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Rediscovery and updated description of the enigmatic annual *Hydrocotyle corynophora* F.Muell. (Araliaceae)

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Abstract

Hydrocotyle corynophora F.Muell. (Araliaceae), a rare species from Western Australia known only from the type collection made in 1889, was recently recollected in 2015 from the region between Southern Cross and Marvel Loch. In light of the new collections, an updated description is provided, along with descriptions of habitat, flowering time and a formal citation of Mueller's holotype held at the National Herbarium of Victoria (MEL).

Introduction

Hydrocotyle corynophora F.Muell. (Araliaceae) is an enigmatic species of annual *Hydrocotyle* endemic to Western Australia. It was first collected from the 'Eastern sources of Swan River' in 1889 by Miss Alice Eaton, who subsequently sent specimens to Ferdinand von Mueller, Government Botanist of Victoria (Eichler 1987; Maroske and Vaughan 2014). Mueller published the new species the following year (Mueller 1890), and named it in reference to the species distinctive club-shaped peduncles. Mueller's description was based on fragmentary material (currently mounted as three parts) representing two fertile plants with limited leaf material (Fig. 1).

Despite the 'remarkable structure' of the peduncles (Mueller 1890, p.21), which makes *Hydrocotyle corynophora* readily distinguishable from all other species of *Hydrocotyle*, it apparently remained uncollected for 125 years. In September and October 2015, flowering and fruiting plants were collected from an area between Southern Cross and Marvel Loch by Jonathan Warden and David Leach during flora surveys, following above average autumn and winter rainfall (BOM 2016).

In March 2016, an undetermined *Hydrocotyle* specimen held at PERTH was identified by the author to be *H. corynophora*. The collection was made by Ken Newbey in September 1979 (south-east of Marvel Loch), and it contains plants in the early stages of reproductive development. Most of the plants have their first umbels in bud but lack the characteristic fully expanded peduncles and mature ornamented fruits. General leaf morphology, stipule shape and colour, shallow ribbing on stems and peduncles, and umbel shape (when in bud) allowed for positive identification when compared to the 2015 specimens of Warden and Leach.

Comparisons between the PERTH specimens and the type sheet (MEL7876) (JSTOR 2015) also indicated that the material available to Mueller, 125 years ago, was not entirely representative of the full variation in leaf and floral morphology for this species. Thus, expanded descriptions of the morphological variation, geographical distribution and habitat for the species, are here provided.



Fig. 1. Holotype of *Hydrocotyle corynophora* F. Muell. (MEL7876) reproduced with permission from the National Herbarium of Victoria (MEL), at the Royal Botanic Gardens Victoria.

Methods

The description of *Hydrocotyle corynophora* here is based on the examination of photographic images of plants *in situ*, nine voucher specimens held at the Western Australian Herbarium (PERTH), and a digital image of the type sheet held at the National Herbarium of Victoria (MEL) (accessed via JSTOR 2015). Morphological comparisons were also made with other *Hydrocotyle* species held at PERTH. A distribution map for *H. corynophora* was produced from voucher specimen data held at PERTH using QGIS Version 2.8.1, and it includes the *Interim Biogeographical Regionalisation for Australia (IBRA) Version 7* boundaries (Department of the Environment 2013).

Taxonomy

Hydrocotyle corynophora F.Muell., Proceedings of the Linnean Society of New South Wales, Series 2, 5(1): 20–21 (1890)

Type: Western Australia: Near the eastern sources of Swan River, *Miss Alice Eaton* s.n., 1889 (holotype: MEL7876 (Figure 1))

Plants annual; consisting of a basal rosette of 4–16 leaves, branched ascending stems bearing leaves and umbellate inflorescences, 7–35 cm high and 10–35 cm wide. *Stems* ascending, terete, shallowly longitudinally ribbed, glabrous, green or reddish green, often with a glaucescent bloom. *Stipules* 1.0–3.1 mm long, 0.2–0.7 mm wide, obovate to lanceolate or linear lanceolate, membranous, translucent, pale orange-brown, margins erose. *Petioles* 4–40 mm long, green with crimson markings, glabrous or occasionally with scattered antrorse hairs concentrated towards the apex. *Leaf* laminas discolorous, 4–20 mm long, 4–26 mm wide; basal rosette leaves orbicular to rhomboid in juvenile leaves, trilobed to palmately lobed in mature leaves; stem-leaves palmately lobed or trilobed to occasionally trifoliolate. Adaxial lamina glabrous, uniformly green or reddish green; abaxial lamina pale green, mostly glabrous or occasionally with scattered simple antrorse hairs on the midvein and lateral veins. Mature leaf margins toothed, obtuse to acute, teeth green or crimson. Median leaf lobes obovate, 4–11 mm long, 2–7 mm wide, margins with 3–5 teeth. Lateral leaf lobes 3–8 mm long, 3–8 mm wide, incised into two asymmetrical lobules in palmatifid leaves, each lobule with 2–4 marginal teeth, leaf sinuses 35–95% of lateral leaflet length. *Inflorescences* leaf opposed, simple umbels, 14–40 flowered, dome shaped in bud and at anthesis; flowers all hermaphrodite, protandrous. *Peduncles* erect, much longer than petioles of subtending stem-leaves at anthesis, glabrous, green or often glaucescent, longitudinally ribbed, 7–52 mm long, conspicuously expanded apically, 1.2–2.5 mm wide at anthesis becoming 2.5–5.4 mm wide and hollow at fruiting. *Involucral bracts* absent. *Flowers* pedicellate; flowering pedicels 0.2–1.2 mm long, longitudinally flattened, strongly deflexed in outermost flowers erect in innermost flowers. *Ovaries* orbicular, papillate between the dorsal and median veins, glabrous between the median veins and commissure; papillae erect, minutely verrucose. *Calyx* absent. *Corolla* creamy white with pale pink colouration towards the apices; petals 5, ovate, 0.8–1.0 mm long, 0.3–0.4 mm wide. *Filaments* white, 1 mm long; anthers white to light cream, 0.2 mm long. *Schizocarps* transversely elliptic, prominently swollen along lateral ribs; bases cordate; fruiting pedicels 0.5–3.0 mm long, erect, incurved, connate at bases in 2 or 3 whorls (each pedicel being joined to neighbouring pedicels by a thin membranous flap of tissue), outermost whorl distinctly longer than inner whorls. *Mericarps* 0.8–0.9 mm wide, 0.9–1.2 mm long; dorsal rib distinct, glabrous; lateral ribs prominently raised, glabrous; median ribs not raised; surface between dorsal and (raised) lateral ribs convex to slightly concave, densely papillate (evenly covered in papillae), surface between lateral ribs and commissure distinctly concave, glabrous; commissure 40–60% the length of mericarps. Fruiting styles 0.6–0.8 mm long, fully reflexed. Mature mericarps creamy brown to brown prior to disarticulation. *Carpophore* persistent after mericarps shed, 0.3–0.5 mm long, entire, acute. *Cotyledons* narrowly elliptic in the seedling. **Figs 2 and 3.**

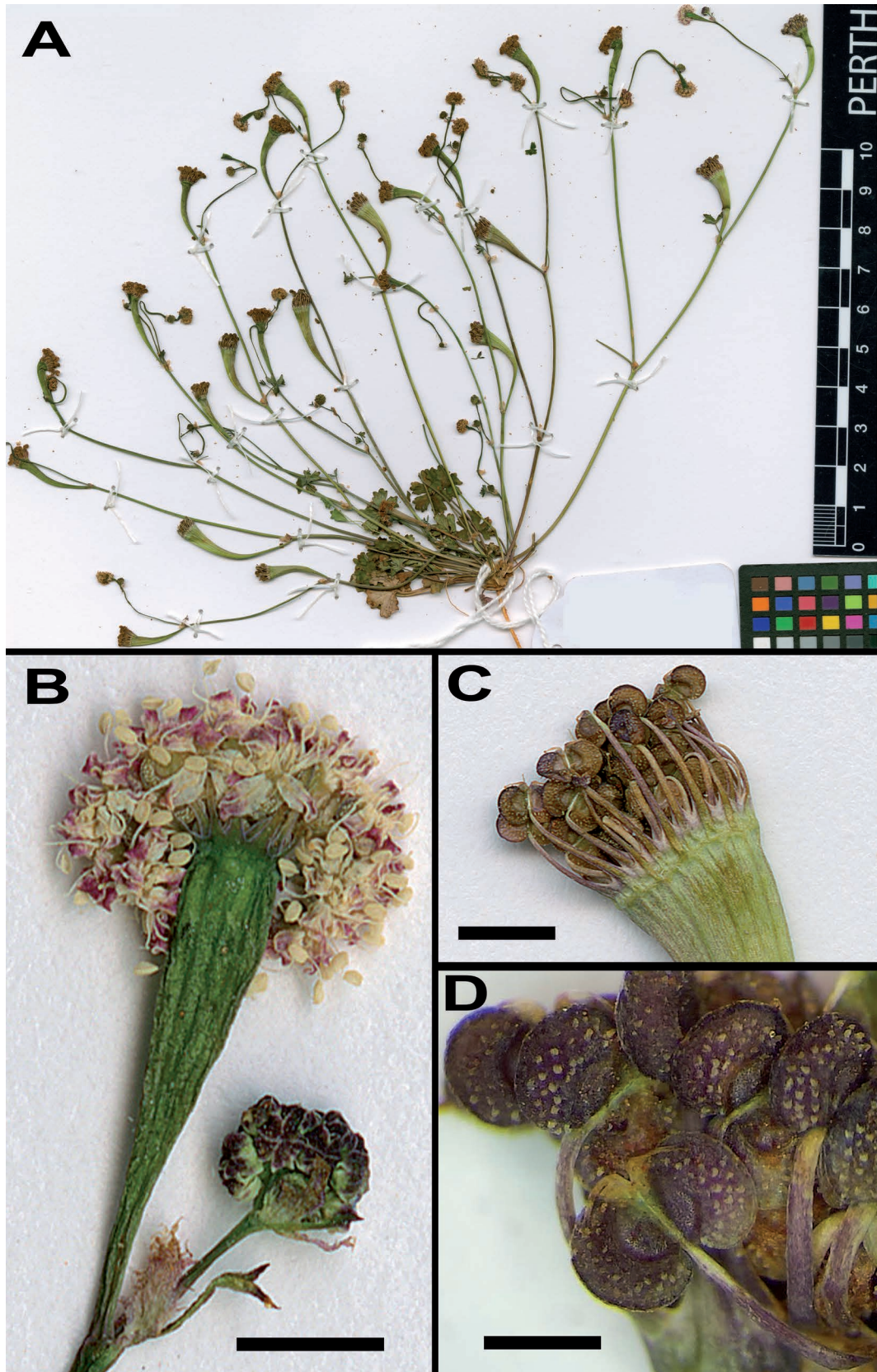


Fig. 2. *Hydrocotyle corynophora* (J. Warden & D. Leach 37945, PERTH 08684529). **A.** habit (scale on right in centimetres); **B.** Flowering umbel showing a swollen peduncle and a dome-shaped umbel at anthesis; **C.** Infructescence showing an umbel with incurved pedicels and maturing mericarps; **D.** Close-up of schizocarps showing surface ornamentation on lateral surfaces. Scale bar: **B, C** = 2 mm; **D** = 1 mm.



Fig. 3. *Hydrocotyle corynophora* (K.R. Newbey 6035, PERTH 03401502). A single plant from the voucher exhibiting a good representation of leaf morphology for the species. Scale on the left indicating both centimetre and millimetre increments.

Additional specimens examined: WESTERN AUSTRALIA: COOLGARDIE: Southern Cross: All nine voucher specimens collected south-east of Southern Cross, within the vicinity of Marvel Loch, [precise localities withheld for conservation reasons], K.R. Newbey 6035, 21 Sep 1979 (PERTH 03401502); J. Warden & D. Leach 37945, 29 Sep 2015 (PERTH 08684529); J. Warden & D. Leach 37954, 21 Oct 2015 (PERTH 08684537); J. Warden & D. Leach 37955, 21 Oct 2015 (PERTH 08684545); J. Warden & D. Leach 37951, 22 Oct 2015 (PERTH 08684502); J. Warden & D. Leach 37952, 22 Oct 2015 (PERTH 08684553); J. Warden & D. Leach 37953, 22 Oct 2015 (PERTH 08684561); J. Warden & D. Leach 37949, 23 Oct 2015 (PERTH 08684499); J. Warden & D. Leach 37950, 23 Oct 2015 (PERTH 08684510).

Etymology: The specific epithet is derived from the Greek words *coryne*, ‘a club’, and *phoros*, ‘bearing’, with reference to the distinctive club-shaped peduncles.

Distribution and habitat: Known only from two areas (approximately 30 km apart) near Marvel Loch, south-east of Southern Cross, Western Australia (Fig. 4). Plants of *H. corynophora* grow in damp depressions which seasonally dry into areas of red or red-brown cracking clays or clay loam, surrounded by low open woodland often dominated by *Eucalyptus salubris* F.Muell. and is associated with other annuals such as *Goodenia pinnatifida* Schltld., *Goodenia heatheriana* L.W.Sage, *Ptilotus carlsonii* F.Muell., and *Gnephosis intonsa* S.Moore.

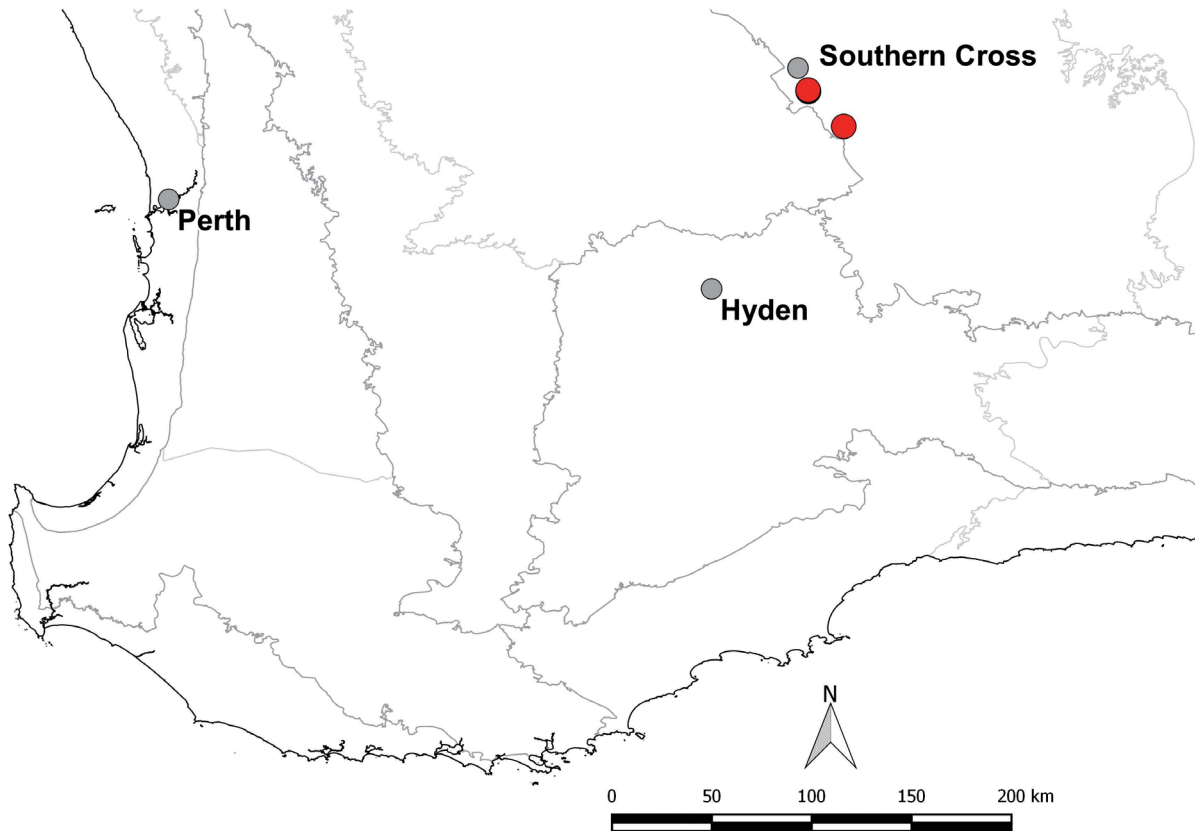


Fig. 4. Distribution of *Hydrocotyle corynophora* within Western Australia based on the specimens held at PERTH (marked by the red dots); *Interim Biogeographic Regionalisation for Australia version 7* bioregions are shown in grey, with subregions in light grey.

Phenology: Flowering and fruiting from September to October.

Conservation status: *Hydrocotyle corynophora* is currently listed as Priority One under Department of Parks and Wildlife Conservation Codes for Western Australian Flora (Jones 2015) and is geographically restricted to areas of open woodland on red-brown clay loam south-east of Southern Cross. Due to the lack of collections of this species over the past 126 years, little is known in regards to habitat specificity, environmental cues for seed germination and possible seed dormancy. Further surveys for *H. corynophora* in similar habitats will be important in determining the level of rarity for this species.

Affinities: *Hydrocotyle corynophora* shares a number of vegetative and reproductive traits with the WA endemic, *H. hispidula* Bunge. Both species are annuals with a basal rosette of trilobed to palmatifid leaves, umbels borne on ascending leafy stems, leaf opposed umbellate inflorescences, dorsiventrally flattened pedicels, mature mericarps with raised lateral ribs in respect to the dorsal and median ribs, surface ornamentation on mature mericarps and persistent carpophores. *Hydrocotyle corynophora* differs from *H. hispidula* by having pale orange-brown stipules (white and translucent in *H. hispidula*) with erose margins (distinctly ciliate in *H. hispidula*), shallowly ribbed stems and peduncles, swollen club-shaped peduncles (formed during fruit development and seed maturation), connate pedicel bases and mature mericarps with glabrous surfaces between the (distinctly raised) lateral ribs and the commissure.

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