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Revision of the tropical genus *Diplacrum* (Cyperaceae: Bisboeckelereae) in Australia

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ABSTRACT

Two new dwarf species of *Diplacrum* are described from tropical Australia: *Diplacrum blakei* K.L.Wilson & R.L.Barrett and *D. latzii* K.L.Wilson & R.L.Barrett. *Diplacrum* is the only genus in Cyperaceae tribe Bisboeckelereae occurring in Australia. Historically, it has been confused with *Scleria* (Tribe Sclerieae). Descriptions are provided for all four Australian species, as well as a generic description and a key to Australian and three additional Malesian and South-East Asian species. Brief comments are made about the species in Africa, the tropical Americas and India.

Keywords: Africa, Malesia, *Naikia*, Northern Territory, Papua New Guinea, plant taxonomy, *Pteroscleria*, Queensland, *Scleria*, sedges, *Sphaeropus*, systematics, tropical Americas, Western Australia.

Introduction

Brown (1810) described a dwarf sedge collected by Banks and Solander from Endeavour River in northern Queensland as *Scleria pygmaea* R.Br. In the same work, he described a morphologically similar sedge, also collected by Banks and Solander from Endeavour River, as *Diplacrum caricinum* R.Br. Brown (1810) placed *D. caricinum* in its own genus on the basis of the unique role played by the two glumes around the nutlet in that species, namely that they tightly enclose the nutlet and fall as a unit at maturity. Brown misinterpreted the two glumes as a perianth. In *S. pygmaea*, the glumes remain on the axis and the nutlet falls freely, as in species of *Scleria* generally. However, *S. pygmaea* has its own distinctive feature: the apex of the peduncle under the female spikelet is strongly expanded at maturity, ultimately being often cup-like around the base of the female spikelet. This led Boeckeler (1873) to place this species in its own genus *Sphaeropus* Boeckeler as *Sphaeropus pygmaeus* Boeckeler (he did not refer to Brown's work or to Banks and Solander's collections, so this is regarded as an independent description). Subsequent authors have varied between regarding *Diplacrum* and *Sphaeropus* as distinct genera (Blake 1954; Napper 1964, 1971; Koyama 1979*a*, 1979*b*; Goetghebeur 1986, 1998; Bruhl 1995; Simpson and Koyama 1998; Chandramohan 2016; Simpson 2019) or including them in *Scleria* (Kern 1974; Rye 1992; Dey and Prasaana 2015).

Blake (1954) distinguished *Diplacrum* from *Scleria* on various features, notably that male spikelets are below the female in the former and above in the latter, and the female spikelets have only two glumes in the former whereas *Scleria* has 3–6 sterile glumes below the flower and usually one or more reduced glumes above. He regarded it as restricted to 'about five small species of the Old World Tropics' (Blake 1954, p. 234), namely *D. africanum* (Benth.) C.B.Clarke (in tropical Africa, Madagascar, southern India and an isolated occurrence in Suriname, which may be introduced), the widespread *D. caricinum* (India to Japan, Malesia, Australia), *D. pygmaeum* (R.Br.) Nees ex Boeckeler (Australia), *D. reticulatum* Holttum (Bangladesh to Hainan, China, and Peninsular Malaysia), and an undescribed Australian species (which is here formally described as *D. blakei*).

Blake (1954) regarded the tropical American and West Tropical African species previously referred to *Diplacrum*, namely *D. capitatum* (Willd.) Boeckeler, *D. guianense* (Nees) T.Koyama and *D. mitracarpoides* (Standl. & L.O.Williams) C.D.Adams, as belonging to *Pteroscleria* Nees, based on their glumes having a prominently winged keel (otherwise

nearly nerveless) and their leaves differing in shape along the length of the culm, and despite the spikelet and other glume features mentioned above agreeing with those of *Diplacrum*. These species are here tentatively regarded as belonging in *Diplacrum*. Further investigation of whether these somewhat larger species belong in *Diplacrum*, perhaps as a subgenus, or would be better recognised as the genus *Pteroscleria*, is outside the scope of this study.

The history of these taxa was discussed in detail by Kern (1961*a*), who treated *Diplacrum* and *Sphaeropus* as separate sections in *Scleria* (Kern 1961*a*, 1974), even though he recognised that this could be an artificial distinction. He described *Scleria pygmaeopsis* J.Kern from Indonesia (Kern 1961*a*) and included it in section *Sphaeropus*.

Napper (1964, 1971) and Koyama (1967) recognised *Diplacrum* as a separate genus. Meert and Goetghebeur (1979), Goetghebeur (1986, 1998) and Bruhl (1995) did likewise, considering that it should be placed in tribe Bisboeckelereae rather than in Sclerieae. These tribes differ in their inflorescence structure (Eiten 1976), as well as in other morphological features such as embryo type (Meert and Goetghebeur 1979; Semmouri *et al*. 2019). Recent molecular studies (Simpson *et al*. 2007; Muasya *et al*. 2009; Bauters *et al*. 2016; Larridon *et al*. 2021) have confirmed that *Diplacrum* and *Scleria* are distinct and do belong to different tribes: *Diplacrum* to tribe Bisboeckelereae and *Scleria* to Sclerieae (Larridon 2022). However, sampling in molecular studies of Bisboeckelereae, and in particular *Diplacrum sens. lat.*, has been limited, including only *D. caricinum* (the type species) in Bauters *et al.* (2016), *D. africanum, D. capitatum* and *D. caricinum* in Semmouri *et al.* (2019), and *D. africanum* and *D. caricinum* in Larridon *et al.* (2021). More comprehensive sampling that includes the American species is needed to understand both generic and infrageneric relationships.

Semmouri *et al*. (2019) recovered *Diplacrum* as monophyletic based on sampling three species, but two species of *Becquerelia* Brongn. were successively sister to the three *Diplacrum* species. As *Diplacrum* is so widely dispersed, yet poorly known, we provide a full table of currently recognised species and references to existing descriptions, to facilitate preparation of a monograph of the genus (Table 1). In addition to the species discussed above, an annual species of Cyperaceae from southern India has been described as a new genus and species, *Naikia kernii* Wad.Khan, Bhuskute & Kahalkar (Wadoodkhan 2014). Floral structures ally *Naikia* Wad.Khan, Bhuskute & Kahalkar most closely to *Diplacrum*, because the female flower is surrounded by only two empty glumes and is not enclosed by an utriculiform glume (Wadoodkhan 2014). However, this species is unusual in having a bifid style and corresponding two-angled nutlets. Within tribe Bisboeckelereae, this character state is otherwise known only in *Calyptrocarya* Nees, which includes species with two- or three-branched styles, which are deeply divided, in contrast to *Diplacrum* (Goetghebeur 1998). In *Calyptrocarya*, most species are perennial, but *C. montesii* Davidse & Kral from Venezuela is apparently an annual (Davidse and Kral 1988).

Naikia differs from all *Diplacrum* species by the following characters: spikelets with a swollen peduncle bearing two stiff, persistent lobes approximately half the length of the nutlet; two caducous glumes that leave the nutlet exposed to eventually fall from the peduncle; a prominent awn on the glumes almost as long as the glume; bifid style; and biconvex nutlets with a distinct marginal ridge (Wadoodkhan 2014). Placement of this species within Bisboeckelereae is probably best left until molecular data can be generated, but it would not be surprising if it turns out to be embedded within *Diplacrum*, and quite possibly related to *D. africanum* or *D. caricinum*, which are both small, leafy annuals with similar habits, although it is noted that the smooth, shiny nutlets of *Naikia* are perhaps more similar to the taxon described here as *D. latzii* K.L.Wilson & R.L.Barrett.

In *Diplacrum reticulatum* and *D. poklei* Wad.Khan, Bhuskute & Kahalkar, the glumes and nutlet fall as a unit as in *D. caricinum* (Holttum 1947; Chandramohan 2016), whereas all of the other species in *Diplacrum* behave like *D. pygmaeum*, with the nutlet falling from the persistent glumes, and with the apex of the peduncle often strongly thickened and cup-like, illustrated for *D. africanum* by Clarke (1909, t. 134, fig. 2) and for *D. pygmaeopsis* by Kern (1961*a*, fig. 9b, c [as *Scleria pygmaeopsis*]).

Extensive collecting in northern Australia by Stan Blake, Peter Latz, and, more recently, the present authors and others has found another two species of *Diplacrum*, which are here described. We also provide a generic description and a key to the species in Australia and the neighbouring regions of Malesia and South-East Asia.

Materials and methods

Our study is based on examination of the Australian species in the field, as well as specimens of these and other *Diplacrum* spp. in the following herbaria: BM, BRI, CANB, DNA, K, MEL, NSW, NT, PERTH, P. Morphological descriptions were prepared mainly from specimens at NSW and material on loan from DNA and NT. Specimens cited have been seen unless indicated as '*n.v.*' (*non vidi*, not seen).

Taxonomy

Diplacrum R.Br., *Prodr.* 240 (1810)

Scleria sect. *Diplacrum* (R.Br.) Kern, *Blumea* 11(1): 208 (1961). *Type*: *D. caricinum* R.Br.

Pteroscleria Nees, in C.F.P. von Martius, *Fl. Bras.* 2(1): 196 (1842). *Type*: *P. guianensis* Nees.

Sphaeropus Boeckeler, *Flora* 56: 89 (1873); *Scleria* sect. *Sphaeropus* (Boeckeler) J.Kern, *Blumea* 11(1): 208 (1961). *Type*: *S. pygmaeus* Boeckeler.

Table 1. Currently recognised species of *Diplacrum*.

Current name	Distribution	Descriptions
D. africanum (Benth.) C.B.Clarke	Tropical Africa, Madagascar, southern India, and in Suriname (possibly introduced; see Koyama and Oldenburger 1971)	Napper (1964)*, Haines and Lye (1983)*, Prasad and Singh (2002)*, Samain and Goetghebeur (2006), Hoenselaar *et al.* (2010)*, Dey and Prasaana (2015), Browning and Goetghebeur (2017)*, Browning *et al.* (2020)*, Lebrun and Stork (2020)
D. blakei K.L.Wilson & R.L.Barrett	Northern Australia	This paper*
D. capitatum (Willd.) Boeckeler	Tropical Americas, western and western–central tropical Africa	Adams (1972), Koyama (1979*b*)*, Kearns (1998)*, Gómez-Laurito (2003), Lye and Thery (2012)*, Mesterházy (2012)*, Lebrun and Stork (2020)
D. caricinum R.Br.	India and Sri Lanka to Japan, Malesia and Australia	Kern (1961*a*, 1974)*, Walker (1976), Koyama (1964, 1985), Hô (1993), Noltie (1994)*, Simpson and Koyama (1998)*, Koyama *et al.* (2000), Prasad and Singh (2002)*, Zhang *et al.* (2010)*, Dey and Prasaana (2015), Simpson (2019)*, this paper*
D. exiguum (J.Kern) T.Koyama	Vietnam	Kern (1962)*
D. guianense (Nees) T.Koyama	Northern South America	Maguire (1967), Kearns (1998)*
D. latzii K.L.Wilson & R.L.Barrett	Northern Australia	This paper*
D. mitracarpoides (Standley & L.O.Williams) C.D.Adams	Honduras	Standley and Williams (1952), Adams (1994)
D. poklei (Wad.Khan) K.C.Mohan	Southern India	Wadoodkhan *et al.* (2007), Wadoodkhan (1999, 2014)*, Dey and Prasaana (2015)*, Chandramohan *et al.* (2016, 2020)*
D. pygmaeopsis (Kern) T.Koyama	Indonesia (Lesser Sunda Islands)	Kern (1961*a*, 1974)*
D. pygmaeum (R.Br.) Nees ex Boeckeler	Northern Australia	Kern (1961*a*)*, Rye (1992), this paper*
D. reticulatum Holtt.	Bangladesh to Hainan and Peninsular Malaysia	Holttum (1947)*, Zhang *et al.* (2010)

Note that species listed here are commonly treated under *Scleria* in the references cited. Asterisks (*) indicate that illustrations are included.

Small or dwarf annuals with reddish roots (rarely slender stoloniferous perennials). *Culms* tufted. *Leaves* basal and cauline, flat, without a ligule or contraligule. *Inflorescence* capitate, or branched with several small, dense clusters of spikelets, or spikelet clusters axillary at the remote nodes of a more elongated inflorescence axis. Primary involucral bracts leaf-like. Lateral spikelets in a cluster male, 0–2; terminal spikelet female. Male spikelets with 1 persistent glume, each subtending 1 male flower; stamen 1(3). Female spikelets on a peduncle usually thickened at the apex at maturity, often strongly so and disc- or cup-like; glumes 2, distichous, keeled or not, persistent or deciduous with the fruit, encircling a (?)pseudo-terminal female flower; style 3-fid; style base deciduous, not thickened. *Disc* usually triangular, adhering to nutlet, usually paler. *Nutlet* sub-globose to ovoid or narrow–obovoid, terete to trigonous in cross-section, inconspicuously 3-angled, surface glabrous or sparsely puberulous near the apex, otherwise smooth or longitudinally ribbed or reticulate, falling freely or enclosed by the persistent, thickened glumes.

This description covers the features of *Diplacrum sens. strict.* as well as the three species sometimes referred to the genus *Pteroscleria* (see discussion above). The features of the latter are given in parentheses where they differ from those of the former.

Key to *Diplacrum* species in Australia, Malesia and South-East Asia

1. Nutlet globose to ovoid.....2
Nutlet narrow–ellipsoid to narrow–ovoid or narrow–obovoid.....5
2. Glumes tightly clasping nutlet and falling as a unit.....3
Glumes not tightly clasping nutlet, remaining on spikelet axis after nutlet falls.....4
3. Glume of female spikelet with several prominent nerves, apex 3-lobed; nutlets globose to broad–ovoid, irregularly longitudinally ridged.....*D. caricinum*
Glumes of female spikelet with only mid-nerve prominent, apex acute, not lobed; nutlets depressed–globose, irregularly reticulate.....*D. reticulatum*
4. Glumes with awn 0.8–1.2 mm long; nutlet with 3 basal swellings adjacent to disc.....*D. pygmaeum*
Glumes without an awn; nutlet lacking basal swellings.....*D. pygmaeopsis*
5. Nutlet prominently ribbed longitudinally.....6
Nutlet more or less 3-angled but without prominent ribs.....*D. latzii*

6. Nutlet 3-ribbed; leaves shorter than inflorescences; leaf blades 1.0–1.5 mm wide .....*D. exiguum*
Nutlet 9–12-ribbed (some not complete); leaves exceeding inflorescences (up to 2.5 times as long); leaf blades 0.3–0.7 mm wide.....
.....*D. blakei*

Diplacrum in Australia

Three species in Australia are apparently endemic (Fig. 1), with only *Diplacrum caricinum* occurring more widely from Malesia to Japan, the Pacific, and India. *Diplacrum exiguum* (J.Kern) T.Koyama from Vietnam and *D. pygmaeopsis* from the Lesser Sunda Islands are not known from Australia, and we have seen no specimens of them. It is quite likely that the latter will be found in Australia, given the similarity of some habitats and the occurrence of many other sedge species in both of these regions.

Two or more of these tiny annual species may occur together, as shown by various mixed collections. They commonly grow in dense swards with other annual sedges on the damp margins of water-bodies.

Stamens are not obvious on most herbarium specimens because specimens tend to be collected when in fruit, at which stage the anthers have dropped and the male spikelets have withered, compressed by the expanding female spikelet above them, as noted by Bentham (1878) for *D. pygmaeum*.

Diplacrum blakei K.L.Wilson et R.L.Barrett, sp. nov.

Type: Northern Territory: Kimberley Park Estate, ~1.5 km NNE of Elizabeth River bridge on Stuart Highway, 1 May 1983, *K.L. Wilson 5055* (holo NSW 2314184; iso DNA D0024243, H, K, P).

Scleria sp. C B.L. Rye in J.R. Wheeler (ed.) *Fl. Kimberley Region* 1107 (1992)

Scleria sp. McMinns Lagoon (M.M.J. van Balgooy 1272) P.S. Short, D.E. Albrecht, I.D. Cowie, D.L. Lewis & B.M. Stuckey (eds), *Checkl. Vasc. Pl. N. Terr.* 28 (2011).

Diagnosis

Nutlets narrow–ellipsoid to narrow–obovoid, with 3 main longitudinal ribs and 3–5 longitudinal ridges between them (not all complete, often more slender and slightly paler in colour), glabrous, glossy; female glumes 1.4–1.8 mm long, including excurved awn 0.4–0.7 mm long; leaves often much exceeding the inflorescence (up to ~2.5 times as long).

Dwarf herbaceous annual, glabrous, 1–6 cm high, with reddish fibrous roots. *Culms* tufted, more or less erect or spreading. *Leaves* longer than inflorescences (up to ~2.5 times as long); leaf blades flat, glabrous, margins with sparse, minute, antrorsely aculeate prickle hairs towards apex, 0.3–0.7 mm wide at mid-length, with mid-nerve and 2 lateral nerves prominent on both adaxial and abaxial surfaces; no ligule or contraligule (top of leaf sheath opposite the junction with the blade truncate, not thickened); sheaths green turning straw-coloured with age, occasionally with reddish tinges. *Inflorescence* approximately the same length as or longer than the culms, composed of several (3 or 4) axillary clusters of spikelets more or less adjacent because of short internodes or occasionally the internodes to 5 mm long and the clusters more distant; each cluster usually with 1 or 2 basal male spikelets and an upper female spikelet. *Involucral bract* at each node leaf-like, usually much longer than inflorescence. *Male spikelets* 0.5–0.7 mm long, with 1 slender, more or less hyaline glume 0.5–0.7 mm long, not or scarcely indurated at maturity and reddish-brown; stamen 1; anther 0.2–0.3 mm long, with apical appendage <0.1 mm long. *Female spikelets* 1.3–1.8 mm long, with 2 glumes encircling the ovary but not tightly clasping the nutlet; peduncle somewhat thickened at apex but rarely cup-like (much less obvious than in *D. pygmaeum*); glumes narrow–elliptical with apex broad–acute to obtuse, green becoming straw-coloured with age, with scattered minute red dots, with narrow hyaline margins, 1.4–1.8 mm long including excurved awn 0.4–0.7 mm long, nearly as long as the body of the glume, strongly 3-nerved. *Disc* triquetrous, white, slightly enlarged at the 3 corners, coinciding with the white thickened base of the 3 ribs of the nutlet, adhering to nutlet. *Style* 3-fid. *Nutlet* narrow–ellipsoid to narrow–obovoid, trigonous in cross-section, with 3 main longitudinal ribs and 3–5 longitudinal ridges between them (not all complete, often more slender and slightly paler in colour), glabrous, glossy, dark purplish brown at maturity, 0.4–0.7 mm long, 0.3–0.4 mm in diameter (Fig. 2).

Distribution and habitat

In tropical Queensland, Northern Territory and Western Australia (Fig. 1*b*). Commonly grows with *D. caricinum, D. latzii, D. pygmaeum* and other annual sedges on the margins of wet areas (swamps and streams).

Conservation status

Widespread, including in national parks, so not considered at risk. We suggest a status of 'Least Concern' (International Union for Conservation of Nature 2019).

Etymology

Named after the eminent Australian cyperologist Dr Stanley Thatcher Blake (1911–1973).

Notes

This is a dwarf sedge like *D. latzii* and *D. pygmaeum*, differing most obviously in having longer leaves that exceed the inflorescence (up to ~2.5 times as long), whereas the other

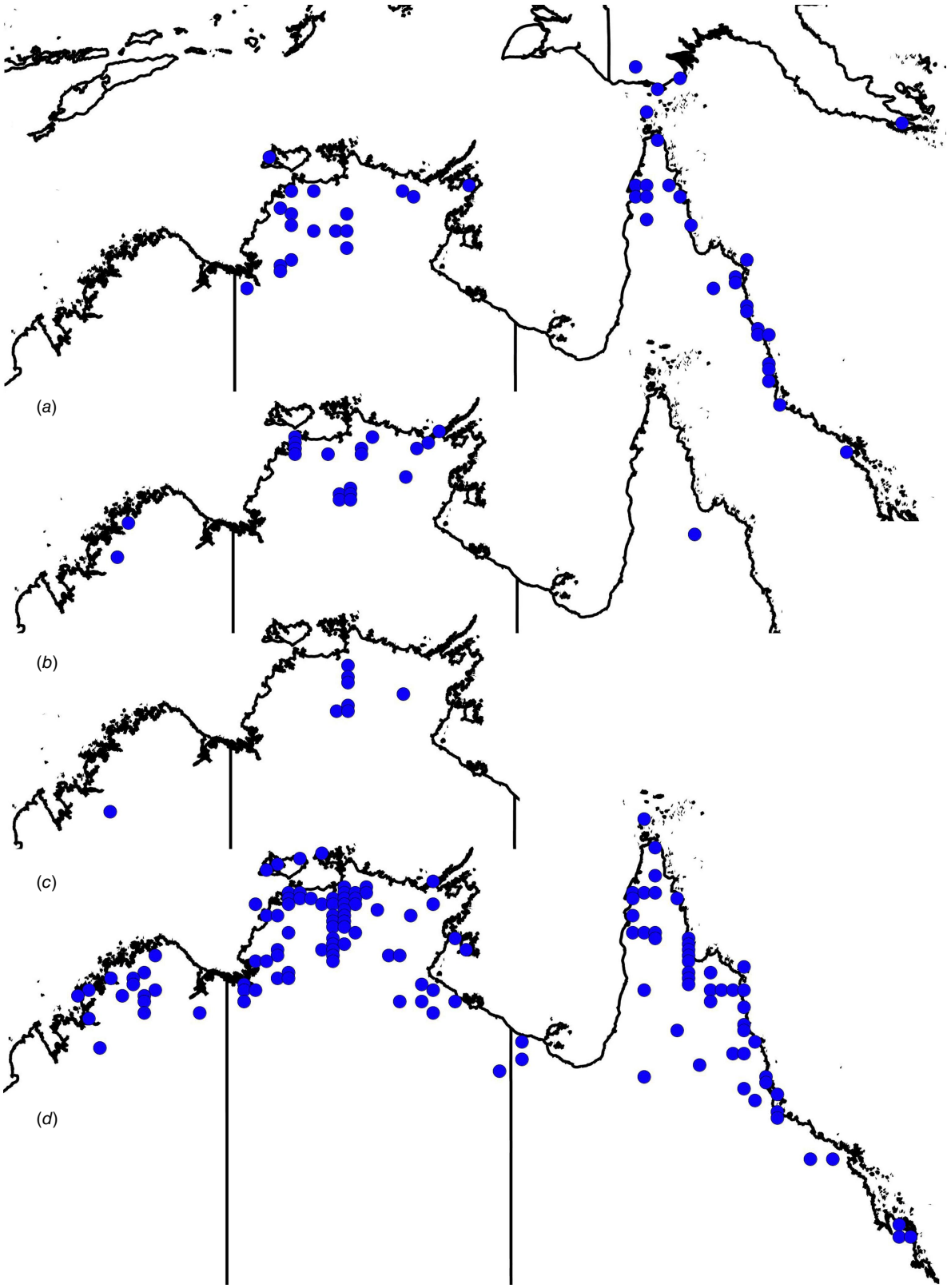

Fig. 1. Distribution of *Diplacrum* species in Australia and Papua New Guinea based on data from the Australasian Virtual Herbarium (see https://avh.ala.org.au/, accessed June 2022). (*a*) *D. caricinum*. (*b*) *D. blakei*. (*c*) *D. latzii*. (*d*) *D. pygmaeum*.

Fig. 2. *Diplacrum blakei*. (*a*, *b*) Habitat (arrows in *b* indicate individual plants). (*c*–e) Habit. (*f*) Inflorescence. (*g*, *h*) Nutlets. Vouchers: (*a*, *b*) *M.D. Barrett and R.L. Barrett MDB2835* (PERTH); (*c*, *g*) *R.C. Carolin 8642* (NSW); (*d*) *K.L. Wilson 5055* (NSW, holotype); (e, *h*) *P.K. Latz 2607* (NT); (*f*) *P.K. Latz 2756b* (DNA). Scale bars: 1 cm (*c*, *d*, e); 1 mm (*f*); 0.5 mm (*g*, *h*). Photos: R.L. Barrett.

species have leaves shorter than the inflorescence. It is similar to *D. latzii* in nutlet shape and glume awn length, but differs in having numerous longitudinal ribs and ridges on the nutlet (*D. latzii* is broadly 3-angled, but is otherwise without ribs). The species is similar to *D. africanum* in having numerous longitudinal ribs and ridges on the nutlet, but it differs in having a narrower nutlet (more or less broad–ovoid to subglobose in *D. africanum*) and a shorter awn on the glumes of the female spikelets (awn ~1.5–2.0 mm long in *D. africanum*).

Specimens examined

WESTERN AUSTRALIA: 29.8 km W of Mt Agnes, Prince Regent River Reserve, N Kimberley Region, 26 Mar. 2010, *M.D. Barrett and R.L. Barrett MDB 2835* (PERTH 9401784); Airfield Swamp, Mitchell Plateau, 1976, *R.J. Hnatiuk MP 52A* (PERTH 2331950); Airfield Swamp, Mitchell Plateau, 1976, *K.F. Kenneally 4853*, (PERTH 2332965); Airfield Swamp, Mitchell Plateau, 1976, *K.F. Kenneally 4873* (PERTH 2332973). **NORTHERN TERRITORY:** Darwin and Gulf: Arnhem Land, ~18 km ESE of Ramingining, 22 June 2001, *I.D. Cowie 9429* (DNA D0159871 *n.v.*, NSW 623096); Arnhem Land, ~30 km ENE of Oenpelli on Maningrida road, 30 June 2001, *I.D. Cowie 9487* (BRI *n.v.*, DNA D0156881 *n.v.*, MEL *n.v.*, NSW 623112); Mary River, ~13°5′S and 131°47′E, Bull Swamp, 29 Sep. 1946, *S.T. Blake 17091* (BRI-AQ219845); 17 miles [~27 km] N Wilton River Crossing, 15 June 1972, *P.K. Latz 2756b* (DNA, L, NT 35325); Elcho Island, 13 July 1975, *P.K. Latz* 6207 (CANB 257382, DNA D0010249, L *n.v.*, NT 49021); Kakadu National Park, Buba Billabong, 4 May 1995, *N.M. Smith 3706 p.p.* (NSW 1119342); Kakadu National Park, Gulungul Creek, 5 km WSW of Mt Brockman, 21 Apr. 1980, *I.R. Telford 7955 and J.W. Wrigley* (CBG 8003335 [CANB], NSW 2314182). **QUEENSLAND:** Burke: 26 miles [~42 km] W of Croydon on the Normanton road, 16 Apr. 1974, *R.C. Carolin 8642* (NSW 1119244, SYD); 6 miles [~10 km] N of Maggieville on the Myravale road, 20 Apr. 1974, *R.C. Carolin 8758* (NSW 1119243, SYD). Cook: Codroy Creek 5.3 km N of Hann River on Laura to Musgrave road, 1 June 1989, *J.R. Clarkson 8034 and V.J. Neldner* (BRI-AQ591470 *n.v.*, DNA *n.v.*, K *n.v.*, MBA *n.v.*, NSW 2314181); 4.3 km E of Peninsula Development Road on Pascoe River Road, 23 Apr. 1990, *J.R. Clarkson 8565 and V.J. Neldner* (BRI *n.v.*, K *n.v.*, MBA *n.v.*, NSW 2314183).

Diplacrum caricinum R.Br., *Prodr.* 141 (1810)

Scleria caricina (R.Br.) Benth., *Flora Australiensis* 7: 426 (1878).

Type citation: '(T.) B. v.s.' *Type*: Queensland: Endeavour River, July–Aug. 1770, *J. Banks and D. Solander*; lecto BM 000833639 (Kern 1961*a*, p. 210, cited as 'holo'; Mabberley and Moore 2022, p. 217); probable isolecto P 00601910.

Dwarf herbaceous annual, glabrous, (3–)5–35 cm high, with reddish fibrous roots. *Culms* tufted, more or less erect or spreading. *Leaves* much shorter than inflorescences; leaf blades flat, with mid-nerve prominent abaxially, glabrous, 2–5 mm wide at mid-length, margins with minute antrorsely aculeate prickle hairs towards apex, with mid-nerve and numerous finer lateral nerves prominent on abaxial surface, several nerves prominent adaxially; no ligule or contraligule (the top of the leaf sheath opposite the junction with the blade truncate, not thickened); sheaths often reddish at the base. *Inflorescence* much longer than the culms, with internodes ~8–20 mm long, composed of 3–14 remote axillary clusters of spikelets; each cluster usually with 1 or 2 basal male spikelets and an upper female spikelet. *Involucral bract* at each node leaf-like, shorter than the inflorescence. *Male spikelets* 0.7–2.0 mm long, with 1 slender, more or less hyaline glume 0.7–2.0 mm long, not indurated at maturity; stamen 1; anther 0.2–0.5 mm long, with apical appendage <0.1 mm long. *Female spikelets* 0.7–2.8 mm long, with 2 glumes encircling the ovary and tightly clasping the nutlet and falling with it at maturity; peduncle thickened and disc-like at apical abscission zone but not enlarged and cup-like at maturity; glumes with narrow hyaline margins, 0.7–2.7 mm long including short erect (becoming incurved over nutlet at maturity) awn 0.2–0.5(–0.8) mm long, 3–9(–11)-nerved (usually only inner 3 prominent, elliptical with broad–acute to obtuse apex, with minute lateral lobes (extension of the hyaline margin on each side of the awn), green turning straw-coloured with maturity. *Disc* trigonous to subcircular, off-white, adhering to nutlet. *Style* 3-fid. *Nutlet* globose to broad–ovoid, circular to subtrigonous in cross-section, sparsely white-hispidulous at apex, otherwise glabrous, glossy, off-white to dark greyish, with 3 prominent paler ribs, 0.7–1.1 mm long, 0.5–0.7 mm in diameter, faintly and irregularly longitudinally rugose-ridged; somewhat tuberculate on ridges (Fig. 3).

Distribution and habitat

Widespread, from India and Sri Lanka to Japan, Malesia and Australia (Fig. 1*a*, Australia and New Guinea distribution only).

Conservation status

Widespread, including in national parks, so not considered at risk. We suggest a status of 'Least Concern' (International Union for Conservation of Nature 2019).

Notes

This species is usually taller, with broader leaf-blades and more elongated inflorescences, than the other Australian species of *Diplacrum*. It differs further in having persistent glumes that enclose, and fall with, the more or less globose nutlet, which is unique among these species in being minutely hispidulous at the apex. Kern (1961*b*) suggested that *D. reticulatum* might not be distinct from *D. caricinum*. *Diplacrum poklei* is described by Chandramohan (2016) as being similar to *D. caricinum*, but smaller in its parts. We have not seen material of either taxon and further investigation is needed to assess their status.

Selected specimens

AUSTRALIA: NORTHERN TERRITORY: Darwin and Gulf: Kakadu National Park, 21 Apr. 1990, *C. Dunlop 8542 and P.F. Munns* (AD *n.v.*, BRI *n.v.*, CANB *n.v.*, DNA *n.v.*, MEL *n.v.*, NSW 2314188);

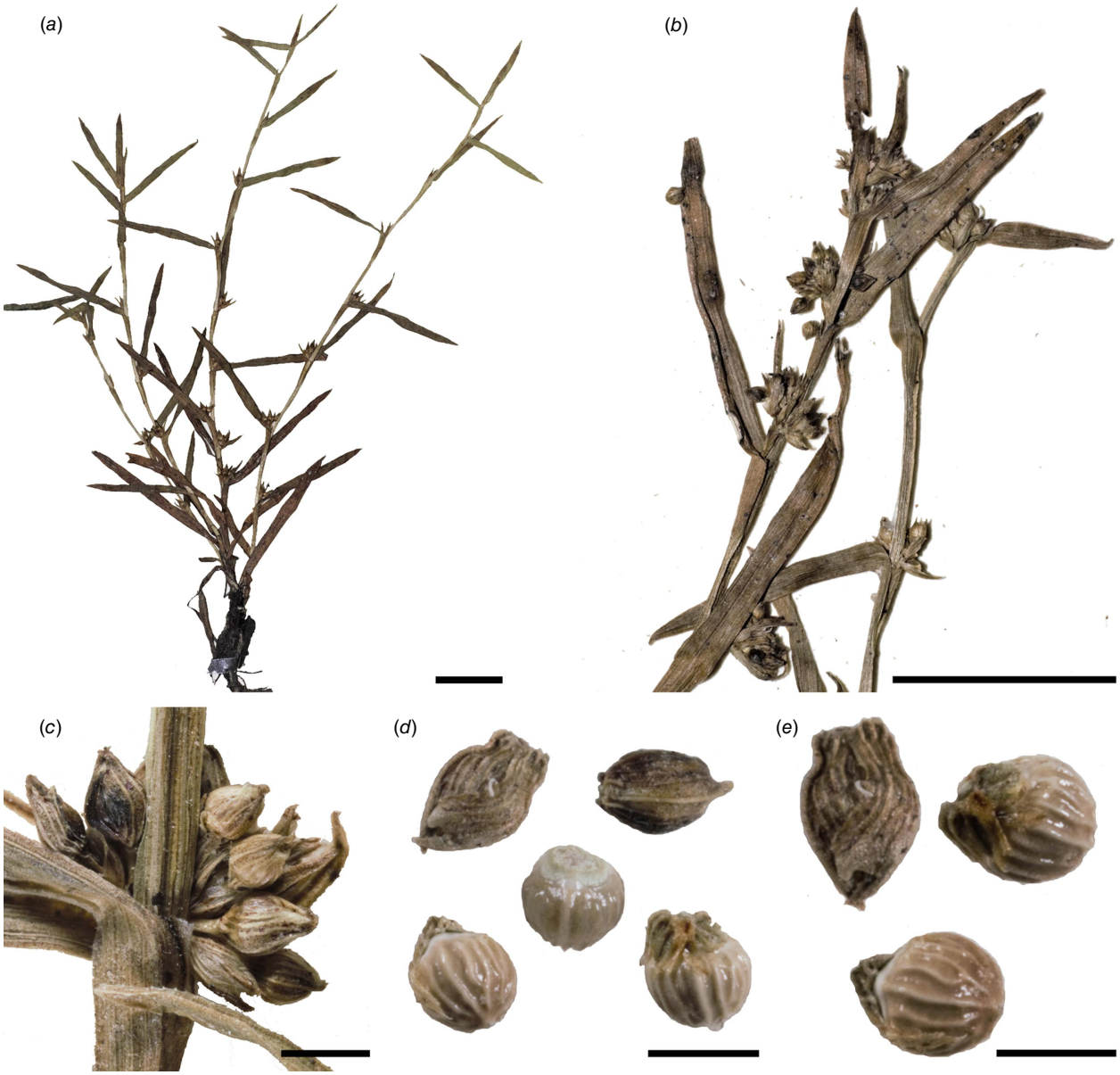

Fig. 3. *Diplacrum caricinum*. (*a*) Habit. (*b*) Inflorescence. (*c*) Cluster of spikelets. (*d*, *e*) Nutlets (three upper-most nutlets surrounded by persistent glumes). Vouchers: (*a*) *J. Russell-Smith 8225 and E.R. Petherick* (NSW); (*b*–e) *P.K. Latz 3700a* (NSW). Scale bars: 1 cm (*a*, *b*), 1 mm (*c*), 0.5 mm (*d*, *e*). Photos: R.L. Barrett.

Lake Deane, 27 May 1973, *P.K. Latz 3700a* (DNA NT40591A, NSW 1119341; Fitzmaurice River headwaters, 12 May 1994, *P.K. Latz 13847 p.p.* (DNA *n.v.*, NSW 451952); headwaters of Haywood Creek, 23 Feb. 1989, *G. Leach 2146 and C. Dunlop* (CANB *n.v.*, DNA *n.v.*, NSW 2314187); Pethericks Park, Woolaning, 1 Apr. 1990, *J. Russell-Smith 8225 and E.R. Petherick* (BRI *n.v.*, DNA D0050016 *n.v.*, NSW); Graveside Creek, 24 May 1987, *K.L. Wilson 7392* (NSW 196640). **QUEENSLAND:** Cook: Yarrabah, near Cairns, 28 June 1935, *S.T. Blake 9652* (BRI *n.v.*, NSW 2314194); tributary of Escape River, 4 June 1978, *J.R. Clarkson 2094* (BRI *n.v.*, CANB 313641, NSW 2314193); Temple Bay, 17 June 1978, *J.R. Clarkson 2136* (BRI *n.v.*, NSW 2314192); Chester River camp site, 28 July 1978, *J.R. Clarkson 2424* (BRI *n.v.*, CANB 339802, K *n.v.*, NSW 2314191); Browns Creek on Iron Range Road, 13 Sep. 1975, *R. Coveny 7095 and P. Hind* (BRI, K, L 0795372, NSW 2314195, P, US); Cape Tribulation, 80 miles [~130 km] N of Cairns, 9 June 1943, *H. Flecker s.n.* (NSW 181503); just north of the Daintree River, 27 Aug. 2008, *B.S. Wannan 5377 and R.L. Jago* (BRI, NSW 920690).

CAROLINE ISLANDS: Ponape Island, near Meilap, W coast 1–1.5 miles [~1.5–2.5 km] N of Palang, 18 Nov. 1978, *F.R. Fosberg 58382a and M.V.C. Falanruw* (NSW 2314211, US *n.v.*).

INDIA: Quilon, Oct. 1835, *R. Wight s.n.* (NSW 2314202).

INDONESIA: Sulawesi Selatan, N shore of Lake Matano E of Nuha, 30 June 1979, *E.F. De Vogel 6036* (L *n.v.*, NSW 2314212).

JAPAN: Honshu, near Yozumi in Kazusa, Oct. 1955, *T. Koyama s.n.* (NSW 2314196).

MALAYSIA: Sabah: Mt Kalawai, 10–11 Dec. 1915, *M.S. Clemens 11164* (NSW 2314203).

PAPUA NEW GUINEA: Derideri, ~15 km NW of Arufi, Morehead Road, 23 Sep. 1990, *S.W.L. Jacobs 5971 and B.J. Conn* (GENT, LAE,

NSW 253616); garden at Sigabaduru village, mainland PNG, W of Daru, 3 June 1999, *A.A. Mitchell 5823 and V. Gei* (CANB *n.v.*, LAE *n.v.*, MBA *n.v.*, NSW 1055489); Tiaura, Saru River track, 5 miles [~8 km] SE of Garaian, Lae Subdistrict, Morobe District, 18 July 1970, *H. Streimann and A. Kairo NGF 47956* (A *n.v.*, BO *n.v.*, BRI *n.v.*, CANB 217027, K *n.v.*, L 0795384 (image seen), LAE *n.v.*, NSW 2314210, SING *n.v.*).

PHILIPPINES: Luzon: Paracale, Camarines Province, Nov.–Dec. 1918, *M. Ramos and Q. Edaño BS 33507* (NSW 2314204).

Diplacrum latzii K.L.Wilson et R.L.Barrett, sp. nov.

Type: Northern Territory: 17 miles [~27 km] N Wilton River Crossing, 15 June 1972, *P.K. Latz 2756a*; holo NSW 1119274; iso BRI, DNA D0006219 *n.v.*, K *n.v.*, L *n.v.*, NT 35325.

Scleria sp. Wilton River (P.K.Latz 2756A) P.S. Short, D.E. Albrecht, I.D.Cowie, D.L.Lewis & B.M.Stuckey (eds), *Checkl. vasc. pl. N. Terr.* 28 (2011)

Diagnosis

Nutlets narrow–ellipsoid to narrow–ovoid, obscurely trigonous in cross-section, obscurely 3-ribbed longitudinally, glabrous, smooth; female glumes 0.8–1.5 mm long (including slightly excurved awn 0.2–0.5 mm long, usually slightly shorter than the body of the glume); leaves shorter than inflorescences.

Dwarf herbaceous annual, glabrous, plants 1.5–8 cm high, with reddish fibrous roots. *Culms* tufted, more or less erect. *Leaves* shorter than to equalling inflorescences; leaf blades flat, glabrous, margins with minute antrorsely aculeate prickle hairs towards apex, 0.7–1.5 mm wide at mid-length, with 3–5 nerves prominent on adaxial surface, 3–7 nerves prominent on abaxial surface; no ligule or contraligule (top of leaf sheath opposite the junction with the blade truncate, not thickened); sheaths often reddish at the base. *Inflorescence* approximately the same length as to longer than the culms, 1–2 cm long, internodes 2–8 mm long, composed of 2–5 remote axillary clusters of spikelets, each cluster with 0–2 basal male spikelets and an upper female spikelet. *Involucral bract* at each node leaf-like, shorter than inflorescence, scabrous towards apex. *Male spikelets* ~0.5 mm long, with 1 slender more or less hyaline glume ~0.5 mm long, becoming chartaceous and dark reddish-brown with age; stamen 1; anther ~0.3 mm long, with apical appendage <0.1 mm long. *Female spikelets* 1.3–2.0 mm long, with 2 glumes encircling the ovary but not tightly clasping the nutlet nor falling with it; glumes narrow–elliptical, with acute to obtuse apex, green drying to straw-coloured with minute red dots, with narrow to broad hyaline margins, 0.8–1.5 mm long (including slightly excurved awn 0.2–0.5 mm long, usually slightly shorter than the body of the glume), 3–5-nerved with only mid-nerve or 3 nerves prominent; peduncle often somewhat thickened at apex at maturity (less obvious than in *D. pygmaeum*). *Disc* triquetrous, white, adhering to nutlet. *Style* 3-fid. *Nutlet* narrow–ellipsoid to narrow–ovoid, obscurely trigonous in cross-section, obscurely 3-ribbed longitudinally, glabrous, smooth, glossy, mid- to dark yellowish-brown to purplish, ~0.4 mm long, ~0.3 mm in diameter. (Fig. 4)

Distribution and habitat

Tropical Northern Territory and Western Australia (Fig. 1*c*); may also occur in northern Queensland but no specimens have been seen. Commonly grows with *D. blakei, D. caricinum, D. pygmaeum* and other annual sedges on the margins of wet areas.

Conservation status

Widespread, including in national parks, so not considered at risk. We suggest a status of 'Least Concern' (International Union for Conservation of Nature 2019).

Etymology

Named after Dr Peter Kenneth Latz (1941–), who has contributed so much to our knowledge of tropical and central Australian sedges and many other plant groups.

Notes

This species is similar in habit to *D. blakei* and *D. pygmaeum*, differing from them most obviously in the smooth, narrow–ellipsoid to narrow–ovoid nutlet, broadly 3-angled but lacking prominent ribs. This species appears to be similar to *D. exiguuum*, based on the description of that species by Kern (1962 [as *Scleria pygmaea*]), particularly in the smooth, 3-angled nutlet, but *D. exigua* is described as having female spikelets with glumes only mucronulate whereas those of *D. latzii* have an elongated awn.

Specimens examined

WESTERN AUSTRALIA: 24 km NW of Drysdale River crossing, 6 km W of Gibb River–Kalumburu Mission road, 30 May 1976, *A.C. Beauglehole 51691B* (DNA A0067966, MEL *n.v.*, NT 51120, PERTH 6217079). **NORTHERN TERRITORY:** Darwin and Gulf: about S of Brocks Creek, between (near junction of) Hayes Creek and Douglas River, 29 June 1946, *S.T. Blake 16227* (BRI-AQ172758, NSW 1119272); O.T. Station, 5 May 1947, *S.T. Blake 17647A* (BRI-AQ173036); Kakadu National Park, site 98, 19 km NNW of Twin Falls, 3 June 1980, *L.A. Craven 6297* (CANB 318175); 17 miles [~27 km] N Wilton River Crossing, 15 June 1972, *P.K. Latz 2755 p.p.* (DNA, NSW 1119245); Lake Deane, 26 May 1973, *P.K. Latz 3701* (DNA NT40592, NSW 1119273); Kakadu National Park, Buba Billabong, 4 May 1995, *N.M. Smith 3706 p.p.* (DNA D0157362 *n.v.*, NSW 623105).

Diplacrum pygmaeum (R.Br.) Nees ex Boeckeler, *Linnaea* 38(4): 434 (1874)

Scleria pygmaea R.Br., *Prodr.* 240 (1810). *Hypoporum pygmaeum* (R.Br.) Nees, *Linnaea* 9: 303 (1834).

Type citation: '(T.) B. v.s.' *Type*: Queensland: Endeavour River, July–Aug. 1770, *J. Banks and D. Solander* (lecto BM000900962;

Fig. 4. *Diplacrum latzii*. (*a*, *b*) Habit. (*c*) Inflorescence. (*d*) Cluster of spikelets. (e, *f*) Nutlets. Vouchers: (*a*) *S.T. Blake 16227* (NSW); (*b–d*) *P.K. Latz 2756a* (NSW); (e, *f*) *P.K. Latz 3701* (NSW). Scale bars: 1 cm (*a–c*), 2 mm (*d*), 1 mm (e), 0.5 mm (*f*). Photos: R.L. Barrett.

probable isolecto BM 000900963, BRI-AQ0341623, NSW 268828, P 00601916, P 00601917; fide K.L. Wilson in D.J. Mabberley and D.T. Moore, *Regnum Veg.* 160: 232 (2002)).

Sphaeropus pygmaeus Boeckeler, *Flora* 56: 89 (1873).

Type citation: 'Fr. Schulz pl. Austral. no. 260 – (Herb. Berolin.) … Nova Holland., Adelaide.' *Type*: Northern Territory: Port Darwin, *F. Schultz 260*; holo B?, *n.v.*; iso MEL 2297608.

Dwarf herbaceous annual, glabrous, 2–15 cm high, with reddish fibrous roots. *Culms* tufted, more or less erect or spreading. *Leaves* shorter than inflorescences; leaf blades flat, midrib prominent abaxially, glabrous, margins with minute antrorsely aculeate prickle hairs towards apex, 1.0–2.5 mm wide at mid-length, with mid-nerve and 2 or more lateral nerves prominent on adaxial surface, mid-nerve prominent on abaxial surface; no ligule or expanded contraligule (the top of the leaf sheath opposite the junction with the blade truncate, not thickened); sheaths reddish at the base. *Inflorescence* much longer than the culms, with internodes 2–20 mm long, composed of 2–6 remote axillary clusters of spikelets; each cluster with 0–2 basal male spikelets and an upper female spikelet. *Involucral bract* at each node leaf-like, usually much longer than inflorescence. *Male spikelets* 1.0–1.3 mm long, with 1 slender, more or less hyaline glume 1.0–1.3 mm long, not indurated at maturity; stamen 1; anther ~0.2 mm long, with apical appendage <0.1 mm long. *Female spikelets* 2.0–3.2 mm long, with 2 glumes encircling the ovary but not tightly clasping the nutlet nor falling with it; peduncle thickened at apex and cup-like at maturity; glumes with narrow hyaline margins, 2.2–3.0 mm long, including somewhat excurved awn 0.8–1.2 mm long, nearly as long as the body of the glume, 3-nerved (usually only mid-nerve prominent, narrow–elliptical with broad–acute apex, green turning straw-coloured with maturity, margins hyaline. *Disc* trigonous to circular, dark grey to blackish, with 6 off-white fine lines radiating from the centre, adhering to the nut. *Style* 3-fid. *Nutlet* globose, circular to subtrigonous in cross-section, glabrous, glossy, off-white maturing to dark purplish to blackish, slightly paler at apex, with 3 slightly paler longitudinal ribs and 3 paler swollen lobes at the base (adjacent to the disc) with a narrow yellowish-brown line between the lobes, 0.6–0.7 mm long, 0.5–0.6 mm in diameter, minutely colliculate or papillose, often more or less rugose when young (Fig. 5).

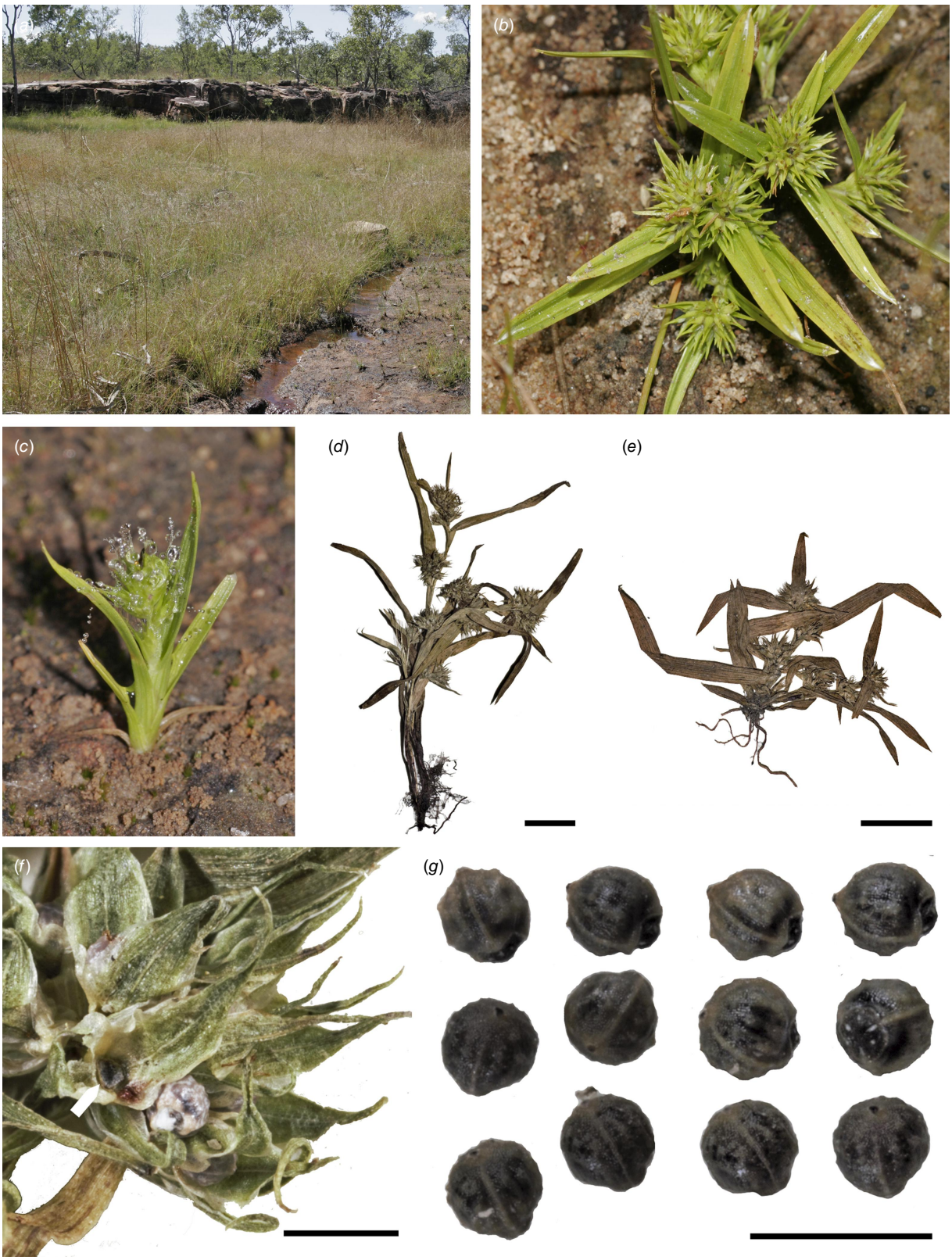

Fig. 5. *Diplacrum pygmaeum*. (*a*) Habitat. (*b*–e) Habit. (*f*) Thickened cup-like apex of peduncle (indicated by arrow). (*g*) Nutlets. Vouchers: (*a*–*c*) *R.L. Barrett RLB5823* (PERTH); (*d*) *S.W.L. Jacobs 1806* (NSW); (e, *g*) *S.T. Blake 23354* (NSW); (*f*) *P.S. Short and R.K. Harwood 4989* (NSW). Scale bars: 1 cm (*d*, e), 1 mm (*f*, *g*). Photos: R.L. Barrett.

Distribution and habitat

Widespread in tropical Australia, from the West Kimberley east to around Rockingham Bay in Queensland (Fig. 1*d*). Grows in seasonally damp sands and loams, on the margins of swamps with a wide range of herbaceous species.

Conservation status

Widespread, including in national parks, so not considered at risk. We suggest a status of 'Least Concern' (International Union for Conservation of Nature 2019).

Notes

This species is similar in habit to *D. blakei* and *D. latzii*, differing most obviously in the more or less globose nutlet and the longer awn on the female glumes. *D. caricinum* also has a globose nutlet, but it differs from *D. pygmaeum* in the nutlet falling tightly clasped by the two glumes and in having a generally taller habit, with an elongated inflorescence.

Specimens examined

WESTERN AUSTRALIA: Mainland 8.3 km SE of Gertrude Cove on Kiska Island, N of Roe River mouth, West Kimberley, 23 Apr. 2008, *M.D. Barrett and R.L. Barrett MDB 1988* (PERTH 9339256); 18.3 km WNW of Munja Airstrip, Harding Range, West Kimberley, 22 Apr. 2008, *M.D. Barrett and R.L. Barrett MDB1923* (PERTH 9339132); 'Skull Creek' camp and trap site, Doongan Station, 24 Apr. 2008, *R.L. Barrett RLB4671* (PERTH); beside King Edward River crossing on old Mitchell River Station Road, Doongan Station, North Kimberley, 28 Apr. 2007, *R.L. Barrett RLB5823* (PERTH); Youwanjela pavement 1, 26.7 km E of Kings Cascades; 12.4 km NNE of junction of Youwanjela Creek and Prince Regent River, Prince Regent Nature Reserve, 25 Jan 2007, *R.L. Barrett and M.D. Barrett RLB7264* (PERTH 8824258); DMR 008 site, 7 km SE of King Edward River on old Mitchell River Road, 30.7 km NW of Doongan Homestead, 18 May 2011, *R.L. Barrett RLB7264* (PERTH 9338012); 1.5 km W of Lennard River Gorge turn-off, Gibb River Road, 24 July 1974, *G.W. Carr 4101 and A.C. Beauglehole 47879* (DNA NT50726, PERTH 1299034). **NORTHERN TERRITORY:** Darwin and Gulf: Western Arnhem Land, ~94 km ESE of Jabiru, 20 Mar. 2000, *I.D. Cowie 8680* (DNA D01411676 *n.v.*, NSW 537187); ~10 km NE 'Mudginbarry' [*sic*; Mudginberri] on Oenpelli road, 1 June 1974, *S.W.L. Jacobs 1806* (CANB 257416, K, NSW 1119254, NT, P, READING); Mt Brockman Outlier, 15 km SE of Jabiru, 20 Apr. 1989, *R.W. Johnson 4765* (BRI *n.v.*, DNA *n.v.*, NSW 470746); Lake Deane, 26 May 1973, *P.K. Latz 3700B* (NT 40591, *p.p.*); Cox River Station, 4 July 1977, *P.K. Latz 7225* (DNA, NSW 2314168); Fish River block, 15 Apr. 2010, *D.L. Lewis 1330* (DNA *n.v.*, LD, NSW 928734); 4.2 km towards Ramingining from Central Arnhem Road, 22 July 1999, *P.S. Short 4989 and R.K. Harwood* (DNA, NSW 675668); South Bay, Bickerton Island, in the Gulf of Carpentaria, 19 June 1948, *R.L. Specht 624* (CANB 29135, MEL 2204177, NSW 1119253, PERTH 2331985); track to Winmurra Billabong from Oenpelli Road, 6 May 1983, *K.L. Wilson 5163* (DNA, H, K, NE, NSW 840767, P); Barramundie Gorge, 20 May 1987, *K.L. Wilson 7305* (NSW 206397); Graveside Creek, 24 May 1987, *K.L. Wilson 7392a* (NSW 1119295); Red Lily Lagoon, Kapalga, 28 May 1987, *K.L. Wilson 7457* (NSW 196723); 19 km N of Arnhem Highway on track to Four Mile Hole, 30 May 1987, *K.L. Wilson 7477* (NSW 196743). **QUEENSLAND:** Cook: near Cooktown, 17 May 1970, *S.T. Blake 23354* (BRI, NSW 1119247); east bank of Little Laura River, S of Laura, 20 May 1975, *N. Byrnes 3425* (BRI, NSW 225743); Codroy Creek 5.3 km N of Hann River on Laura to Musgrave road, 1 June 1989, *J.R. Clarkson 8037 and V.J. Neldner* (BRI-AQ591471 *n.v.*, K *n.v.*, NSW 2314174); 37 km SSE of Aurukun, ~12 km E of the Archer River, 28 May 1982, *J.R. Clarkson 4387B* (BRI-AQ0367052 *n.v.*, K *n.v.*, NSW 2314173); Browns Creek on Iron Range Road (174 km [~108 miles] N of Coen by road, 13 Sep. 1975, *R.G. Coveny 7095b and P.D. Hind* (NSW 1119248); Bulleringa National Park, 80 km NW of Mount Surprise, Donkey Spring Creek, 23 Apr. 1998, *P.I. Forster PIF22528 and R. Booth* (BRI *n.v.*, NSW 461971); ~5 km N of Ayton, Cooktown road, 22 May 1976, *S.W.L. Jacobs 2734 and A.N. Rodd* (BRI, NSW 1119252); W of Petford, 23 May 2009, *B.S. Wannan 5660 and J. Beasley* (BRI, NSW 823068); Dulhunty River crossing, 18 km SW of Heathlands base (by road), 6 Mar. 1992, *K.L. Wilson 8253 and P. Sharpe* (DNA, MBA, NSW 339173). North Kennedy: Rockingham Bay, *J. Dallachy s.n.* (NSW 1119246 ex MEL).

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Data availability. The data that support this study will be shared upon reasonable request to the corresponding author.

Conflicts of interest. Dr Russell Barrett is an associate editor for *Australian Systematic Botany* but did not at any stage have editor-level access to this manuscript while in peer review, as is the standard practice when handling manuscripts submitted by an editor to this journal. *Australian Systematic Botany* encourages its editors to publish in the journal and they are kept totally separate from the decision-making processes for their manuscripts. The authors have no further conflicts of interest to declare.

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