

An additional introduced species of *Nuttallanthus* (Plantaginaceae) in Australia

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Abstract

Nuttallanthus texanus (Scheele) D.A.Sutton (Plantaginaceae) has been identified as occurring in southern Queensland and eastern New South Wales, Australia. This species had not previously been distinguished from *Nuttallanthus canadensis* (L.) D.A.Sutton. Both species are naturalised and spread by seed. The two species can be distinguished by floral and seed morphological differences.

Introduction

The genus *Nuttallanthus* D.A.Sutton (Plantaginaceae – until recently the genus was assigned to Scrophulariaceae) consists of herbaceous annuals and perennials that are native to North and South America (Sutton 1988). Prior to 2014, it was assumed that only *N. canadensis* (L.) D.A.Sutton had become naturalised in Queensland and New South Wales (Anonymous 2011, Barker 1992, as *Linaria canadensis* (L.) Dum.-Cours. var. *canadensis*, 2014, Conn and Murray 2015).

Examination of recent plant collections by James Fleming, from near Boggabri (North Western Plains subdivision, New South Wales) revealed that *N. texanus* (Scheele) D.A.Sutton had also become naturalised in Australia. Both species of *Nuttallanthus* were previously included in the genus *Linaria* Mill., with *N. canadensis* originally described as a species of *Antirrhinum* L. *Nuttallanthus canadensis* is native throughout much of temperate North America and is recorded as naturalised in Europe and South America (Sutton 1988), whereas *N. texanus* is native to southern North America, Mexico, and possibly native to temperate South America (Sutton 1988). It is also recorded as naturalised in other temperate regions.

Morphological differences between *Nuttallanthus canadensis* and *N. texanus*

These species are superficially morphologically similar, and hence, easily confused. They share similar habit, flower colour and the inflorescences and infructescences are approximately the same length. However, they are readily distinguished by differences in flower size, hairiness of the inflorescence axes and by the surface features of the seed. Since there have only been relatively few collections of both species from Australia, the circumscriptions based on the available Australian material has been supplemented by those provided by Sutton (1988) and Diggs *et al.* (1999).

Nuttallanthus canadensis has glandular trichomes on the inflorescence axes and pedicels (whereas the inflorescences of *N. texanus* are usually glabrous); smaller corollas 8–13 mm long (compared to *N. texanus*

with corolla 14–22 mm long) (Diggs *et al.* 1999); however, the one specimen from New South Wales of *N. canadensis* appears to only be c. 6–10 mm long; spur c. 5 mm long (*N. texanus* with spur 6–11 mm long); seeds with low entire longitudinal ridges (c. 0.04 mm wide) and intervening faces almost smooth or with sparse low tubercles up to 0.01 mm long (*N. texanus* with seed surface covered completely with tuberculate protuberances 0.01–0.02 mm long).

The seed coat of these two species is linarioid (*sensu* Elisens 1985), with testal sculpturing consisting of differentially elongated epidermal cells that are radially arranged. The seed coat of *N. canadensis* has epidermal cells that are almost square, slightly irregular and angular, c. 0.02 mm long and wide (Fig. 1), whereas the epidermal cells of *N. texanus* are distinctly elongated, slightly angular, 0.02–0.03 mm long, c. 0.01 mm wide (Fig. 2). Each longitudinal wing/ridge of a seed of *N. canadensis* (Fig. 1) is mostly formed by the length of one epidermal cell (each cell 0.03–0.04 mm long, c. 0.01 mm wide).

Unfortunately, very few collections of these two introduced species have been made in Australia. However, the seeds of the Australian plants are perhaps slightly smaller than those in their native habitat. *Nuttallanthus canadensis* – seeds 0.25–0.3 mm long (Australian material), average 0.5 mm long in North America (Elisens and Tomb 1983); *N. texanus* – seeds 0.25–0.3 mm long (Australian material), average 0.44 mm long in North America (Elisens and Tomb 1983).

Note: Specimens examined are listed according the botanical districts of Queensland (Anonymous 1975) and botanical divisions of New South Wales (Anderson 1961).

Key to species of *Nuttallanthus* in Australia

- 1 Corolla 8–13 mm long, including 5 mm long spur, lower lip 2–6 mm long; seeds with low, entire longitudinal wings/ridges, the intervening faces more or less smooth or with sparse, short tubercles (tubercles up to 0.01 mm long); inflorescence with glandular hairs *N. canadensis*
- 1: Corolla 14–22 mm long, including 6–11 mm long spur, with lower lip 6–11 mm long; seeds densely tuberculate (tubercles 0.01–0.02 mm long), without longitudinal wings/ridges or, if present, then small, obtuse or rounded; inflorescence glabrous *N. texanus*

Descriptions

***Nuttallanthus canadensis* (L.) D.A.Sutton**

Fig. 1.

Revision of the Tribe Antirrhineae 460 (1988)

Synonym: *Linaria canadensis* (L.) Dum.Cours. *Le Botaniste Cultivateur*, ... 2: 96 (1802)

Basionym: *Antirrhinum canadense* L. *Species Plantarum* 2: 618 (1753)

Slender glabrous biennial or winter annual to 75 cm tall, with a rosette of prostrate stems (over-wintering branches) to 10 cm long; stems and leaves glabrous. *Leaves* alternate, often opposite or whorled on over-wintering branches, linear, to 30 mm long, 1–2 mm wide. *Inflorescence* many-flowered, congested at anthesis, elongating in fruit, with glandular hairs; bracts 1.5–3 mm long; *pedicels* ascending, 2–4 mm long in fruit, glandular hairy; bracts and pedicels with glandular hairs. *Sepals* 2–3 mm long. *Corolla* 8–13 mm long, blue to violet blue with a 2-ridged white or pale palate; spur 5 mm long; upper lip recurved, shorter than the recurved lower lip. *Capsule* compressed-globose, 2.5–3 mm long, emarginate; *seeds* brown, 0.35–0.5 mm long, 0.25–0.3 mm wide, surface usually smooth between thin, entire longitudinal wings/ridges (ridges 0.03–0.04 mm wide), sometimes with a few tubercles up to 0.01 mm long.

Distribution in Australia: naturalised in Queensland and New South Wales. One unsubstantiated record from South Australia (Anonymous 2011).

Selected specimens examined: Australia: Queensland: Moreton: Samford, 10 Oct 1960, *H.S. McKee* 7416 (NSW823164). New South Wales: North Coast: Tanilba Station No. 5, Zone 2, 25 Sep 2001, *D.L. McNair* 8895 (NSW713001).

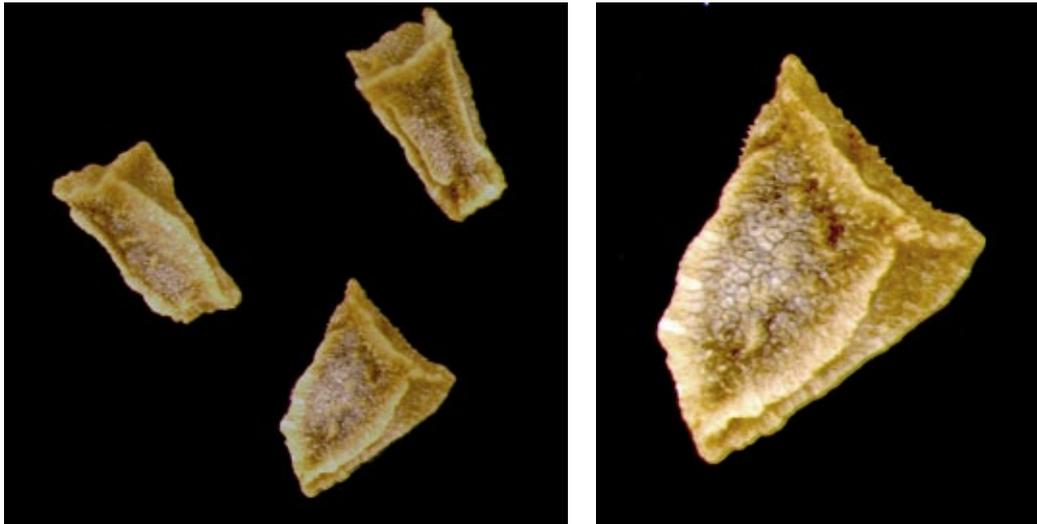


Fig. 1. *Nuttallanthus canadensis*. a. seeds; b. detail of surface features of angular seed, showing longitudinal wings and papillae. (NSW713001). Scale bar = 0.4 mm

***Nuttallanthus texanus* (Scheele) D.A.Sutton**

Fig. 2.

Revision of the Tribe Antirrhineae 460 (1988); *Linaria canadensis* (L.) Dum. Cours. var. *texana* (Scheele) Pennell *Proceedings of the Academy of Natural Sciences of Philadelphia* 73: 502 (1922).

Basionym: *Linaria texana* Scheele, *Linnaea* 21(6): 761 & 762 (1849).

Slender glabrous biennial herb, 17–70 cm high, with fertile stems (1–)3–30, erect, mostly unbranched; vegetative stems many, prostrate or procumbent. *Leaves* alternate distally (on fertile stems), often 3- or 4-whorled basally (especially on vegetative stems), linear to oblong-elliptic, 7–34 mm long, 1–2.7 mm wide. *Inflorescence* many-flowered, congested at anthesis, internodes elongating in fruit; bracts 2–3 mm long; pedicels ascending, 2–6(–9) mm long, *Sepals* 2.5–3.5 mm long, 1–4 mm wide. *Corolla* 14–22 mm long, pale lilac or violet with white palate; spur 6–11 mm long, 0.4–0.6 mm wide at base; lower lip 6–11 mm long; upper lip 3–5 mm long. *Capsule* obloid-ovoid, 2.5–4.5 mm long, glabrous; *seeds* blackish grey, 0.3–0.5 mm long, surface densely tuberculate (apiculate sensu Elisens 1985) (tubercles 0.01–0.02 mm long), longitudinal ridges lacking or small, obtuse or rounded.

Distribution in Australia: Queensland and New South Wales

Selected specimens examined: Australia: New South Wales: Central Coast: Lansdown Farm, University of Sydney, Camden, 07 Oct 2005, *F. Deverall s.n.* (AD, BRI, CANB, MEL, NSW729732); Central Western Slopes: End of Bradley Lane, Amiens, *A.R. Bean* 20975, 18 Oct 2003 (BRI, MEL); Alongside Boyden Bridge over Castlereagh River, 10.6 km west south west of Mendooran, *J.R. Hosking* 3433 & *G.R. Sainty*, 17 Oct 2010 (AD, CANB, MEL, NE, NSW); North Western Plains: Boggabri, 2 Oct 2014, *J. Fleming s.n.* (NSW85899), 20 Oct 2014, *J. Fleming s.n.* (NSW880168).

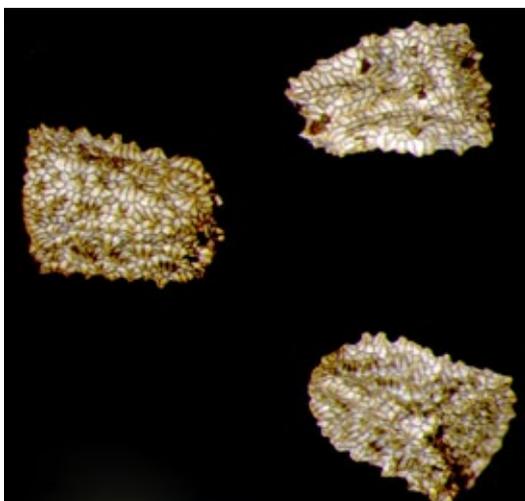


Fig. 2. *Nuttallanthus texanus*. Angular seeds, showing densely tuberculate surface, completely covering all sides. (NSW729732). Scale bar = 0.3 mm

Notes: Similar to *N. canadensis*, this species appears to be spread by seed and may prove to be an aggressive coloniser (refer discussion below). This species is naturalised at a number of locations in southern Queensland where it was at one time referred to as *N. canadensis*. *Nuttallanthus texanus* also appears to have naturalised in Argentina, Brazil, Chile and Uruguay where it is currently treated as *Linaria canadensis* (Souza 2008).

Potential weediness of *Nuttallanthus* in Australia

In Australia and elsewhere, both species are spread by seed (Johnson *et al.* in preparation). *Nuttallanthus canadensis* has been recognised as a weedy species and possible control measures have been considered (e.g. Anonymous 1985, DeFelice 2011, Wiersema and Léon 2013). The biological control of *N. canadensis* and *N. texanus* has been investigated (Cock *et al.* 2006). The weediness of both of these species of *Nuttallanthus* has not been evaluated for Australia. However, the reproductive strategies of both species are self-fertilization via cleistogamy and self-pollination in chasmogamous flowers (Crawford and Elisens 2006). Many hundreds of plants of *N. texanus* have been recorded in some Australian localities (e.g. Hosking 3433). The Deverall collection (NSW729732) of *N. texanus* records the species as a crop contaminant in an experimental field sown for wheat.

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