

A. nullanulla (Type), *A. lanata, A. vickeryana.*

Lemma superficie nitenti, glabra vel subglabra.

Lemma with a shiny surface, glabrous or almost so.

The epithet is from Latin 'lanterna', a lantern or lamp, referring to the bright, shining surface of the lemma.

Austrostipa subgenus **Lancea** S.W.L. Jacobs & J. Everett, **subgen. nov.**

A. flavescens (Type), *A. exilis, A. mundula, A. echinata, A. velutina, A. multispiculis, A. crinita.*

Glumae angustae, circa flosculum confertae. Coma lemmatis praesens; callus lemmatis longus, gracilis rectusque. Panicula saepe contracta, ramis brevibus.

Glumes narrow, close around the floret. Lemma with a coma and a long, fine and straight callus. Panicle often contracted, with short branches.The epithet is Latin for 'small lance', referring to the shape of the floret.

Austrostipa subgenus **Lobatae** S.W.L. Jacobs & J. Everett, **subgen. nov.**

A. juncifolia (Type), *A. geoffreyi, A. stipoides, A. petraea.*

Lemma ad apicem lobis longis acutisque.

Lemma with long, acute lobes at the apex. The epithet refers to the long lobes at the lemma apex characterising these species.

Austrostipa subgenus **Tuberculatae** S.W.L. Jacobs & J. Everett, **subgen. nov.**

A. rudis (Type), *A. aphylla, A. oligostachya, A. pubescens, A. pubinodis, A. nivicola, A. muelleri.*

Lemma versus apicem plusminusve glabrum, superficie scabra vel tuberculata. Glumae valde costatae.

Lemma glabrous for varying lengths below the apex, the surface rough ('crystalline' — with clear small lumps or ridges of translucent silica — or tuberculate). Glumes strongly ribbed.

The epithet refers to the tuberculate surface of the upper lemma characteristic of this group of species.

Austrostipa subgenus **Falcatae** S.W.L. Jacobs & J. Everett, **subgen. nov.**

A. nitida (Type), *A. nodosa, A. scabra, A. variabilis, A. trichophylla, A. blakei, A. drummondii, A. tenuifolia, A. pilata.*

Arista falcata. Lemma angustum aciculareque.

Bristle of awn falcate. Lemma narrow and needle-like.

The epithet has been used informally for a long time (e.g. Hughes 1922) and refers to the sickle-shaped bristle of the awn.

Austrostipa subgenus **Ceres** S.W.L. Jacobs & J. Everett, **subgen. nov.**

A. gibbosa (Type), *A. aristiglumis, A. curticoma, A. bigeniculata, A. blackii, A. dongicola.*

Glumae latae, circum flosculum dilatatae. Coma lemmatis praesens; callus lemmatis valde angulatus brevisque. Panicula effusa, ramis longis.

Glumes broad and inflated around the floret. Lemma with a coma and a short, strongly angled callus. Panicle expanded with long branches.

The epithet is a name for the Roman goddess of grain and agriculture and refers to both the almost Oat-like appearance of the broad glumes and the high ranking many of the species in this group are given as pasture species.

Austrostipa subgenus **Eremophilae** S.W.L. Jacobs & J. Everett, **subgen. nov.**

A. eremophila (Type), *A. metatoris, A. wakoolica, A. puberula, A. plumigera, A. centralis.*Coma lemmatis praesens; pili lemmatis ad maturitatem saepe fuscescentes. Arista longa.

Lemmas with a coma. The lemma hairs often darkening at maturity. Awn long.

The epithet is derived from the name of one of the species which in turn is Latinised Greek usually translated as being desert- or wilderness-loving.

Austrostipa subgenus **Petaurista** S.W.L. Jacobs & J. Everett, **subgen. nov.**

A. elegantissima (Type), *A. tuckeri.*

Panicula grandis pyramidalisque vice diasporae fungens. Culmi ramosi sed ramis non verticillatis. Lemma palea minimum 2-plo longius.

Panicle large and pyramidal, acting as the diaspore. Panicle branches plumose. Culms branched but the branches not whorled. Palea less than half the length of the lemma.

The epithet is Latin for 'tumbler' or 'vaulter', referring to the wind-dispersed inflorescence.

Austrostipa subgenus **Bambusina** S.W.L. Jacobs & J. Everett, **subgen. nov.**

A. verticillata (Type), *A. ramosissima*.Culmi ramis verticillatis. Flosculi parvi (minus quam 4 mm).

Culms with whorled branches. Florets small (< 4 mm long).

The epithet is a Latinised diminutive of the Malay word 'bambu', referring to the resemblance of plants of the two species to small clumps of bamboo.

Nassella

Nassella Desvaux in Gay (1854: 263); Barkworth (1990, 1993).

Nassella hyalina *(Nees) Barkworth* (1990: 610).
Basionym: *Stipa hyalina* Nees (1829: 378); Vickery, Jacobs & Everett (1986: 66).

Nassella leucotricha *(Trin. & Rupr.) Pohl* in Barkworth (1990: 610). Barkworth (pers. comm.) states that this should be cited as 'Pohl in Barkworth' even though she mistakenly stated on p. 608 that only two new combinations were being made by Pohl instead of the three made.
Basionym: *Stipa leucotricha* Trinius & Ruprecht (1842: 54); Vickery, Jacobs & Everett (1986: 69–70).

Nassella megapotamia *(Spreng. ex Trin.) Barkworth* (1990: 610–611).
Basionym: *Stipa megapotamia* Spreng. ex Trinius (1830: 77); Vickery, Jacobs & Everett (1986: 72–73).

Nassella neesiana *(Trin. & Rupr.) Barkworth* (1990: 611).
Basionym: *Stipa neesiana* Trinius & Ruprecht (1842: 27); Vickery, Jacobs & Everett (1986: 81).

Nassella trichotoma *(Nees) Hack. ex Arechavaleta* (1895: 276).
Basionym: *Stipa trichotoma* Nees (1829: 375); Vickery & Jacobs (1980: 21–23).

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