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***PULTENAEA KRAEHENBUEHLII*, A NEW SPECIES ENDEMIC
TO THE NORTHERN MOUNT LOFTY RANGES,
SOUTH AUSTRALIA**

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Abstract

A new rare species of *Pultenaea* is described that has hitherto been included in *P. largiflorens*, and more recently, *P. stricta*. It is confined to a narrow range of habitats on the upper rocky slopes of Tothill Range and one small outlying hill. Despite a strong superficial resemblance to *P. stricta*, the new species is morphologically distinct and many characters distinguishing the two species are tabulated. *Pultenaea kraehenbuehlII* seems most closely related to *Pultenaea stricta* and *P. gunnii* ssp. *tuberculata*.

The first collection of *Pultenaea kraehenbuehlII* was made by Enid Robertson in 1952 from a small hill known locally as Spring Hill, near Black Springs in the northern Mount Lofty Ranges. This site was of interest because it had the (then) only known South Australian population of *Eriostemon verrucosus* A. Rich. (Bendigo Wax-flower), a remarkably disjunct outlier from its main distribution in western Victoria. The *Pultenaea* specimen was incorrectly identified as *P. largiflorens* F. Muell. ex Benth., a species widely distributed in woodlands of southern Australia. Subsequent collections of the *Pultenaea* made by botanists visiting the *Eriostemon* population at this site over the years have remained misidentified in the same way.

In 1963 the new species was inadvertently collected in the nearby Tothill Range but remained unrecognised in a mixed collection with *Pultenaea largiflorens*. Notably this coincided with the discovery of a second *Eriostemon* population, also on Tothill Range (Kraehenbuehl, 1992, p. 352).

The *Pultenaea* was disregarded until a 1973 collection from Tothill Range (A.G. Spooner 3029) was given a field determination as *Pultenaea* ? *stricta*. As *P. stricta* Sims was otherwise confined to Victoria, Tasmania and the lower Southeast of South Australia, the occurrence was finally recognised as being biogeographically significant. A collection that has been attributed to NSW from the herbarium of R. Tate dated 13.xi.1882 from Lake George most likely refers to Lake George near Beachport in the South-east of South Australia. Henceforth the Tothill Range *Pultenaea* was generally identified as a Northern Lofty outlier of *P. stricta*, the view adopted in the flora treatments of Weber (1986; 1993), although some material continued to be confused with *P. largiflorens*.

Despite the general morphological similarity with *P. stricta*, the possibility of the Tothill Range *Pultenaea* being a distinct species was suggested by the very different habitat (rocky quartzite slopes compared to swampy habitat) and habit (a dense, stiff, often compact and woody shrub compared to an effuse, flexuose and slender shrub). Closer examination revealed that the new species is quite different from *P. stricta* in many morphological characters.

***Pultenaea kraehenbuehlII* P. Lang, sp. nov.**

Pultenaeae strictae Sims affinis, a qua differt caulibus cito glabrescentibus; ramulis lateralibus divergentibus late vel patentibus, saepe subsperiscentibus; internodiis brevioribus (longitudine 2-5 mm a basi ramuli lateralis ad nodum primum ramuli lateralis); facie adaxiali folii impolita, insuper nervo medio plana atque sine sulco; apice folii modo leniter recurvato, obtuso, sine mucrone; lobis stipulae divergentibus; floribus (1)2-4(5) per racemo capitato.

Type: P.J. Lang 2532, 19.ix.1996, south side of Niblet Gap, 33°56'09"S 138°57'03"E, Tothill Range, Northern Lofty Region, South Australia (holo.: AD 99727281; iso.: AK, BRI, CANB, HO, K, MEL, NSW, NY, PERTH, PRE).

Description (Fig. 1)

Dense, intricate, erect, woody *shrub* to 1.5m (rarely 2m) high with stiff, divaricate branches; mainly glabrescent, with sericeous-pubescent indumentum of simple, straight, whitish, basifixed, antrorse, appressed hairs on young shoots, and persisting on pedicels, calyx and ovary. *Branchlets* rapidly glabrescent; recently-hardened young stems glabrate, angular, pale buff to light orange-brown (RHS, 1966: 174A–D) aging red-brown (176 B) with pustulate to irregularly tuberculate ribs confluent with rostriform pulvini on which petioles are inserted; older ribs swollen, rounded and crisped or corrugated; older stems becoming terete with shiny pellicle aging whitish to silver-grey (198 D) and splitting along ribs to form longitudinal vitae; lateral branchlets mostly widely divergent to patent, often subspinescent after abscission of terminal inflorescence and distal leaves. *Leaves* alternate, rather crowded, often reducing markedly in size towards branchlet apices on flowering branches; *petiole* 0.4-0.9 mm long, light brown (165 C), finely rugose, glabrate; *lamina* (2) 4-9 (10.5) mm long x (1.4) 2-3 (3.7) mm wide, narrowly oblong-obovate to oblanceolate (or broadly elliptic-obovate and very small immediately below inflorescence or near apex of terminal shoots), more or less flat to slightly concave above with a gently recurved, obtuse apex; strigose when young, soon glabrate; discolorous, slightly darker dorsally than ventrally, greyish-green (136 B-C); margins on ventral surface slightly thickened and usually weakly pustulate; *midrib* dorsally not evident to obscurely and faintly ridged (in dried material), ventrally inconspicuous, slightly raised, concolorous with lamina except for pale brownish tinge near junction with petiole, and usually lightly pustulate. *Stipules* 0.5-1 mm long, orange-brown (172 A-D) aging dark red-brown (166 A), fused behind petiole with only upper 1/2 to 1/4 of lobes free; lateral outer faces narrow-triangular, comprising divergent midribs and narrow outer laminae; inner laminae connate, forming a central membrane c. 0.5 mm wide appressed to stem. *Inflorescence* usually terminal, sessile, condensed head-like raceme of (1)2-4(5) flowers and a terminal vestigial pubescent *rhachis* 3-4 mm long bearing 2-3(5) reduced brown floral bracts at summit. *Bracts* 12-17, imbricate, obtuse to obscurely emarginate, chartaceous, glabrate except for small tomentose apical tooth and minutely fimbriate margins, deciduous just before anthesis (except for a few persistent basal, small, dark, stipuliform bracts); inner bracts to 5-6 mm long, ovate to elliptic, (light) orange-brown (172 A-D), outer bracts shorter, broadly ovate, red-brown (166 A). *Flowers* 7.5-9 mm long; *pedicels* 1.8-3 mm long, sericeous; *bracteoles* 2.5-3 (4) mm long x 0.4-0.8 mm wide, (narrowly)-oblanceolate, sparsely strigose to glabrescent, orange-brown (172 B-C), lacking stipules, inserted 1/3 to 1/2 way up from base of calyx tube, stipe-like base of bracteole often adnate to calyx tube for 0.5-0.8 mm proximally; *calyx* (3.5) 4-5 (5.5) mm long, inside surface pinkish-red (47C) and mostly glabrous but puberulent near margins of lobes, outside of tube pubescent to sericeous with lobes sericeous; dorsal lobes broadly triangular; ventral lobes (1.7)2-3 mm long, triangular; *standard* 11.5-14 mm wide x 8-10 mm high with claw 2-3.5 mm long, yellow-orange (16 A), with a yellow (9 B) central patch at base surrounded by a corona of 20-25 red (53A) rays and suffused orange-red (34 A); *wings* 8.5-9.5 mm long x 3-3.5 mm wide with claw 2 mm long; *keel* 6.5-8 mm long x 3.5 mm high, red (53 A) with a small pouch near the base on each lobe, and claws 2-3 mm long; *ovary* sessile, 2-2.5 mm long, sericeous; *style* slender, curved, 6-7.5 mm long. *Pod* 7.4-8.8 mm long x 4.3-4.8 mm wide with a short mucro formed from base of style, compressed ovoid-ellipsoid, with fine raised transverse veins emanating from the thickened margins, glabrous inside, pubescent outside when young, becoming glabrous above but retaining pubescence in proximal 1/4 - 1/3 that is enclosed by calyx. *Seed* 1-2 per pod, (irregularly) ovoid, 2.7-3.6 mm long x 1.9-2.1 mm wide brown (165 A) to black (202 A); *aril* 2-2.3 mm long, pale whitish brown (165 D), divided distally into an irregular mass of fine white lobes. (Fig. 1).

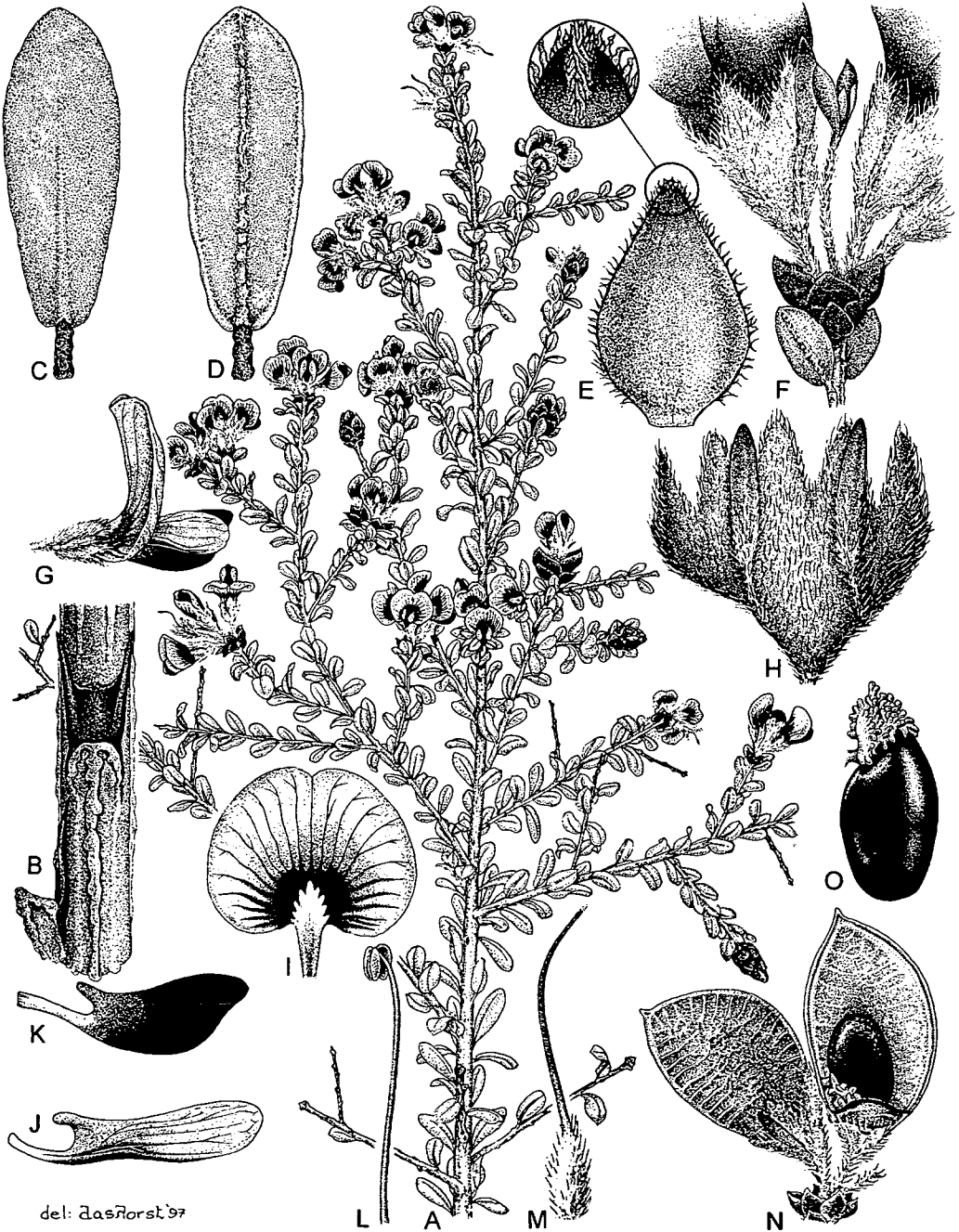


Fig. 1. *Pultenaea kraehenbuehlii* P. Lang. A, flowering branch with some buds still enclosed by floral bracts $\times 8$; B, young stem with leaves removed, showing stipules and ribs $\times 15$; C, leaf from above $\times 10$; D, leaf from below $\times 10$; E, outer floral bract $\times 5$; F, part of inflorescence showing persistent lower bracts and vestigial rachis bearing terminal bracts $\times 3$; G, flower in side view $\times 2.5$; H, opened out calyx with bracteoles $\times 10$; I, standard petal $\times 4$; J, wing petal $\times 4$; K, keel petal $\times 4$; L, stamen $\times 7$; M, gynoecium $\times 7$; N, pods $\times 4$; O, seed $\times 8$. (A–M, P.J. Lang 2532 (isotype); N & O, D.N. Kraehenbuehl 5520).

Affinities

Pultenaea kraehenbuehlii differs from many species of similar general appearance by its glabrate branchlets and leaves. It belongs with a group of species characterised by: more-or-less flat leaves with margins recurved to flat and the upper surface darker than the lower, inflorescences of terminal head-like racemes, floral bracts (when present) entire and deciduous, and pubescent ovaries. Its closest relatives appear to be *Pultenaea stricta*, and *P. gunnii* Benth. (particularly *ssp. tuberculata*), with a more distant relationship to *P. platyphylla* N.A. Wakef.. The first two species are from Victoria and Tasmania (with *P. gunnii ssp. tuberculata* confined to the Brisbane Ranges in Victoria) and the last from Victoria and southern New South Wales. This fits the pattern of a number of other species in the Northern Lofty region displaying biogeographical links with Eastern Australia.

Pultenaea largiflorens is similar to the new species in growth form and stature, leaf size, floral morphology and flowering time. It sometimes occurs sympatrically and not surprisingly has often been confused with *P. kraehenbuehlii*. However, it appears not closely related and can be readily distinguished from the new species by its: conduplicate leaves often clustered in groups of three; green, terete young stems; caducous floral bracts (falling well before flowering); axillary inflorescences; and more persistent indumentum on stems and underside of leaves. A previously unreported character in *P. largiflorens* is the presence of sub-basifixed unequally bifid hairs, distinct from the basifixed (but still ventrally attached) hairs in *P. kraehenbuehlii* (Fig. 2). Similar sub-basifixed hairs have also been observed in broad-leaved forms of *P. laxiflora* Benth.. These differences in hair types are subtle and easily overlooked but they may prove helpful in clarifying relationships within the genus.

Pultenaea kraehenbuehlii most closely resembles *P. stricta*, although there are many morphological differences between the two species which are summarised in Table 1. Useful diagnostic characters distinguishing *P. kraehenbuehlii* include its obtuse leaf apex (mucronate in *P. stricta*), absence of a furrow or crease above the midrib, divergent stipule lobes, and fewer-flowered inflorescences. It is also distinguished by more closely spaced leaves, and a series of measurements of the distance to the first leaf on lateral branchlets displayed virtually no overlap between the two species. A somewhat unreliable character is the marked reduction in fully expanded leaf size towards branchlet apices, particularly on flowering branches. This feature, while very obvious on some specimens of *P. kraehenbuehlii*, is not apparent on many others. It has also been observed once in *P. stricta* and occurs in *P. gunnii*. It may be related to growth that is put on rapidly late in the season and its significance requires further investigation.

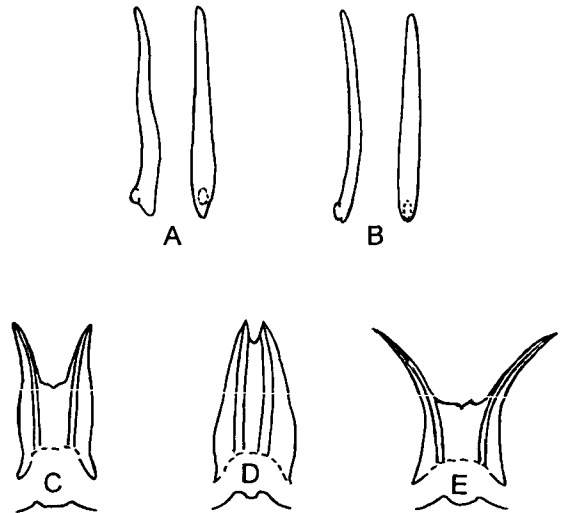


Fig. 2. Stem hairs: A, sub-basifixed unequally bifid hairs of *Pultenaea largiflorens* in lateral and dorsal view (D.N. Kraehenbuehl 5407); B, basifixed hairs of *P. kraehenbuehlii* in lateral and dorsal view (P.J. Lang 2535). Stipules: C, *P. kraehenbuehlii* (P.J. Lang 2532 (isotype)); D, *P. stricta* (R.M. Welbourne 230); E, *P. gunnii ssp. tuberculata* (M.G. Corrick 10787).

Pultenaea gunnii approaches the new species in having: flattish, generally non-mucronate leaves, and stipules with divergent lobes (Fig. 2), but overall it seems to be more different than *P. stricta*. Most significantly *P. gunnii* lacks properly developed floral bracts, having only small stipuliform bracts which (according to Corrick, 1977) enclose the buds only when very young. It also differs in its much smaller bracteoles, its stipule lobes being free for the greater part of their length, and its indumentum of loosely appressed or curved hairs that are sometimes golden or brownish-coloured particularly on the calyx. In ssp. *gunnii* the leaves differ in their ovate/lanceolate shape and their undersurface which is hairy and has distinctly recurved margins, although they agree in the obscure midrib. The resemblance to *P. kraehenbuehlii* is greater in ssp. *tuberculata* Corrick which has leaves with their maximum width near the centre and their margins thickened and not recurved, although the midrib differs in being prominently thickened (Corrick, 1993b, 1996). The presence of tubercles or pustules on the upper leaf surface and leaf margins below suggests a possible relationship with *P. kraehenbuehlii* which has pustulate to tuberculate ribs on the stem and is often lightly pustulate on leaf margins.

Pultenaea platyphylla also displays some similarities to the new species, most notably in its flattish, obtuse, non-mucronate, glabrate leaves and its angular stems developing swollen ribs which persist as silvery vitae on older branchlets. However, it differs substantially by: the more persistent stem indumentum; the markedly discoloured leaf surfaces; the emarginate leaf apex and prominently thickened midrib; the lack of pustules or tubercles; the stipules with parallel to convergent lobes; and the inflorescence of more than five flowers.

	<i>P. stricta</i>	<i>P. kraehenbuehlii</i>
Habit	<ul style="list-style-type: none"> • effuse, slender shrub with major axes largely unbranched • major branches often weak/flexuose 	<ul style="list-style-type: none"> • dense, intricate shrub with major axes divaricate • major branches always stiff and woody
Lateral branches	<ul style="list-style-type: none"> • mostly inclined to axes • never subsppinescent 	<ul style="list-style-type: none"> • mostly widely divergent to patent • often subsppinescent following abscission of terminal inflorescence and leaves
Stems	<ul style="list-style-type: none"> • persistently sericeous to sparsely pubescent or glabrescent • ribs smooth to weakly pustulate, remaining angular 	<ul style="list-style-type: none"> • glabrate • ribs pustulate to irregularly tuberculate, becoming swollen, rounded and crisped or corrugated
Leaves	<ul style="list-style-type: none"> • widely spaced, 5–30 mm to first node on lateral branches • more or less uniform in size when fully expanded • conspicuously discoloured • upper surface shiny • apex abruptly recurved, mucronate • midrib marked by furrow on upper surface • lower midrib prominent, distinctly raised • petioles pubescent or sparsely puberulent, rarely glabrous 	<ul style="list-style-type: none"> • crowded, 2–5 mm to first node on lateral branchlets • often reducing in size markedly towards apices of branchlets • obscurely discoloured • upper surface matt • apex gently recurved, obtuse • midrib obscurely raised or not evident above • lower midrib inconspicuous, barely raised
Stipules	<ul style="list-style-type: none"> • lateral lobes parallel to slightly convergent, fused median section narrower than base of lobes 	<ul style="list-style-type: none"> • petioles glabrate • lateral lobes divergent, fused median segment wider than base of lobes
Inflorescence	<ul style="list-style-type: none"> • (3) 4–6 (9) -flowered • floral bracts 15–22 	<ul style="list-style-type: none"> • (1) 2–4 (5) -flowered • floral bracts 12–17
Calyx	<ul style="list-style-type: none"> • lobes villous 	<ul style="list-style-type: none"> • lobes sericeous
Pods	<ul style="list-style-type: none"> • strigose 	<ul style="list-style-type: none"> • glabrescent

Table 1: Comparison of *Pultenaea stricta* and *P. kraehenbuehlii*.

Distribution (Fig. 3)

Endemic to the Northern Lofty region of South Australia and confined to the Tothill Range and nearby Spring Hill. The distribution is contained within an area 22 km by 6 km.

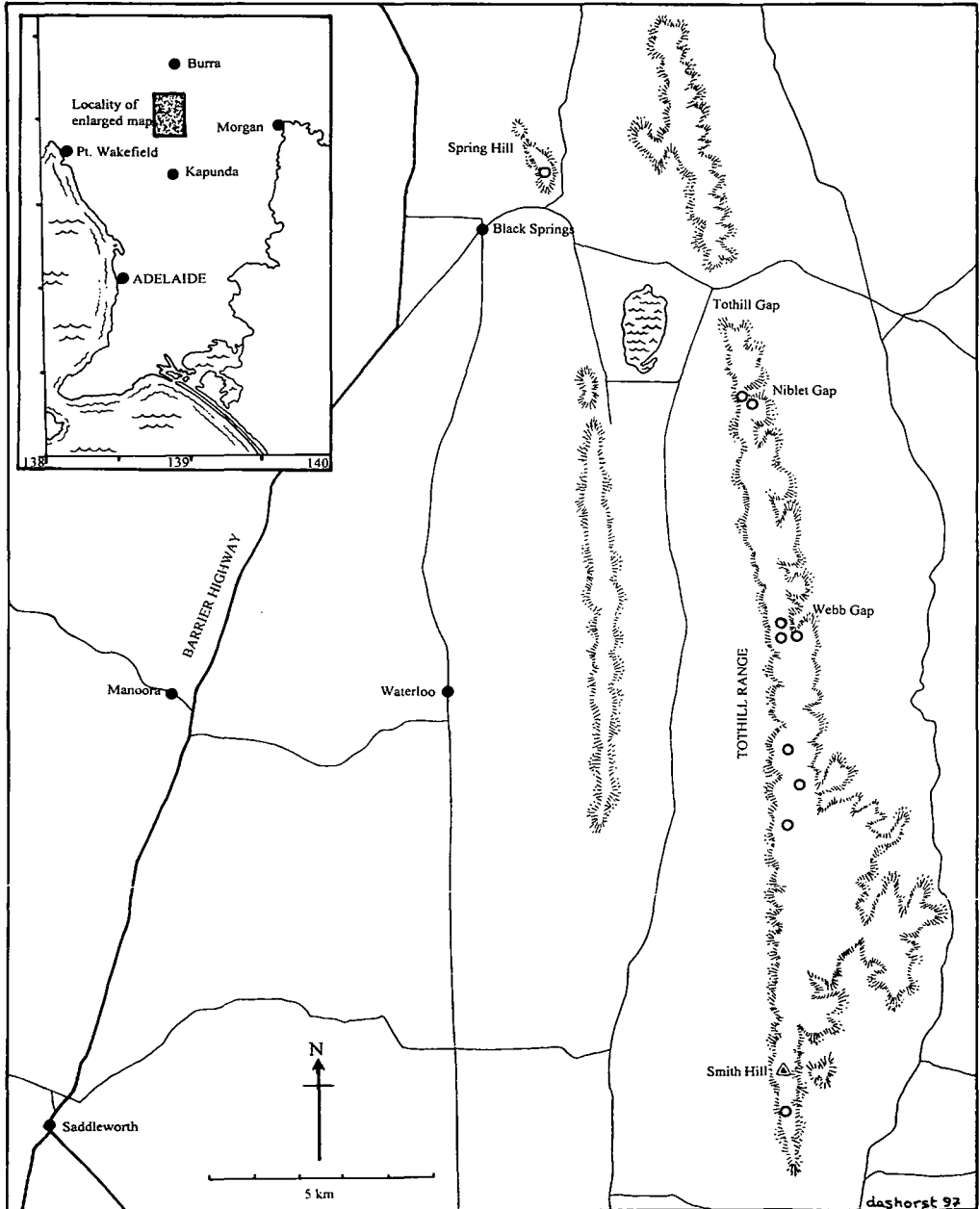


Fig. 3. Distribution of *Pultenaea kraehenbuehlii* (○).

Ecology

Pultenaea kraehenbuehlii is restricted to the upper rocky slopes of hills and ranges composed of Gilbert Range quartzite (Forbes, 1964) within an altitudinal range of 540-650 m. Soil sampled at the type locality amongst rocky outcrops was a skeletal dark grey (Munsell: 10YR 2.5/1; 3/1.5 dry) sandy loam of pH 5.25; at another less rocky site it was a dark greyish-brown (10YR 3.5/2; 6/2 dry) sandy clay-loam of pH 4.75.

The plant community comprises a Low open woodland usually with *Allocasuarina verticillata* (Drooping sheoak) and other species such as *Eucalyptus odorata* (Peppermint box), *Callitris preissii* (Native pine), *Exocarpos cupressiformis* (Native cherry) and in wetter sites, *Eucalyptus goniocalyx* (Long-leaf box). The understorey usually supports a mid-dense to scattered shrub layer with a selection of the following major species: *Spyridium parvifolium*, *Xanthorrhoea quadrangulata*, *Hakea carinata*, *Correa glabra*, *Allocasuarina muelleriana* and *Eriostemon verrucosus*. The ground cover is typically dominated by *Gonocarpus elatus*, *Cheilanthes austrotenuifolia* and various herbs.

In several instances *Pultenaea largiflorens* has been observed growing side-by-side with *P. kraehenbuehlii*. Very similar flower colouring and floral morphology, together with coincident flowering times suggests that both species employ the same pollination strategy. Despite this, they must be effectively reproductively isolated as no intermediates have ever been detected between them. This is consistent with the fact that they do not appear to be closely related on morphological grounds. *Pultenaea laxiflora* also occurs on the upper slopes of Tothill Range although uncommon, and again there is no evidence of it intergrading with *P. kraehenbuehlii*.

Closely browsed bushes of *P. kraehenbuehlii* occur both within, and outside of, stock-proof fences and indicate that it is palatable to euros as well as sheep. Macropod browsing has been reported for *P. victoriensis* Corrick by Corrick (1993a).

Conservation status

The population on Spring Hill is regarded as vulnerable because continued grazing by stock presents a long-term threat to seedling recruitment. The main population on Tothill Range is considered to be adequately reserved being well represented in Heritage Agreements areas (HA655, HA669 and HA927). Conservation status for the species is assessed as Rare (and not threatened) at national, State and region levels and the code 2RCa is proposed following the system of Briggs and Leigh (1996).

Etymology

Named after my colleague Darrell N. Kraehenbuehl, an esteemed South Australian botanist, naturalist and historian who has had a long-standing interest in the flora of the Tothill Range, and in recognition of his contribution to botanical endeavour in this State. Darrell directed my attention to this species and was the first to collect it from the Tothill Range.

Selected specimens of *Pultenaea kraehenbuehlii* (30 seen at AD):

SOUTH AUSTRALIA. NORTHERN LOFTY: *E.L. Robertson s.n.*, 29.v.1952, Black Springs.; *D.E. Symon s.n.*, 28.xii.1952 Black Springs; *G.E. Gardiner s.n.*, 2.ix.1962, Black Springs; *A.G. Spooner 1577*, 12.ix.71 Black Springs; *D.N. Kraehenbuehl 1176(B)*, 27.x.1963, Tothill Range, 1 km S of Smith Hill; *A.G. Spooner 4235*, 5.x.1975, Niblet Gap, Tothill Range; *D.J. Pfitzner 4*, 22.viii.1982, Tothill Ranges, 33°55'30"S, 138°57'30" [= Niblet Gap]; *P.J. Lang 1918*, 13.ix.1991, 5.6 km N of Smith Hill, central Tothill Range, north-facing gully behind western escarpment of Range, Section 349, Hundred of Waterloo (CANB); *P.J. Lang 1952*, 13.ix.1991, 0.5 km SE of Webb Gap, Tothill Range; *D.N. Kraehenbuehl 5520*, 7.xii.1992, Western foothills of Niblet Gap, northern Tothill Range (CANB, PERTH); *P.J. Lang 2545*, 19.ix.1996, 3.1 km S of Webb Gap, Section 352 Hundred of Waterloo, Heritage Agreement No. 655, Tothill Range, 34°00'26"S, 138°57'37"E (MEL).

Selected specimens of Pultenaea stricta (42 seen at AD):

SOUTH AUSTRALIA. SOUTH-EASTERN: *R.M. Welbourn 230 & D. Klein*, 20.x.1964, Overland Track 3 mi [c. 5km] S of Mt. Burr; *R.M. Welbourn 218*, 24.x.1964, Glencoe-Wandilo Road (CANB); *I.B. Wilson 889*, 12.x.1968, Marsh's Swamp; *N.N. Donner 9480*, 21.x.1982, Honan's Scrub Native Reserve, Mt. Gambier Forest (TRN, W, WSL); *R. Bates s.n.*, xi.1986, Piccaninnie Ponds.

VICTORIA: *P.S. Short 3208* et al., 26.ix.1988, c. 5 km east of Casterton-Dartmoor Road, along Moonlight Road (CANB, MEL); *I.C. Clarke 2111*, 30.xi.1992, Otway Plain, c. 7 km S of Purrumbete South on Jancourt Forest Road, 38°24'40"S, 143°12'47"E (A, BRJ, CANB, MEL, S).

TASMANIA: *A. Moscal 2942*, 29.ix.1983, Lyme Regis (Lagoon Flat) (HO).

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