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A REVISION OF THE GENUS *KUNZEA* (MYRTACEAE) I. THE WESTERN AUSTRALIAN SECTION *ZEANUK*

H.R. Toelken

State Herbarium of South Australia, Botanic Gardens of Adelaide
North Terrace, Adelaide, South Australia 5000

Abstract

Within *Kunzea* sect. *Zeanuk*, 21 species in three subsections are described and accompanied by discussion on their affinities based on morphological and anatomical evidence. Numerous natural putative hybrids are briefly discussed under the taxon placed first in the hybrid formulae. The paper includes publication of (a) 16 new taxa: sect. *Zeanuk*, subsect. *Arborescentes*, subsect. *Floridae*, subsect. *Globosae*, *K. acuminata*, *K. ciliata*, *K. cincinnata*, *K. clavata*, *K. glabrescens*, *K. newbeyi*, *K. rostrata*, *K. similis*, *K. spathulata*, *K. ericifolia* (Sm.)Rchb. ex Heynh. subsp. *subulata*, *K. micrantha* Schauer subsp. *hirtiflora* and subsp. *petiolata*, and (b) one new combination: *K. micrantha* Schauer subsp. *oligandra* (Turcz.)Toelken.

Introduction

Schauer(1844) distinguished seven species of *Kunzea* from Western Australia in the first volume on plants collected by Preiss, and described an eighth in the second volume (Schauer 1848). Bentham (1867) rearranged the species and placed most of them in his sect. *Eukunzea,* which largely agrees with the present sect. *Zeanuk* except that it is no longer considered to be the typical section of the genus, because, when *Kunzea* was conserved (Toelken 1981, 1981a), *K. capitata*, from eastern Australia, was selected as the type of the genus. Reichenbach (1828) in his original use of the genus *Kunzea* referred to three species. *Kunzea capitata* was selected as the type in preference to *K. ericifolia* and *K. corifolia* (now *K. ambigua*), because it has at all stages a capitate stigma, the distinguishing character used in the original publication. In the present circumscription of sect. *Zeanuk* all species are from Western Australia. Bentham's *K. muelleri* is excluded, although it shows a similar reduction of the placenta and number of ovules, because, in contrast to the western species, it has a well developed network of lateral veins in the leaves and does not shed the epidermis of its branches in a slough-like manner. A full discussion of the characteristics, their variation and affinities is included under each taxon.

The sect. *Zeanuk* is treated separately because it represents a large clearly demarcated group in the genus. The reduced venation of the leaves and the small placenta with decreasing numbers of ovules show that it is an advanced group when compared with some species of sect. *Kunzea*. As it consists of such a uniform group of species it was considered to be more informative to defer a general discussion of the morphology and generic concepts until the publication of the latter more heterogeneous section. The terminology of the inflorescences, i.e. the reduced conflorescence, the botryum, is used here as defined by Briggs & Johnson (1979). Attention is also drawn to the elongate late inflorescences sometimes observed, particularly in the subsections *Arborescentes* and *Globosae*, as they usually look quite different since their bracts enlarge and sometimes become almost leaf-like as for instance in *K. ciliata*. It is assumed that such a specimen of *K. recurva* was described as *K. spicata* (cf. typification of *K. recurva*). The bracts and bracteoles subtending each flower often vary in size relative to the flower in different plants of the same species, but their shape was found to be a reliable characteristic of each species. The lower bracts grade into the shape of the perules or scales surrounding the terminal perennating buds from which the inflorescence or vegetative shoot develops. These perules, below the botrya and usually caducous, are described to distinguish them from the bracts but they often differ from perules surrounding terminal vegetative buds.

The bark of kunzeas is not easily described although some types are very distinctive. 'Early bark' refers to that of young branches up to 1 cm in diameter as it is often observed on herbarium specimen. The bark on old stems often differs markedly. As soon as the epidermis has worn off an often distinctive bark develops, usually with vertical splits along the branches at an early stage. The solid ridges thus formed particularly in corky bark rarely show obvious transverse splits. In fibrous bark the ridges are much less distinct partly because they consist of membranous layers obtaining their fibrous texture by the decay of the soft cells in between and, partly because successive layers often split at different points. The third type of bark, not found in the Western Australian species, splits more regularly vertically and transversely, resulting in chartaceous pieces of rectangular to square shape which are shed in their entirety or as parts with straight cleavages. This tessellated pattern often grades into the fibrous one which in turn can show intermediates with the corky bark.

Keys are provided to the three subsections and in each of which there is a key to the species, subspecies and hybrids. Some species which could be mistaken as belonging to another subsection are included in both keys. For instance, *K. acuminata* and *K. similis* are included in the keys to both subsections *Globosae* and *Floridae*. Hybrids between species of different subsections have been included in both keys in order to draw attention to their existence.

The conservation status of individual taxa could not be fully evaluated since the available data were insufficient.

As it is not known how many of the duplicates of the types Schauer (1844) examined for descriptions of the species in Lehmann's compilation of the plants collected by Preiss, lectotypes have been selected. It was, however, found that he inscribed only one specimen of each collection cited, except in the case of *K. micrantha/K. micromera* where they represent different species (cf. typification of *K. micromera*). It is therefore highly likely that he had seen only the specimens he annotated and some of them should be holotypes, e.g. *K. pauciflora*, as at least some duplicates (=isotypes) had been distributed by then. Most types were examined for this study and the few that could not be located are marked 'n.v.'.

Putative hybrids

Hybrids between taxa were often observed and investigated in the field. Time was insufficient to attempt controlled artificial crossings. The shortcomings of morphological comparisons are realised; the object here is to create an awareness of the widespread existence of hybrids. Since they were largely found along disturbed road sides an increased occurrence must be expected with further interference with the vegetation.

Many, but not all possible hybrid combinations between taxa described here have been recorded. Some species do not grow near to one another. In other cases, for instance *K. affinis* and *K. jucunda*, although they often grow next to *K. micromera* and *K. recurva*, do not apparently cross with one another. Such cases of incompatibility seem to be rare as even these species hybridise with others in their own and other subsections. These individual cases do not seem to warrant studies of compatibility to obtain a wider understanding of relations. Pollen sterility was investigated in a few hybrids and was rarely found to exceed 10 to 20%, so it was not pursued as a means of identifying hybrids.

The many hybrids recorded show that the pollination mechanism(s) within sect. *Zeanuk* cannot be very selective as even pink-, white- or yellow-flowered species seem to cross easily. The flowers of different species are morphologically very similar, especially in the spacial arrangement of the floral parts, differing mainly in size.

The importance attributed here to hybrids might seem out of proportion to the numbers of plants found in a population if it were not that unusual plants, e.g. putative hybrids, are

often selectively collected. As early as the late 1840s J. Drummond collected and transmitted specimens of what seem to have been a hybrid between *K. montana* and *K. recurva*, which Turczaninov (1852) described as *K. squarrosa* (cf. 1(ii) *K. montana*).

That particular example shows the problem encountered with identifying hybrids and, closely linked to it, descriminating the species associated with them. Turczaninov based *K. squarrosa* on the pink-flowered (hybrid) form, while a yellow-flowered specimen, just mentioned at the end of the description, is now known to be one of the parental species, *K. montana*. Superficially the two specimens seem only to be colour forms of the same species. But this hybrid is an example in which a wide range of hybridisation with a complete range of backcrossing has resulted in forms so close to the original species that delimitation has become practically impossible. Without field studies of such a hybrid swarm it is impossible to distinguish between parent taxa and hybrids. A few such putative hybrid populations between different species were investigated, and the parents and the hybrids were eventually artificially delineated by what seems to be single character differences. It is purely a practical approach for localised situations which are at present rare.

This procedure was followed only where at least one large hybrid swarm with extensive backrossing was found. Most putative hybrids are incompletely known from a limited number of plants or even 'intermediate herbarium specimens' which can not be reconciled with known variation of the parental taxa involved. As more information on some of the hybrids becomes available similar artificial delimitations will have to be decided. In others the state of information is at present based on few records with limited backcrossing that they are sufficiently discrete to be individually recognised. Further field work may show some such disparate hybrids to be local forms, possibly even infraspecific taxa, of one of the putative parents (e.g. *K. micrantha* subsp. *oligandra* × *K. micromera* cf. 12c(i) for discussion). The intention here is to draw attention to the problems which field studies were too limited to resolve. Hybrids will, remain a problem in assessing herbarium material because:

1. the wide range of intermediates of a hybrid swarm resembles the range of intermediates between taxa.
2. isolated hybrids from two or more areas need not be similar to another with the same parents. Only in a hybrid swarm is the linking of all characters of the two parents achieved.
3. hybrids of perennial plants such as *Kunzea* can, at least theoretically, persist at a locality where one or both parents are no longer found. The alternative, that of long distance distribution of *Kunzea* seeds, is regarded as very unlikely. The sizes of populations of kunzeas were found to fluctuate extensively since they thrive in disturbed areas but soon get overgrown by the more permanent members of the vegetation of the area. Although most putative hybrids described here are based on field studies by the author, some specimens are cited from areas where one of the parents has not yet been recorded. Additional collecting to the original material seen has already redressed this in a few cases during the study.

With a full awareness of the problems, future collectors will be able to contribute to their clarification. Additional information of at present insufficiently known hybrids will soon render the keys provided useless. Nevertheless the mention of these hybrids in the keys will hopefully draw the user's attention to the discussion of hybrids, which are often far removed from the second taxon in the hybrid formula. The system of cross referencing and numbering, cumbersome though it is, avoids the repetition of discussions under each taxon.

KUNZEA sect. ZEANUK

Kunzea sect. **Zeanuk** Toelken, *sect. nov.*

Kunzea sect. *Eukunzea* Benth., Fl. Austr. 3: 112 (1867), nom. inval. partly, excl. *K. muelleri.*

A sectionibus aliis epidermide decorticanti opaca, foliis venis supralateralibus brevissimis, loculis ovarii (2–) 8–12 (–16) ovulis differt.

Type species: *K. glabrescens* Toelken.

Young branches with epidermis and cuticle soon becoming replaced and are resembling the slough of a snake. *Leaves* often with horny margins and usually without marginal cilia, with supralateral primary veins up to one-third of the leaf length and all veins free. *Calyx lobes* flat and appressed to buds (except in *K. ciliata*), not or scarcely ridged. *Ovary* with (2–) 5 locules, with small placenta with 2 more or less free lobes each with 1 or 2 rows of ovules which are spreading and smaller above, and/or pendulous and longer below; ovules (2–) 8–12 (–16) per locule.

Notes

Species of this section are restricted to south-western or rarely southern Western Australia. Bentham's sect. *Eukunzea*, which closely resembles this section, was based only on the low number of ovules, the most easily accessible characteristic of this section. It included for that reason *K. muelleri* from eastern Australia, and would now also need to incorporate the more recently described *K. cambagei.* That this similarity is a result of convergent evolution is shown by the characteristic leaf venation of the sect. *Zeanuk*, a character not easily observed in herbarium material. In contrast to this the other character typical of the sect. *Zeanuk* is the peculiar shedding of the epidermis as it becomes first opaque and then peels in large pieces. In all the eastern species the epidermis first splits longitudinally and then usually wears off as the bark develops, so that branches at no stage have an opaque outer layer as is typically found in sect. *Zeanuk.* These three characteristics are shown by the 21 Western Australian species grouped here in three subsections, but not by *K. baxteri* and *K. pulchella*, which also occur in that region.

Bentham's concept of sect. *Eukunzea* as being the typical section of *Kunzea* cannot be maintained since *K. capitata* was chosen, in preference to *K. ericifolia*, as lectotype of the genus *Kunzea* when it was conserved (Toelken 1981, 1981a). The epithet 'Zeanuk', an anagram of *Kunzea*, is used here for a section which now largely represents what Bentham considered to be true kunzeas.

Key to subsections

1. Petals and stamens yellow to cream; large shrubs or trees with few erect stems, (1.2–) 1.5–3 (–5) m tall; young bark usually pale yellowish-brown, smooth to slightly fluted, somewhat corky ..... A. subsect. *Arborescentes*
1: Petals and stamens pink, purple or mauve, rarely white; shrubs with spreading to decumbent branches, 0.2–1.2 (–2.5) m tall; young bark grey, usually irregularly lacerated and more or less fluted, fibrous:

2. Inflorescences with (10–) 15–30 (–40) spreading flowers, with leaves below not clasping or only in lower third, mainly terminal on long shoots; stamens longer than petals ..... B. subsect. *Globosae* (see p. 00)
2: Inflorescences with (1–) 3–8 (–12) flowers more or less erect, with leaves below clasping at least two-third, terminal commonly on short shoots clustered below one on a long shoot (superconflorescence); stamens shorter, as long as, or sometimes just longer than petals ..... C. subsect. *Floridae* (see p.oo)

A. **Kunzea** subsect. **Arborescentes** Toelken, *subsect. nov.*

A subsectionibus aliis fruticibus elatis vel arboribus ad 6 m altis, floribus luteis vel cremeis differt.

Type species: *K. glabrescens* Toelken.

Large shrubs or trees (1.2–) 1.5–3 (–6) m tall, usually with few or rarely one stem, each with erect often almost virgate branches and without short shoots; bark on branches 5–15 mm diam. usually scarcely fluted and somewhat corky. *Leaves* linear to obovate and usually without distinct horny margin. *Inflorescence* with (12–) 18–30 (–38) flowers in globular heads, with vegetative growth after flowering from the terminal bud. *Petals* obovate to almost orbicular, shorter than stamens, yellow or cream.

Distribution and ecology

Species of subsect. *Arborescentes* are usually found in wet habitats along banks of rivers and lakes or seepage areas, rarely in winter-wet depressions. Only *K. montana* is found on upper slopes and then often in association with rock outcrops of the Stirling Range. Most of the species are locally common and occur mainly west of these mountains except for *K. ericifolia* which extends south-east to West Mount Barren.

Notes

The pale yellow flowers and arborescent habit may seem trivial characters to segregate these six species but they seem to form a natural grouping. Even *K. montana,* which had often been combined with *K. recurva* and which is here placed in subsect. *Globosae,* shows more similarities to *K. sulphurea* and was therefore placed in this subsection. *Kunzea montana*'s more robust habit and often unusually small plants must be attributed to its frequently more exposed habitat as at other times it becomes tree-like with erect branches, unlike *K. recurva* (compare also the shrub-like plants of *K. ericifolia* subsp. *subulata* on top of West Mount Barren). The confusion was probably caused by the early records of hybrids between the two species (cf. *J. Drummond 5, 136* and *137* in discussion of 2(ii) *K. squarrosa* under hybrids of *K. montana*), which then provided a complete range of intermediates similar to those now also recorded between *K. recurva* and *K. sulphurea.*

Young branches of plants of species of subsect. *Arborescentes* may at first appear to produce peeling fibrous bark, but this is usually only the peeling epidermis for the corky bark develops later.

The rate of growth in these species is generally so rapid that, at least on herbarium specimens, growth patterns can only be studied on specimens of senescent plants. Terminal vegetative growth above fruiting inflorescences, unless injured, is the usual pattern. In contrast to the *Floridae* all branches are long shoots and only exceptionally subterminal short shoots with inflorescences are produced in mature plants of especially *K. ericifolia.*

Key to species, subspecies and hybrids of subsect. *Arborescentes*

1. Petals pale to deeper pink (sometimes becoming pale in dried specimens):
    2. Calyx lobes with margins recurved ..... 7. *K. recurva*
    2: Calyx lobes with margins incurved or spreading:
        3. Bracts with acute apex; young branches tomentose with coiled hairs:
            4. Branches wiry; leaves more or less ridged ..... 13(ii). *K. micromera* × *K. montana*
            4: Branches rigid, spreading; leaves without ridges ..... 1(ii). *K. montana* × *K. recurva*
        3: Bracts truncate to rounded; young branches glabrous or with few straight hairs:
            5. Bracteoles spathulate-obovate; leaf lamina broadly elliptic ..... 6(ii). *K. clavata* × *K. recurva*
            5: Bracteoles sessile-obovate; leaf lamina obovate to broadly obovate ..... 7(vii). *K. recurva* × *K. sulphurea*
            5: Bracteoles sessile obovate; leaf lamina oblong-oblanceolate..... 7(iii) *K. glabrescens* × *K. recurva*
1: Petals pale to deeper yellow:
    6. Leaf lamina flat, with rounded apex, elliptic, obovate to rarely almost orbicular:
        7. Bracts longer than 3.5 mm; young branches with coiled hairs ..... 1. *K. montana*

7: Bracts up to 3 mm long; young branches glabrous or with short erect hairs:
8. Young branches with short erect hairs; bracteoles obovate, glabrous ..... 2. *K. sulphurea*
8: Young branches glabrous; bracteoles obovate-spathulate, with scattered long hairs at the base ..... 6(ii). *K. clavata* × *K. recurva*

6: Leaf lamina almost terete or club-shaped, or if compressed then with pointed apex:
9. Bracteoles ovate to broadly ovate ..... 3. *K. glabrescens*
9: Bracteoles linear, linear-oblanceolate or -spathulate:
10. Leaf lamina club-shaped, glabrous or with few scattered hairs; bracts truncate, rounded or rarely bluntly acute, if hairy then restricted to lower central vein:
11: Young leaves and branches glabrous; bracts truncate or rounded and glabrous on lower flowers ..... 6. *K. clavata*
11: Young leaves and branches with few hairs; bracts bluntly acute or rounded and usually hairy on lower parts ..... 6(i). *K. clavata* × *K. ericifolia* subsp. *ericifolia*
10: Leaf lamina linear and more or less terete, or if broader then somewhat dorsiventrally compressed; bracts beaked or pointed, more or less covered with dense hairs:
12. Leaves glabrous; bracteoles spathulate ..... 5. *K. spathulata*
12: Leaves more or less hairy; bracteoles linear to linear-oblanceolate:
13. Young leaves hairy on both surfaces, somewhat dorsiventrally compressed or triangular in section; hairs on branches and leaves equally long ....4a. *K. ericifolia* subsp. *ericifolia*
13: Young leaves mainly hairy above, strongly convex below (to semicircular in section); hairs on branches often shorter and appressed ..... 4b. *K. ericifolia* subsp. *subulata*

1. **K. montana** (Diels) Domin, Mém. Soc. Sci. Bohême (1921) 22, 2: 87 (1923); Blackall and Grieve, West. Austr. Wildflow. edn 2, 3A: 97 (1980).

Type: Western Australia, Stirling Range, *F. Mueller s.n.*, (*lecto.*—selected here: MEL 92674; B†; *possible isolecto.*: MEL 92775; *syn.*: Toolbrunnup, *F.L.E. Diels 4675* (B†, PERTH — fragment).

K. recurva var. *montana* Diels in Diels & E. Pritz., Bot. Jahrb. Syst. 35: 424 (1905); Blackall & Grieve, West. Austr. Wildflow. edn 1, 1: 293 (1954); Erickson et al. Flow. & Pl. West. Austr. 71, fig. 193 (1973).

K. squarrosa Turcz., Bull. Cl. Phys.-Math. Acad. Imp. Sci. Saint-Pétersbourg 10: 336 (1852), partly as for syntype: *J. Drummond 5, 136* — not as to lectotype.

K. recurva var. *recurva* auct. non Schauer: Benth., Fl. Austr. 3: 114 (1867), partly as for *J. Drummond 24 & 5, 136.*

Shrubs or sometimes trees with a short stem, up to 2 m tall, little- to much branched with lateral branches spreading to usually stiffly erect with terminal inflorescences; young branches often with distinct decurrent flanges, villous with long and short more or less twisted or coiled hairs but sometimes hairs restricted to area around leaf bases; early bark shallowly fissured, corky. *Leaves*: *petiole* (0.8–) 1–1.8 (–2.1) mm long, appressed in lower part; *lamina* orbicular, obovate to depressed obovate or rarely oblanceolate, (2.2–) 2.5–4.5 (–6.7) × (2.8–) 3.6–5 (–6.1) mm, rounded to truncate, but apex usually mucronate, cuneate to abruptly constricted into petiole, flat to more or less furrowed above, flat to somewhat convex below, spreading, becoming recurved at least in the upper third, glabrous. *Inflorescence* a spherical botryum with 18–32 (–38) flowers terminal on some branches, rarely clustered at the end of branches on short and long shoots, with terminal vegetative growth after flowering; *perules* usually 5 or more, depressed obovate, with rounded to truncate apex, usually with numerous veins (more than 10), glabrous or with few mainly marginal hairs, decidous; *bracts* broadly depressed-obovate to broadly obovate-spathulate, with the stalk as long as the broadened apex when subtending flowers of the upper parts of the inflorescence, 5.5–7 (–8) × 5–6 (–6.7) mm, rounded or rarely mucronate, with more than 10 veins if broad, to 3 in spathulate ones, glabrous rarely with few hairs towards the apex or at the base, or sometimes ciliate; *bracteoles* in pairs, linear-oblanceolate to oblanceolate-spathulate, 4.8–5.5 × 1.5–1.9 (–2.1) mm, truncate to rounded, tapering into a shorter or longer stalk-like base, 1 to few-veined, with hyaline margins, glabrous except for

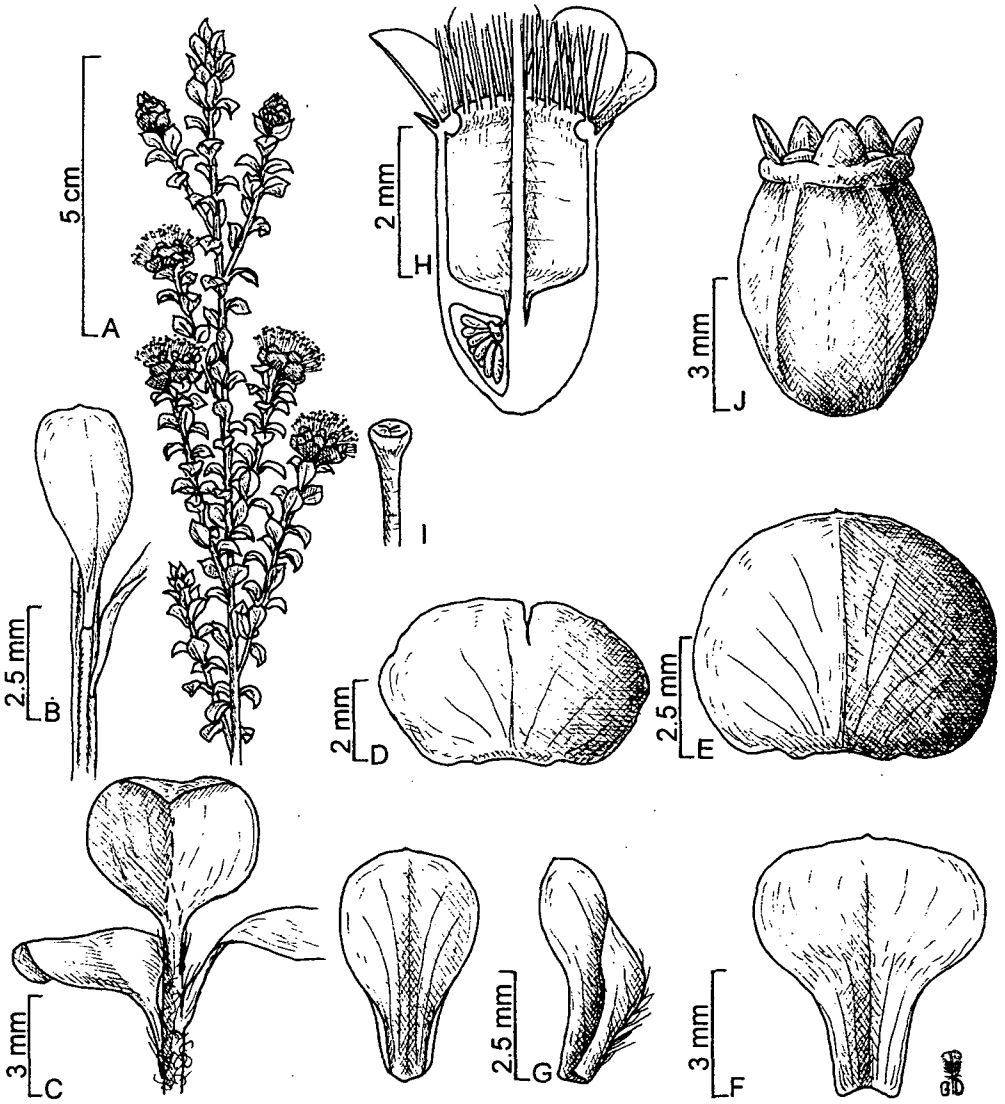
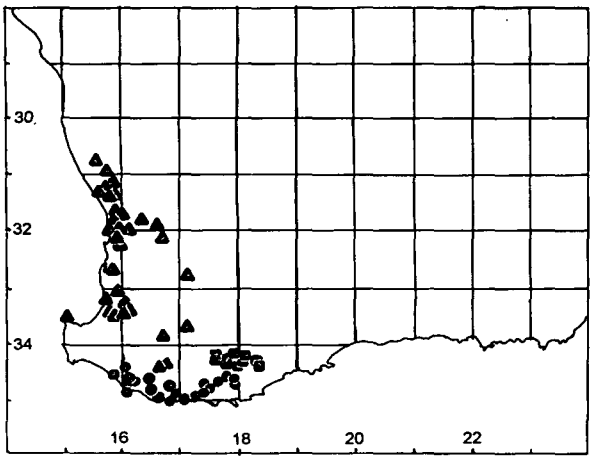


Fig. 1. ***K. montana*** (Diels)Domin. A, flowering branch; B, C, branchlet variation with or without coiled hairs, or with narrow or broad leaves; D, perule; E, lower bract; F, upper bract; G, bracteole; H, half flower; I, stigma; J, fruit. (A, B, D–I, *H.R. Toelken 7170*; C. *A. Morrison s.n.*, 13.x.1902; J, *J. Drummond MEL 92700.*)

long hairs along central ridge. *Hypanthium* 4.5–5.3 mm long when flowering (free tube ca 3 mm long), glabrous. *Calyx lobes* ovate, 0.7–1.1 mm long, rounded, often with hyaline margin, scarcely incurved, not ridged, glabrous. *Corolla lobes* obovate-orbicular, 2.2–2.5 mm long, sessile or scarcely clawed, cream to pale yellow. *Stamens* 50–67 in more than one whorl; filaments 4.2–5 mm long; anthers with dorsal gland scarcely protruding. *Ovary* with 5 locules, surmounted by a scarcely broadened style base sunk into the upper surface; placenta narrowly elliptic forming a scarcely fleshy disc with conical attachment connected to the upper third, with lobes connate mainly on the outside margins, each lobe with 1 to 2 rows of ovules; ovules 12–14 per locule, spreading except for two lowest longer pendulous ones; style 6.8–7.5 mm, scarcely broadened towards the base; stigma scarcely broader than style with shallow central depression. *Fruit* an elongate urceolate capsule usually slightly constricted below the erect calyx lobes. *Flowers:* October, November. *Common name:* mountain kunzea (Erickson et al. 1973, Blackall & Grieve 1980). Fig.1.

Distribution and ecology



Map 1. ***K. montana*** ■; ***K. sulphurea*** ●; ***K. glabrescens*** ▲.

Known only from the Stirling Range where it grows on rocky slopes or associated with rock outcrops often below rock faces. Map 1.

Conservation status

Rare but all populations are conserved in Stirling Range National Park.

Diagnostic features

The species could be confused with *K. sulphurea* because of the yellow flowers and very broad bracts, but is distinguished by its hypanthium being almost twice as long, broader leaves and spathulate bracts that subtend the upper flowers.

Variation

Specimens of *K. montana* show considerable variation in size and shape of leaves and in tomentum as well as in the more or less pronounced flanges on the branches. Some of this variation is local, as, for instance, a form with particularly broad leaves which are abruptly constricted towards the base that has been recorded from Red Gum Pass. Since plants are usually restricted to rock outcrops or rock faces, populations are often isolated. However, until a full range of variation of each population has been recorded such local variation cannot be fully evaluated.

Typification

The sheets of two syntypes in B were destroyed. A fragment of *F.L.E. Diels 4675* exists in PERTH. Another small specimen from the Blackall collection bears no number or other means by which it can be recognised as a type except from an annotation that it was collected by Diels. The leaves are narrower than 4–5 mm as described by Diels, but then they are not much broader in the PERTH specimen except that leaves below the inflorescence tend to be narrower. The specimen *Mueller s.n.* MEL 92674 was selected as the lectotype because it is accompanied by the field label. MEL 92775 is a possible duplicate.

Specimens examined

WESTERN AUSTRALIA: *T.E.H. Aplin 2088*, Mt Toolbrunup, 17.x.1962 (PERTH); *A.M. Ashby 585*, towards Toolbrunup, 5.x.1963 (AD); *J.S. Beard 7446*, Toolbrunup, 25.ix.1975 (NSW); *7604*, Talynberlup, 30.ix.1975 (NSW); *B.G. Briggs NSW 124060*, Red Gum Pass, 10.x.1960 (NSW); *E.M. Canning CBG 34182*, Bluff Knoll, 24.x.1968 (CBG); *CBG 34183*, Bluff Knoll, 24.x.1968 (CBG); *CBG 34414*, 12.8 miles from Chester Pass Road, 23.x.1968 (CBG); *CBG 45970*, Mt Hamilton, 9.x.1968 (CBG); *F.L.E. Diels s.n.*, Stirling Range, s.d. (PERTH); *A.A. Dorrien-Smith s.n.*, Warrunup Hill, Stirling Range, -.-.1910 (K); *J. Drummond 24*, W. Australia, s.d. (MEL 92677); *J. Drummond 5, 136*, W. Australia, 1849 (BM, K, NSW); *J. Drummond MEL 92700*, W. Australia, s.d. (MEL); *R. Edmiston 776*, Stirling Range, 9.vii.1974 (PERTH); *A.R. Fairall 466*, above Red Gum Springs, 9.x.1962 (KPBG, PERTH); *J. Forrest MEL 92724*, Stirling Range, xi.1934 (PERTH); *A.S. George 10430*, The Arrows, 11.x.1970 (PERTH); *A.S. George s.n.*, Bluff Knoll, 12.xi.1961 (PERTH); *R. Hill AD 966041738*, Stirling Range, ix.1953 (AD); *R. Hill & R. Jordan AD 966081036*, Ross Peak, ix.1953 (AD); *A. Morrison s.n.*, Red Gum Pass, 13.x.1902 (K, PERTH); *E. Mullins 376*, Bluff Knoll, 6.i.1978 (CBG); *K. Newbey 1455*, Mt Warrungup, 6.ix.1964 (PERTH); *M.E. Phillips CBG 10061*, above Red Gum Springs, 9.x.1962 (CANB, CBG); *R.D. Royce 6055*, Bluff Knoll, 27.x.1959 (PERTH); *B. Sachse CBG 32891*, track up Mt Toolbrunup, 27.x.1968 (CBG); *H.*

Steedman 14, Stirling Range, i.1932 (PERTH); *A. Strid 21564*, Bluff Knoll, 25.xi.1982 (K, PERTH); *H.R. Toelken 7170*, Bluff Knoll, 1.xi.1981 (AD, PERTH); *J.W. Wrigley CBG 028472*, Mt Hamilton, 9.x.1968 (BRI, CBG).

Putative hybrids

1(i) *K. micromera* × *K. montana* see 13(ii) *K. micromera*

1(ii) ***K. montana* × *K. recurva***

K. squarrosa Turcz., Bull. Cl. Phys.-Math. Acad. Imp. Sci. Saint-Pétersbourg 10: 336 (1852), **pro species**.

Type: Western Australia, *J. Drummond 5, 137* (*lecto.* selected here: KW—photo in PERTH!; *isolecto.*: BM, K, MEL 92676; *syn.*: excl. *J. Drummond 5, 136* BM, NSW—now identified as *C. montana*).

The rigid and robust habit, the villous tomentum with short coiled hairs, and the absence of recurved margins of calyx lobes are characters of *K. montana*. The broad, short petiole (0.6–1 mm long), the strongly recurved leaf lamina, the narrower inconspicuous bracts (3.2–3.5 (–5) mm broad), which are acute or bluntly acute and shorter than the flower buds, as well as the pink petals suggest that *K. recurva* is the second parent.

Typification

K. squarrosa Turcz. (1852), the first name for the species complex, must be rejected as it is based on a hybrid. The author stated unambiguously in the diagnosis to the protologue that the pink-flowered syntype (*Drummond 5, 137*), i.e. the hybrid, is the typical one and the other one with white (pale yellow?) flowers is cited as an additional specimen. A lectotype was chosen accordingly from a number of duplicates of *Drummond 5, 137*, while *Drummond 5, 136* with white (pale yellow?) flowers and longer and larger bracts must be identified as typical *K. montana* and excluded from this taxon. A specimen of *Drummond 5, 137* (K) must also be identified as *K. montana.*

Specimens examined

WESTERN AUSTRALIA: *J. Drummond 5, 137*, s.loc., 1849 (MEL); *J.W. Wrigley CBG 26964*, above Red Gum Springs, 10.x.1968 (CBG, BRI).

2. **K. sulphurea** Tovey & P. Morris in Proc. Roy. Soc. Victoria n.s. 35: 194 (1923).

Type: Western Australia, Big Brook near Pemberton, *M. Koch 2539*, *(lecto.*—selected here: MEL 92310; *syn.*: *M. Koch 2539* (BM, MEL 92311, 92312, 92313, 92315); *possible isosyn.*: *M. Koch 2539* (K, NSW, PERTH).

Shrubs or small trees 1.7–3.5 (–6) m tall, with few stems stiffly erect and with thin and wiry lateral branches, much branched; young branches with decurrent flanges slightly raised, usually densely covered with very short erect hairs; early bark fibrous-mosaic becoming thinly corky, very shallowly fluted. *Leaves*: *petiole* (0.2–) 0.3–0.5 (–0.6) mm long, appressed; *lamina* oblanceolate, rarely elliptic-oblanceolate, (2.8–) 3–3.4 × (1–) 1.4–2.5 mm, bluntly acute to rounded, gradually constricted into petiole, usually flat above, below slightly convex or ridged and with subterminal blunt point, spreading becoming sometimes recurved later, glabrous or rarely with very short hairs on the lower parts of the leaves. *Inflorescence* a spherical botryum with (12–) 15–19 (–23) flowers, terminal mainly on lateral branches and usually not clustered, rarely with terminal vegetative growth after flowering; *perules* few to usually more than 5, broadly ovate to depressed ovate, with rounded apex, with numerous but usually indistinct veins, with hyaline margin and often with marginal cilia; *bracts* broadly obovate to obovate-spathulate towards the apex of the

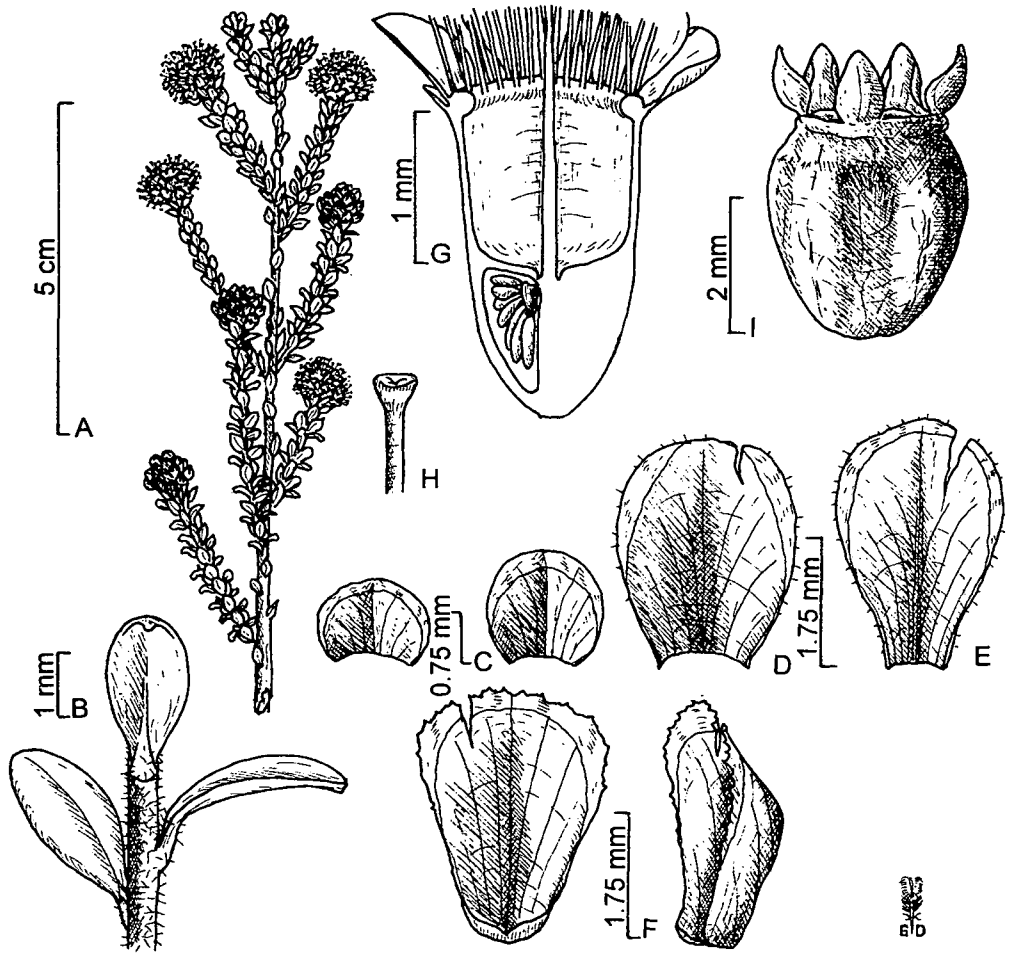


Fig. 2. ***K. sulphurea*** Tovey & P.Morris. A, flowering branch; B, branchlet showing spreading trichomes; C, perules; D, lower bract; E upper bract; F, bracteole; G, half flower; H, stigma; I, fruit. (A–H, *M.E. Phillips CBG 22621* (NSW); I, *M. Koch 2539* (MEL).)

inflorescence, rarely oblong, (1.6–) 2–2.3 × (1.3–) 1.5–2.4 mm, rounded or rarely bluntly acute, with several veins from the base but often indistinct, glabrous except for sometimes a few cilia on lower third or rarely with few hairs on the base of the abaxial surface; *bracteoles* in pairs, oblong-obovate to rarely oblanceolate, (1.8–) 2–2.2 × 1.3–1.7 (–2) mm, rounded and more or less hooded but often split, hyaline except for central ridge, glabrous or rarely with a few hairs towards the base of the abaxial surface. *Hypanthium* 2.6–2.8 mm long when flowering (free tube ca 1.4 mm), glabrous. *Calyx lobes* ovate-triangular, 0.7–1 mm long, rounded, with hyaline margins somewhat incurved, not ridged, glabrous. *Corolla lobes* obovate-orbicular, 1.4–1.7 mm long, scarcely clawed, pale yellow. *Stamens* 29–42 (–50) in more than one whorl; filaments 3.2–3.8 mm long; anthers with dorsal gland broad but not much protruding. *Ovary* with 5 locules, surmounted by a style base slightly sunk into the upper surface; placenta narrowly elliptic, a scarcely fleshy disc with conical attachment connected to the upper third, with lobes connate mainly on the outside margins, each lobe with one row of ovules; ovules 6–8 per locule, spreading except for two lowest longer pendulous ones; style 3.9–4.6 mm long, slightly broadened towards the base; stigma scarcely broader than style and with central depression. *Fruit* an urn-shaped capsule with

vertically bulging ridges alternating with the erect clasping calyx lobes. *Flowers*: (September) October, November. Fig. 2.

Distribution and ecology

Growing usually in sandy soil in swampy areas or along streams often associated with forested areas from near Pemberton in a belt along the coast to near Mt Barker and Porongurup (excluding the area between Denmark and Albany). Map 1.

Conservation status

Often common along swampy areas in Sir James Mitchell National Park but also in other parks.

Diagnostic features

This distinct species has commonly been ignored and specimens identified as either *K. montana*, *K. recurva* or even *K. ericifolia*. *K. sulphurea* is superficially similar to *K. montana* but may be distinguished by its very short erect hairs on the branches, smaller flowers and more delicate bracts. The much less robust plant but yet a tall shrub or tree as compared with *K. montana* is easily distinguished from *K. recurva* by its broad rounded bracts and bracteoles and yellow flowers. The oblanceolate leaves and rounded bracts and bracteoles distinguish it from *K. ericifolia*. The specific epithet is somewhat misleading as flowers are pale yellow and have never been recorded as sulphur yellow.

Variation

Some local variation in the shape of the bracts has been observed:

1. Specimens from the area between Denmark and Walpole and apparently up to the Shannon River have broad, obovate-spathulate bracts with a rounded to almost truncate apex which are as long or longer than the hypanthium.
2. West of the Shannon River and in particular near Pemberton and Northcliffe the bracts tend to be oblong-oblanceolate and often only half as long as the hypanthium. Their apex is usually bluntly acute to acute. The fact that specimens from between Northcliffe and Windy Harbour often have hairs on the abaxial surface of the bracts (e.g. *Ashby 2702*, a collection which includes hybrids) could indicate that the material determined as this species includes a series of introgressive hybrids with *K. recurva*, as the latter species usually has hairs on the basal abaxial surface and so has the putative hybrid between the two species (cf. *K. recurva*).
3. Similarly collections from near Mt Barker and eastwards to the Porongorup Range have obovate-spathulate bracts with a bluntly acute to almost acute apex at least on the upper flowers of an inflorescence, and tend to be shorter than the hypanthium. Since some of the specimens have hairs on the basal abaxial surface of the bracts, e.g. *Wittwer 279* (S Mt Barker), it is tempting to ascribe this phenomenon to an introgressional range of hybridisation. However, although *K. recurva* has been recorded from near that area no hybrids have been recorded.

Typification

Koch re-collected the species several times under the same number *2539*. Eight sheets were examined but none bore the crucial date "Nov. 1920" cited in the protologue. Since it has not been documented that this is in error for 1921, which is probably the correct date judging by the sequence of events (cf. specimens listed below), a holotype could not be determined. There is, however, some evidence that the specimens on six of the sheets were

seen by at least one of the authors before 1923, when the name was published. It is therefore proposed to treat all the following specimens as syntypes, and a lectotype has been selected from them. The status of two more sheets with the same collector's number, i.e. possible isotypes of the lectotype in NSW and PERTH, cannot be clearly assessed. Since the name *'K. sulphurea'* is written in what seems to be Koch's handwriting, it is assumed here that they were distributed by the collector without the authors having seen them and probably after publication. No information could be obtained on whether they are in fact even later collections or whether they are duplicates of earlier collections.

1) MEL 92311 "1.1921/ a shrub 2 to 4 m high/ in sandy places" in Koch's hand (fruiting).
2) BM s.n. "Jan. 1921" A Melbourne Herbarium label, not in Koch's hand. added "comm. 1922" in S. Moore's hand. (fruiting and flowering).
3) MEL 92312 (sheet 1 of 2) no date/ "shrub 2 to 6 m high" in Koch's hand (flowering; precursor manuscript description attached).
4) MEL 92313 (sheet 2 of 2), like 3 but nothing attached.
5) MEL 92310 (sheet 1 of 2) "fl: Nov 1921/ fr: January 1921/ a shrub up to 18 feet high/ almost arborescent" on original label and on field note" 2539/ 21 Nov 1921" in Koch's hand (flowering and fruiting; S. Moore's reply attached).
6) MEL 92315 (sheet 2 of 2). Label as in 5 but different field note possibly in Koch's hand "fruiting specimens/ 2539/ Kunzea/ 1.1922" (flowering and fruiting).

The selection of a lectotype must be guided by (i) only flowering specimens are described in the Latin diagnosis, and (ii) the phrase "almost arborescent ... shrub up to 18 feet high" in the protologue. The combination of these two statements apply only to sheets 5 and 6, but 6 is discarded in preference to 5 because its flowering specimen has only a few intact flowers. The flowering specimen on the lower right of sheet 5 (MEL 92310 which contains also a fruiting specimen) being attached to a label in the collector's hand "2539 21 Nov 1921" and also being the most complete specimen on that sheet, is selected as the lectotype.

In the selection process not much weight was given to documents now attached to some of the sheets, because they were only recently mounted and, for instance, S. Moore's reply concerning the identification of the specimen was added later, as inscribed. The specimen at BM (2) must be regarded as a syntype because it was part of the collections examined by the authors of this species before it had been sent there for confirmation. S. Moore in his reply (Sept. 1922) encouraged the authors to describe the taxon. The description is included in a paper read before the Royal Society of Victoria on 14th December, 1922. The specimen at K is probably a duplicate sent there from MEL after the name was published as it combines information of 2 and 3.

Specimens examined (68 seen)

WESTERN AUSTRALIA: *A.M. Ashby 2702*, near Windy Harbour, 22.x.1968 (AD, MEL, PERTH); *J.S. Beard 5775*, between Pemberton and Northcliffe, 2.xi.1968 (KPBG, PERTH); *7692*, S Mt Barrow, Mt Barker, 16.x.1975 (NSW); *R.J. Cranfield 4909*, NW edge of Lake Maringup, 13.xii.1983 (PERTH); *H. Eichler 16123*, Walpole, 2.ix.1959 (AD); *L. Fell 34*, between Chudalup & Cape D'Entrecasteaux, 3.xi.1968 (KPBG); *C.H. Gittins 1760*, Bow River, ix.1967 (BRI); *J.W. Green 1121*, ca 5 miles SW Walpole, 3.xii.1956 (PERTH); *T.A. Halliday 269*, Naenup swamp, 10.xii.1974 (AD); *S.W. Jackson s.n.*, Bow River, between Irwin's and Brooke's Inlets, xi.1912 (CANB, NSW, PERTH); *M. Koch 2539*, Pemberton, i.1921 (BM, K, MEL, NSW, PERTH); *J.H. Maiden NSW 124054*, Porongorup, xi.1909 (BRI, NSW); *F. Mueller MEL 92827*, Swampy banks of the Shannon, 12.xii.1877 (MEL); *K. Newbey 1506*, east-end of Porongorup Range, 12.xi.1964 (PERTH); *M.E. Phillips CBG 13226*, near Northcliffe, 20.x.1962 (BRI); *CBG 19312*, 11 miles from Denmark to Manjimup, 12.x.1962 (CBG); *CBG 22621*, near Walpole, 12.x.1962 (CBG); *A.N. Rodd 49498 & G. Fenson*, 5 km E Kent River, 12.xi.1985 (PERTH); *F.M.C. Schock 70*, Warren River, 19.x.1916 (PERTH); *J.A. Thomson s.n.*, Denmark 24.x.1939 (PERTH); *H.R. Toelken 6445*, 72 km NW Walpole, 5.x.1979 (AD, PERTH); *6447*, 44 km NW Walpole, 5.x.1979 (AD, PERTH); *6449*, 10 km NW Bow River bridge, 6.x.1979 (AD, PERTH); *6451*, 2.3 km E Bow River bridge,

6.x.1979 (AD, PERTH); *7177*, 16 km S of turnoff from Mt Barker Manjimup road along road to Denmark, 2.xi.1981 (AD, PERTH); *7179*, 15 km W Denmark, 2.xi.1981 (AD, PERTH); *H.R. Toelken 7180*, 19 km W Denmark, 2.xi.1981 (AD, PERTH); *7900*, 10 km S from Manjimup – Mt Barker Road on road to Denmark, 26.ix.1988 (AD, PERTH); *J.H. Willis MEL 92678*, 15 miles from Walpole to Pemberton, 6.ix.1947 (MEL); *E. Wittwer 279*, South Mt Barker, 27.ix.1963 (KPBG, PERTH); *J.W. Wrigley CBG 30395*, 6 miles from Denmark to Mt Barker, 13.x.1968 (AD).

Putative hybrids

2(i) *K. recurva* × *K. sulphurea* see 7(vi) *K. recurva*

3. **K. glabrescens** Toelken, *sp. nov.*

K. ericifolia (Sm.)Rchb. ex Heynh. var. *glabrior* Benth., Fl. Austr. 3: 113 (1867); Domin, Mém. Soc. Sci. Bohême (1921) 22, 2: 86 (1923).

Type: Western Australia, Swan River, *J.A.L. Preiss 271* (*lecto.* — selected here: K ; *isolecto.*: LD, W; *syn.*: Gordon River, *G. Maxwell s.n.*, and excluding type of *K. propinqua*, see under *K. ericifolia*.

K. propinqua auct. non (Endl.)Schauer: Schauer in Lehm., Pl. Preiss. 1: 126 (1844) as for *J.A.L. Preiss 271*.

K. ericifolia auctt. non (Sm.)Rchb. ex Heynh.: Blackall & Grieve, West. Austr. Wildflow. edn 1, 1: 293 (1954), partly; Rye in N.G. Marchant et al., Fl. Perth Region 1: 410 (1987), partly, as for specimens from the Perth area.

K. vestita auctt. non Schauer: A.D. Chapm., Contrib. Herb. Australiense 18: 2 (1976), partly; Blackall & Grieve, West. Austr. Wildflow. edn 2, 3A: 98 (1984), partly, as for specimens from the Perth area.

K. ericifoliae similis sed bracteis et bracteolis sessilibus late obovatis obtusis vel subtruncatis brevioribus quam hypanthiis differt.

Type: Western Australia: Greenwood, S Lake Goolelal, *H.R. Toelken 7103* (holo.: AD; *iso.*: B, K, MO, PERTH).

Large shrubs rarely up to 4 m tall, with several much branched erect stems and erect branches; young branches with flanges slightly raised, with few to many short and long hairs usually somewhat appressed, often coiled, glabrescent rarely glabrous; early bark fibrous-mosaic, becoming slightly corky and very shallowly fluted. *Leaves*: *petiole* up to 1 mm long, appressed; *lamina* linear-oblanceolate to linear or sometimes linear-subulate (4–) 5–8 (–10) × 0.5–1 (–1.5) mm, bluntly acute or rounded, rarely acute, more or less gradually constricted into petiole, flat to slightly concave above, usually distinctly convex below to almost triangular, rarely flat on both surfaces and with slightly depressed central vein below and then usually linear-lanceolate, straight, erect to spreading or recurved when older, with few to many hairs but soon glabrescent. *Inflorescence* a spherical to slightly elongate botryum with 18-28 flowers, terminal on long shoots, rarely with vegetative growth after flowering; *perules* usually more than 5, deciduous, ovate, bluntly acute and often mucronate, with a number of radiating branched veins from the base, with short hairs at the abaxial base and/or apex becoming often almost glabrous; *bracts* ovate to usually angular obovate, 1.8–3.2 × 1.2–2.3 mm, bluntly acute or acute, with 3 veins, with few short hairs at the abaxial base or sometimes with marginal cilia; *bracteoles* in pairs, broadly ovate to depressed ovate, 1.9–2.2 × 2.8–3.1 mm, rounded or truncate rarely emarginate, with 3-5 main veins, with few short hairs at the abaxial base. *Hypanthium* 3–4 mm long when flowering (free tube 1.2–1.6 mm), usually longer than bracts, glabrous, often distinctly ridged along the veins. *Calyx lobes* ovate-triangular, 1–1.8 mm long, acute to bluntly acute, more or less ridged, glabrous. *Corolla lobes* obovate to orbicular, 1.2–2.1 mm long, to rarely clawed, pale yellow. *Stamens* 30–45 (–60) in more than one whorl; filaments 2.4–2.7 mm long; anther with scarcely developed subterminal gland. *Ovary* 5-celled, with style slightly sunk into the upper surface; placenta a narrowly elliptic fleshy disc with short attachment on upper third, 2-lobed and fused on outer margin, each lobe with 1 row of ovules; ovules 8–12 (–15) per locule in lower flowers, 6–8 in upper ones, spreading or lowest 2–4 pendulous and slightly longer; style 4.2–4.6 mm long, with disc-like terminal stigma. *Fruit* an urn-shaped capsule with locules bulging and calyx lobes spreading to

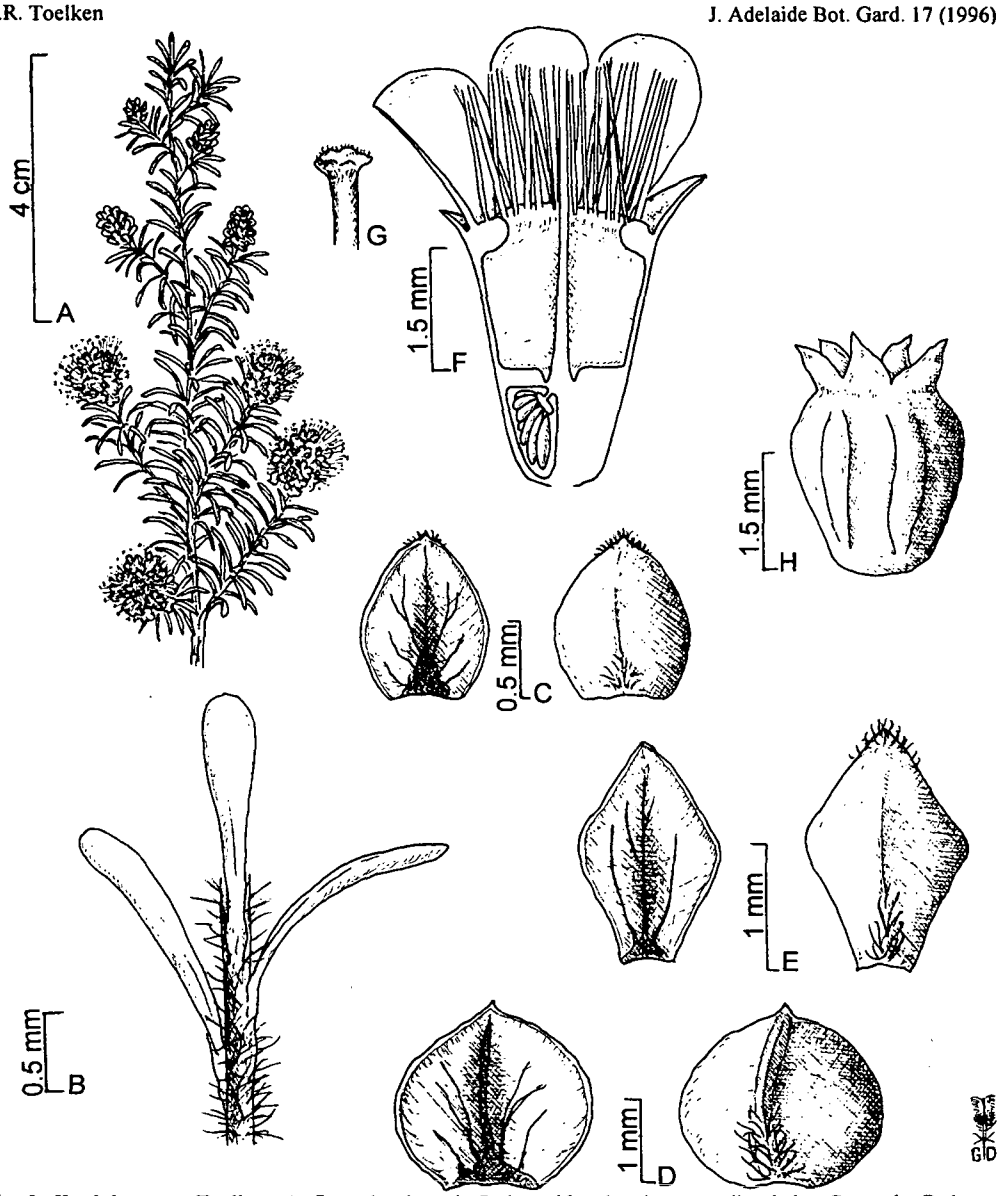


Fig. 3. ***K. glabrescens*** Toelken. A, flowering branch; B, branchlet showing spreading hairs; C, perule; D, bract; E, bracteole; F, half flower; G, stigma; H, fruit. (A–G, *H.R. Toelken 7103*; H, *F. Stoward 142*.)

recurved. *Flowers:* (September) October, November. *Common name*: spear-wood (Rye in Marchant et al. 1987). Fig. 3.

Distribution and ecology

Growing usually on sandy soil on edge of swamps, lakes, rivers or in depressions temporarily flooded. Locally common near Perth but also recorded from near Picton Junction, Cape Naturaliste and on the Gorden River and Lake Muir near Cranbrook. Map 1.

Conservation status

Although apparently widespread its main population in and around the urban spread of Perth and Freemantle need to be monitored.

Diagnostic features

K. glabrescens is similar to and has often been confused with *K. ericifolia*, but is distinguished from all other species with linear leaves and yellow flowers by its very broadly ovate, sessile bracteoles.

Variation

The normally broad bracts are frequently somewhat elongated especially on late inflorescences but they are usually leaf-like so that they should not be confused with the acuminate ones of *K. ericifolia*. The bracts are more or less covered with short hairs unlike bracts and bracteoles of normal inflorescences where usually only a few short hairs occur on the abaxial base.

The tomentum on the leaves shows considerable variation but mature leaves are generally glabrous.

This species which is often common around wet areas in the vicinity of Perth has been recorded from three localities some distance from the main population. They differ only in minor detail.

Typification

Bentham's (1867) description of *K. ericifolia* var. *glabrior* as generally less villous and sometimes nearly glabrous compared with typical *K. ericifolia*, fits *J.A.L. Preiss 271* (K) well, which is selected as the lectotype in preference of *G. Maxwell s.n.*, which represents a slightly unusual population of the species.

Etymology: The epithet 'glabrescens' (= becoming glabrous, Lat.) was preferred to Bentham's var. *glabrior*.

Selection of specimens examined (ca 85 seen)

WESTERN AUSTRALIA: *W.H. Atkins 68*, 194 m Albany Highway, iii.1952 (PERTH); *N. Byrnes 3969*, 16 km W Gingin, 1.x.1980 (BRI); *N. Byrnes 3981*, 30 km N Gingin, 2.x.1980 (BRI); *J.S. Beard 8205*, 16 km N Kojonup on Albany Highway, 26.x.1977 (PERTH); *W.E. Blackall 2955*, Gingin, 1.x.1932 (PERTH); *M.L. Cambridge s.n.*, Leschenault Inlet, 6.xii.1971 (PERTH); *E.M. Canning CBG 31515*, near Medina along Baldivis Road, 3.x.1968 (CBG, CANB); *F.L.E. Diel & E. Pritzel 248*, Picton Junction, xii.1900 (K, PERTH); *J. Drummond 1, 131*, s.loc., -.1843 (BM, K, NSW, W); *J.L. Francis s.n.*, Popanyinning, 1982 (AD); *R. Helms s.n.*, Guildford, 15.x.1897 (PERTH); *R. Helms NSW 124017*, Cannington, 2/9.i.1899 (NSW); *M. Koch 1768*, Onlina River near Wooroloo, xi.1907 (AD, K, MEL, NSW, W); *2647*, Picton Junction, 25.xii.1922 (MEL, NSW, PERTH); *T.R. Lally 46*, Jandakot Airport, s.d. (AD, CANB, CHR, LAE, MEL, MO, PERTH); *Mrs McHard MEL 92803*, Blackwood River, 1853 (MEL); *J.H. Maiden NSW 124024*, Welshpool to Kalamunda, ix–x.1909 (NSW); *NSW 124025, NSW 124022*, Cape Naturaliste, x.1909 (BRI, K, NSW); *F. Mueller MEL 92854, MEL 92741*, between Preston and Collies River, xii.1877 & 7.xii.1877 (MEL); *G. Maxwell MEL 92527*, Gordon River, s.d. (MEL); *Oldfield MEL 92835*, Lake Muir, Blackwood to KGS, s.d. (MEL); *C.H. Ostenfeld 1316*, Kings Park, 1914 (PERTH); *M.E. Phillips 1781*, 8 mls from Gingin to Regans Ford, 28.ix.1968 (CBG, CANB); *J. Pocock AD 96923626*, Harvey, 30.x.1968 (AD); *Preiss 271*, Perth, xi.1839 (W); *R.A. Saffrey 1767*, Blue Waters, Collie, 1.xi.1979 (PERTH); *J. Sanster 592*, Bilbra, 17.xi.1946 (K); *B.H. Sargent 1035*, Talbot Brook, 1.xi.1914 (NSW); *F. Stoward NSW 124015*, Kulikup, iii.1916 (NSW); *A. Strid 21626*, 26 km Kojonup to William, 27.xi.1982 (K); *H.R. Toelken 7898*, N.E. Lake Muir, 26.ix.1988 (AD, PERTH).

Putative hybrids

3(i) ***K. glabrescens* × *K. recurva***

The specimen has mainly fine long hairs on young internodes and leaves and broadly ovate bracts and bracteoles which resemble those of *K. glabrescens*. However, the large flowers with pink petals (pale mauve) and the long hairs on the bracts and bracteoles could only have been derived from *K. recurva* in that area. The flat linear-elliptic leaves are distinctly recurved. Although only one specimen was examined its characters, which are

intermediate between the two species, would suggest this hybrid in spite of it being recorded 'locally common'.

Specimen examined

WESTERN AUSTRALIA: *R.W. Purdie 4068*, Kojonup - Frankland road, 38.7 km S from Frankland road turnoff at Kojonup end, 9.xi.1990 (CBG).

4. **K. ericifolia** (Sm.) Rchb. ex Heynh., Nom. Bot. Hort. Dresden edn 1, 1: 337 (1840), as 'ericaefolia'; Benth., Fl. Austr. 3: 113 (1867).

Type: Western Australia, King George Sound, *A. Menzies s.n.* (*holo.*: LINN-S, microfiche!).

Metrosideros ericifolia Sm. in Rees, Cycl. 23: No. 16 (1813).

Shrubs up to 3 m tall, with one to few erect stems and lateral branches ascending to spreading; young branches with flanges more or less raised, villous with usually only long hairs, rarely with long and short ones, hairs usually straight and spreading but becoming somewhat appressed with age; early bark fibrous-mosaic becoming elongate-mosaic and slightly corky but usually flaking. *Leaves*: *petiole* 0.5–1.5 mm long and appressed; *lamina* linear-lanceolate to linear-elliptic, (28–) 34–63 (–82) × (0.5–) 0.6–1 mm, with pointed pale apex, gradually though slightly constricted into the petiole, flat to somewhat concave above, flat to slightly but rarely strongly convex below, with pointed pale apex, with central vein rarely visible at the base, spreading and strongly recurved when old, rarely erect, more or less covered with long spreading hairs rarely becoming glabrous. *Inflorescence* a more or less spherical botryum with 20–35 spreading flowers terminal on but rarely clustered at the end of branches, rarely with terminal vegetative growth after flowering; *perules* usually more than five, deciduous, similar to basal bracts and often pointed with leaf-like projection or leaves with basal membranes, with many veins from the base, usually covered with long hairs; *bracts* ovate on lower part of inflorescence to spathulate above, 4–6 × 2.3–3.2 mm, with 3–6 main veins, acuminate to rostrate, with long spreading hairs all over except for beak and lower margins; *bracteoles* in pairs, linear-falcate to narrowly oblanceolate-falcate, 3.2–4.4 × 0.25–0.46 mm, with one central vein with scarcely membranous margins, pointed, covered with long spreading hairs. *Hypanthium* 3–4.5 mm long, when flowering (free tube 1.3–1.6 mm), usually shorter than bracts, veins usually not distinct, glabrous. *Calyx lobes* triangular, 1–1.8 mm long, usually acute, sometimes ridged towards the apex, glabrous. *Corolla lobes* obovate-orbicular to broadly spathulate, 1.6–2.1 mm long, pale yellow to greenish-yellow. *Stamens* 35–46 in more than one whorl; filaments 3.2–3.8 mm long; anthers with small subterminal gland. *Ovary* 5-celled, with style slightly sunk into the upper surface; placenta a narrow-elliptic fleshy disc with attachment on upper third, 2-lobed, fused mainly on outer margin, each lobe with one row of ovules; ovules (6–) 8–10 (–12), upper ones short and spreading, lowest 4 longer and pendulous; style to 8 mm long, broadened towards the base, with disc-like stigma about twice the diameter of style below. *Fruit* an urn-shaped capsule with locules more or less bulging and calyx lobes erect.

4a. subsp. **ericifolia**.

Metrosideros ericifolia Sm. in Rees, Cycl. 23: No. 16 (1813); DC., Prodr. 3: 225 (1828); Steud., Nomencl. Bot. 2 edn, 2: 137 (1841).

K. ericifolia (Sm.)Rchb. ex Heynh., Nom. Bot. Hort. Dresden edn 1, 1: 337 (1840) as 'ericaefolia'; Benth., Fl. Austr. 3: 113 (1867); Domin, Mém. Soc. Sc. Bohême (1921) 22, 2: 86 (1923); Blackall & Grieve, West. Austr. Wildflow. edn 1, 1: 293 (1953); Beard, West Aust. Pl. 98 (1965).

Stenospermum ericifolia (Sm.)Sweet ex Heynh., Nom. Bot. Hort. Dresden edn 1, 2: 787 (1841), as 'ericaefolia'.

Metrosideros propinqua Endl., Enum. Pl. Huegel 50 (1837); Walp., Repert. 2: 165 (1843) — non Salisb. (1796).

Type: Western Australia, King George Sound, *K.A.A. Hügel s.n.* (*holo.*: W).

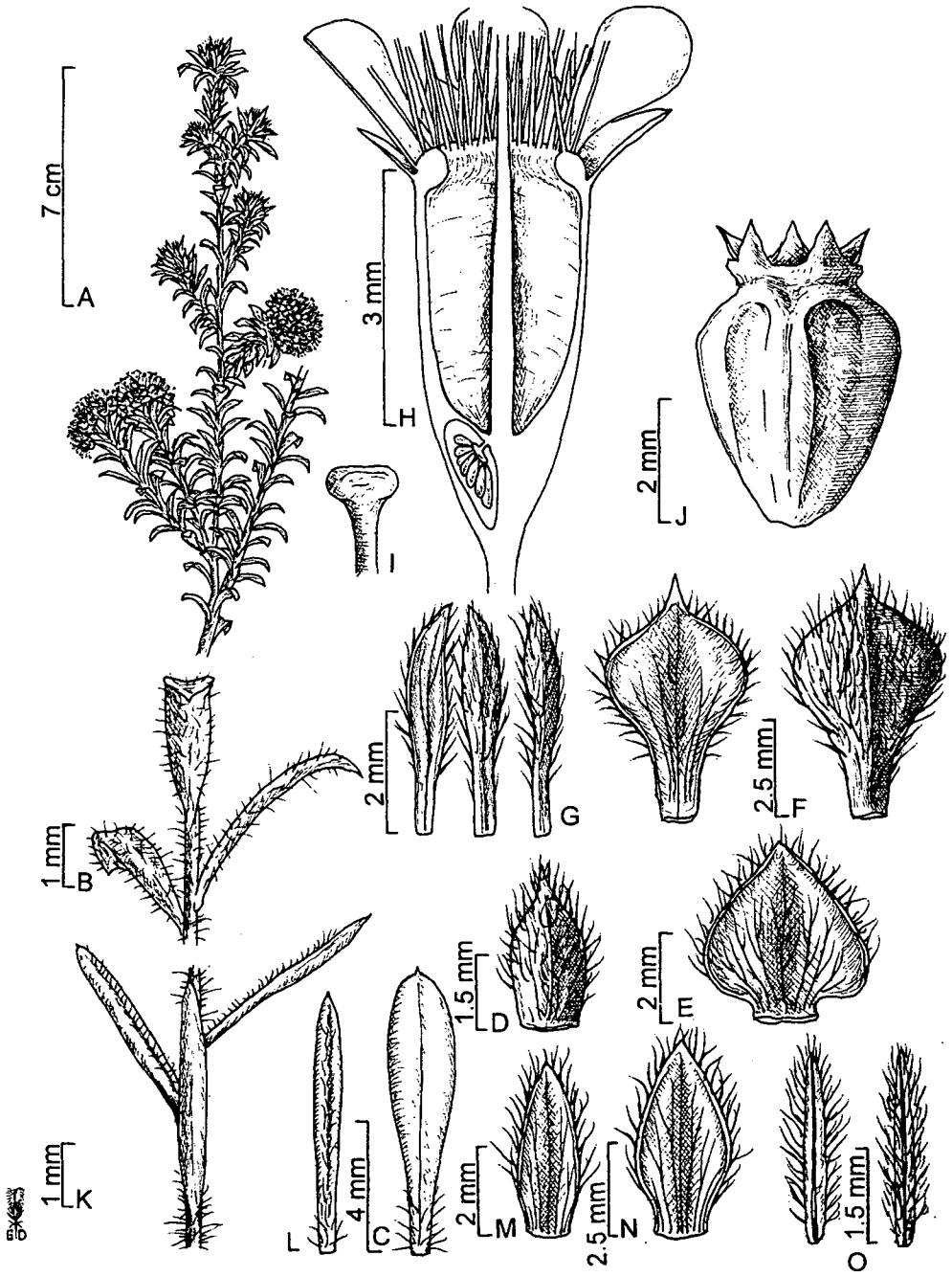


Fig. 4. *K. ericifolia* (Sm.)Rchb. ex Heynh. subsp. *ericifolia*. A, flowering branch; B, branchlet with leaves hairy above and below; C, leaf; D, perule; E, lower bract, F, upper bract; G, bracteoles; H, half flower; I, stigma; J, fruit. – subsp. *subulata* Toelken. K, branchlet with leaves hairy above; L, leaf; M, perule; N, lower bract; O, bracteole. (A–I, *A.M. Ashby 2000*; J, *F. Oldfield MEL 92533*; K–O, *H.R. Toelken 7137*.)

Kunzea propinqua Schauer in Lehm., Pl. Preiss. 1: 126 (1844), partly as for type; Walp., Repert. 5: 742 (1844), partly.

Type: as for *Metrosideros propinqua* Endl. (see typification).

Kunzea vestita Schauer in Lehm., Pl. Preiss. 1: 126 (1844); l.c. 2: 224 (1848); A.D. Chapm., Contrib. Herb. Australiense 18: 2 (1976); Blackall & Grieve, West. Austr. Wildflow. edn 2, 3A: 98 (1980); Green, West. Austr. Pl. 77 (1981).

Type: Western Australia, near King George Sound, *J.A.L. Preiss 272* (*lecto.* — selected here: W; *isolecto.*: K, MEL (2×), W.

K. ericifolia var. *typica* Domin, Mém. Soc. Sc. Bohême (1921) 22, 2: 86 (1923), nom. illeg.

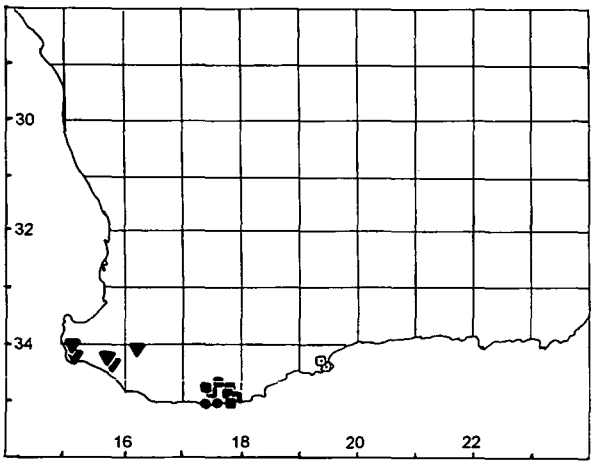
Young branches villous with mainly long hairs 0.5-0.7 mm. *Leaves* usually recurved to often more than 90° at least when old (if erect then broader than 1.5 mm), lanceolate to linear-lanceolate, (0.8-) 1.4-2.2 mm broad, flat or slightly convex below; *petiole* 0.4-0.8 mm long. *Flowers*: September, October. Fig. 4A–J.

Distribution and ecology

Known mainly from the area between Denmark, Mt Barker and just east of Albany where it grows usually in and around swamps or on the banks of creeks or rivers. A specimen from near Walpole (*A.R. Annels 839*) was based on a single plant and could be interpreted as naturalised there (J.R. Wheeler pers. comm.). Records from Wagin (*A.H.S. Lucas* NSW 124013) and Manjimup (*R. Hill & R. Jordan s.n.*, AD) could not be substantiated. Map 2.

Conservation status

Locally common.



Map 2. ***K. ericifolia*** subsp. ***ericifolia*** ■; ***K. ericifolia*** subsp. ***subulata*** ⊡; ***K. spathulata*** ▼; ***K. clavata*** ●.

Variation

The leaves of this subspecies are usually dorsiventrally compressed, but in a few specimens, e.g. *E.M. Bennett 1082*, they range from flat to a somewhat convex abaxial surface. These leaves are oblong, 3–5 mm long, covered with long spreading hairs at least when young and have a petiole 0.5–0.7 mm long so that they cannot be confused with those of subsp. *subulata*.

Typification

Two specimens collected by Hügel from King George Sound are preserved in W. Since that specimen annotated in what seems to be Endlicher's handwriting 'Metrosideros propinqua n.sp.' has also densely hairy leaves and young branches — 'lanuginoso-villosis' in the protoloque — this must be the holotype. The second specimen which is much less hairy was already considered different and annotated by Beck '*Kunzea ericifolia* Rchb. var. *glabrior* (*K. propinqua* Schauer)'. It is here placed into 7(i) *K. clavata* × *K. ericifolia* subsp *ericifolia*. Endlicher's name is, however, a superfluous later homonym of *Metrosideros propinqua* Salisb. (1796), but it is a legitimate basionym (cf. A. 52.3) for *Kunzea propinqua* Schauer, which is treated here as a nomen novum (cf. A. 58.1). Therefore the same type applies as Schauer explicitly retained the type specimen in his

citation (cf. A. 48, 1) in spite of his protologue predominantly referring to *J.A.L. Preiss 271*, a specimen which is here included in *K. glabrescens*. Schauer also annotated the Hügel type specimen above Endlicher's name '*Kunzea propinqua* Schauer Pl. Preiss.' but neither of the two specimens of *J.A.L. Preiss 271* (W) bear any inscription in his hand.

Concerning the type of *K. vestita*, no specimen of *J.A.L. Preiss 272* was found in LD. Of the two specimens in Vienna (W) which Schauer would possibly have seen, the specimen with a Hügel label was selected as the lectotype because it is accompanied by collecting details as found in the protologue. The other three specimens (W, 2× MEL) lack that information.

Chapman (1976) changed the name of the species to *K. vestita* as he was at the time not aware that Heynhold (1840) had validly published the combination *K. ericifolia* before Mueller (1855) published a later homonym.

Selection of specimens examined (ca 45 seen)

WESTERN AUSTRALIA: *A.M. Ashby 2000*, Lower King, 10.x.1966 (AD, PERTH); *W. Baxter NSW 124021*, King George Sound, ca 1828 (NSW); *E.M. Bennett 1082*, Lower King Road, Albany, 16.ix.1966 (PERTH); *H. Davies 564*, Porongorup, 7.ix.1950 (AD); *J. Galbraith 806*, Albany, 3.x.1964 (MEL); *B.T. Goadby 93*, King George Sound, -.x.1896 (NSW); *B.T. Goadby B.2161?*, King George Sound, -.x.1898 (PERTH); *J.H. Maiden NSW 124023*, King George Sound, xi.1909 (NSW); *A. Meebold 11661*, Mt Barker, viii.1933 (PERTH); *F. Mueller MEL 92529*, King George Sound, -.x.1867 (MEL); *MEL 92530*, King George Sound, -.x.1867 (MEL); *MEL 92533*, Torbay (MEL); *MEL 92534*, King George Sound, x.1867 (MEL); *K. Newbey 973*, 3 mls N Albany, 21.ix.1963 (PERTH); *S.P. Pfeiffer 31*, Upper King, ix.1958 (PERTH); *H.R. Toelken 7174*, 5 km NW King River, 2.xi.1981 (AD); *7178*, 22 km N Denmark, 2.xi.1981 (AD); *G.L. Webster 18771*, Lake Powell, 23.ix.1973 (NSW); *F.W. Went 134*, near Denmark, 15.ix.1962 (PERTH); *E. Wittwer 263*, Millbrook Creek Road, Albany, 27.ix.1963 (PERTH).

Putative hybrids

4a(i) *K. clavata* × *K. ericifolia* subsp. *ericifolia* see 6(i) *K. clavata.*

4a(ii) ***K. ericifolia* subsp. *ericifolia* × *K. recurva.***

The folded leaves with usually acute apex as well as the bracts which are acute or bluntly acute and hairy over much of the surface show its resemblance to *K. ericifolia* subsp. *ericifolia*. However, the broad leaves, pink petals and long hairs (short in *K. ericifolia*) on bracts on floral axis relate to *K. recurva*, the only pink-flowered species recorded from King George Sound. The calyx lobes have sometimes in bud the typical recurved margins of *C. recurva* but at the flowering stage the margins are scarcely incurved and are similar to those of *K. ericifolia*, the only other species common in that area.

Specimen examined

WESTERN AUSTRALIA: *B.T. Goadby 2163*, King George Sound, -.x.1898 (PERTH).

4b. subsp. **subulata** Toelken, *subsp. nov.*

A subsp. *ericifolia* foliis rectis, subulatis convexissimis subtus pilis paucis longis supra, petiolis 0.8-1.5 mm longis differt.

Type: Western Australia, West Mt Barren, *H.R. Toelken 7137* (*holo.*: AD; *iso.*: B, C, G, K, LE, MEL, MO, NSW, NY, PERTH, S).

Young branches villous with short and long hairs up to 3.5 mm long and usually shorter than those of leaves. *Leaves* linear rarely linear-lanceolate, very convex below to semicircular in section but flat or slightly grooved above with hairs, straight or if slightly recurved then from the petiole; *petiole* 0.8–1.5 mm long. *Flowers*: September, October. Fig. 4K–O.

Distribution and ecology

Known only from the vicinity of West Mt Barren where plants grow among rocks towards the summit but it has also been recorded from lakes nearby. Map 2.

Conservation status

Very localised but several populations conserved in Fitzgerald River National Park.

Variation

The plants growing among rocks on top of and on the southern slopes of West Mt Barren form spreading shrubs to 1.5 m high and their terminal branches are usually short and gnarled. These shrubs have quite a different appearance from those of the typical subspecies but plants of subsp. *subulata* growing around a nearby lake, e.g. *Royce 9105*, which was described as 'erect many-stemmed shrub 6-8 ft tall'. This aptly describes the habit of the typical subspecies although according to all other characters this specimen must be identified as subsp. *subulata.*

Etymology: The epithet 'subulata' (= awl-shaped, Lat.) refers to the leaves of that shape.

Specimens examined

WESTERN AUSTRALIA: *A.S. George 6972*, West Mt Barren, 28.x.1965 (PERTH); *K. Newbey 2884*, West Mt Barren, 20.ix.1969 (PERTH); *R.D. Royce 9105*, around salt lake SE Mt Bland, 20.x.1970 (PERTH); *A. Strid 20966*, West Mt Barren, 23.x.1982 (AD); *H.R. Toelken 7137*, West Mt Barren, 30.x.1984 (AD, B, C, G, K, LE, MEL, MO, NSW, NY, PERTH, S); *E. Wittwer 1991*, West Mt Barren, 14.i.1982 (KPBG).

5. **K. spathulata** Toelken, *sp. nov.*

K. ericifolia (Sm.)Rchb ex Heynh. var. *glabrior* auct. non Benth.: Domin, Mém. Soc. Sci. Bohême (1921) 22, 2: 86 (1923).

A *Kunzeis* similibus foliis ramisque glabris, inflorescentis usque ad 8 mm diametro, et bracteolis obovato-spathulatis truncatis differt.

Type: Western Australia, 26 miles S Nannup, *V. Mann & A.S. George 77*, (*holo.*: PERTH; *iso.*: K, NSW).

Tall shrubs or trees up to 4.5 m high, with a number of erect stems, much branched with ascending branches; young branches slender (0.4–0.6 mm in diameter), flanges faint with ridges below each leaf, glabrous rarely with scattered hairs when very young; early bark fibrous-mosaic becoming corky with shallow fluting. *Leaves*: *petiole* 0.4–0.8 mm long, more or less appressed, broadened towards the base; *lamina* linear, rarely linear-elliptic, (4-) 5–7 × 0.4–0.6 (–0.75) mm, with abrupt blunt apex, gradually tapering into petiole, flat or almost so above, strongly convex below, spreading and rarely slightly recurved, glabrous. *Inflorescence* a sphaerical or elongate botryum with 10–18 spreading flowers, terminal on branches and rarely clustered at the apex on long and short shoots, with some terminal vegetative growth after flowering; *perules* below inflorescence few and often less than 5, broadly ovate, with bluntly acute, rarely mucronate apex, glabrous or with few hairs on the base of the abaxial surface, with 3, 5 (7) branching veins; *bracts* broadly obovate below to angular oblong-obovate or rhombic with 2 hyaline wings on an oblong centre with upper flowers, 2–3 (–3.5) × 1.8–2.5 (–3) mm, fleshy central midrib with 1 vein, with a tuft of forward-directed hairs on the lower abaxial surface, hyaline margins sometimes reduced to short wings; *bracteoles* in pairs, obovate-spathulate to angular-spathulate, (2–) 2.5–3.5 × 1–2.2 mm, truncate or central ridge continued into short terminal point with 1 vein, with few hairs on the abaxial base. *Hypanthium* 2.5–3.2 mm long when flowering (free tube 1.5–1.8 mm) slightly ridged towards the base, glabrous. *Calyx lobes* ovate-triangular, 0.5–0.7 mm long, bluntly acute, glabrous. *Corolla lobes* obovate-orbicular, usually without distinct

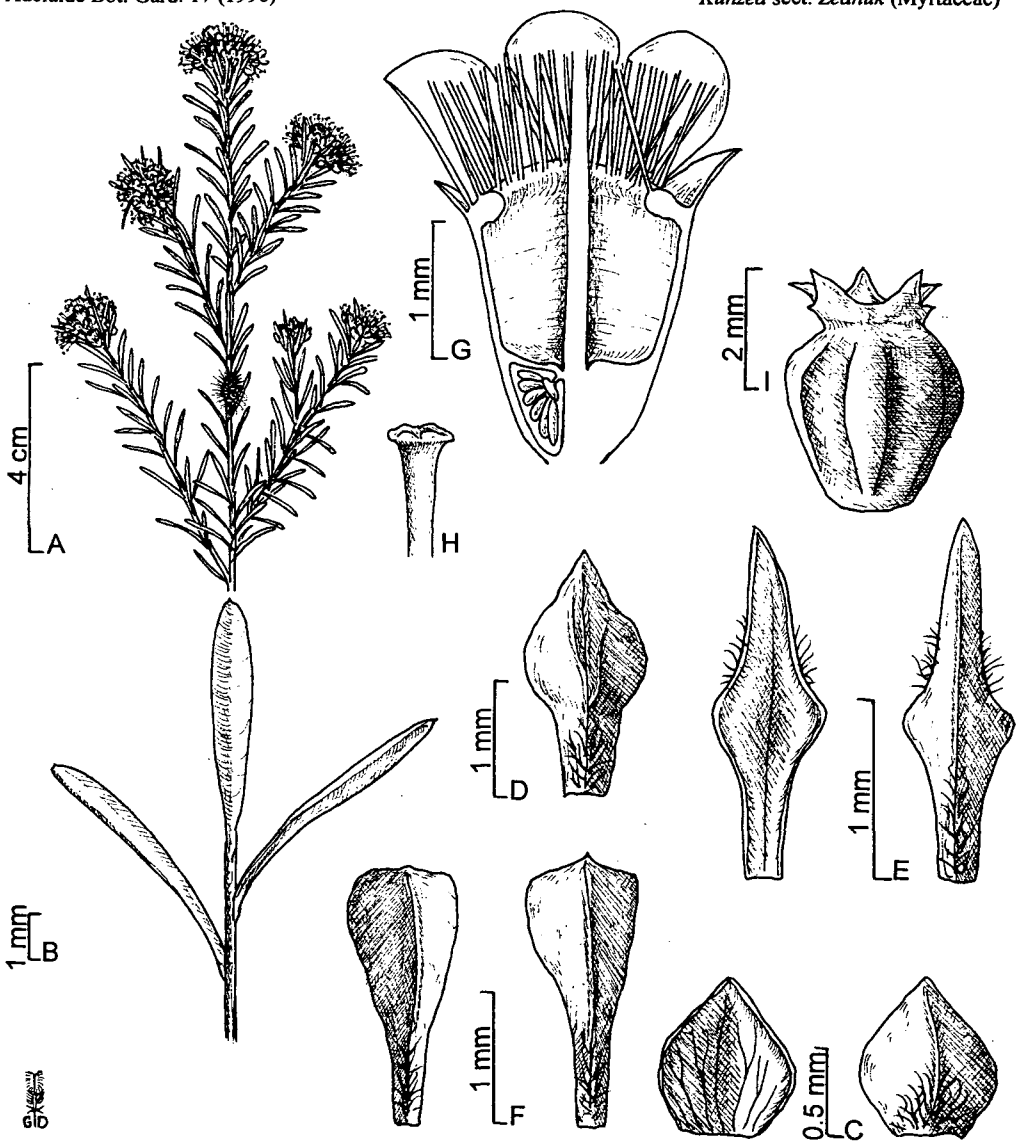


Fig. 5. ***K. spathulata*** Toelken. A, flowering branch; B, glabrous branchlet; C, perule; D, lower bract; E, upper bracts; F, bracteoles; G, half flower; H, stigma; I, fruit. (A–H, *V. Mann & A.S. George 77*; I, *R.D.Royce 5414*.)

claw, 1.6–2 mm long, yellow or yellowish-green. *Stamens* 26–30 in more than one whorl; *filaments* 2.6–2.9 mm long; *anthers* with small subterminal gland. *Ovary* 5-celled, with style scarcely sunk into the upper surface; placenta a narrowly elliptic fleshy disc with short central attachment, scarcely 2-lobed except in the centre, each lobe with 1 row of ovules; ovules 9 or 10 per locule, spreading, with lowest 2 pendulous and often slightly longer; style 3.1-4.3 mm long; stigma small to moderately expanded. *Fruit* not seen. *Flowers:* October, November. Fig. 5.

Distribution and ecology

Recorded from sandy soil usually associated with swampy areas mainly in the extreme south-western corner of Western Australia. The main populations seem to occur near Augusta and south of Nannup but the one record NW of Pemberton shows that it might

have a much wider distribution. The record from West Cape Howe, near Denmark, could, however, not be confirmed. Map 2.

Conservation status

Not common although found in a few large populations outside conserved areas.

Diagnostic features

Although superficially similar to *K. glabrescens* and *K. ericifolia* it is distinguished by its glabrous young leaves and branches, the obovate-spathulate truncate bracteoles and small inflorescences. All organs of this species tend to be smaller and more delicate than other members of the subsection although the plants themselves are recorded up to 15 feet high (*Mann & George 77*), which is considerably taller than records for *K. glabrescens* and *K. ericifolia*.

Variation

A fruiting specimen, *R.D. Royce 5414* from West Cape Howe, agreed in all aspects with this species, but the occurrence of this species so far from the main distribution of the species and so close to the distribution of the similar *K. clavata* could not be confirmed.

As is also exhibited in *K. glabrescens*, the bracts of late inflorescences have the tendency to elongate excessively, a phenomenon shown in a number of inflorescences of the type collection.

The bracts and bracteoles of specimen *R.J. Cranfield 959* are densely hairy at the base, along the margins, and more or less on the inner surface.

Notes

The earliest record of this species is a collection by *Mrs McHard s.n.*, 1892 (MEL 92781), from Blackwood River. This is of particular interest since she had collected a few years earlier, i.e. in 1883 (MEL 92803), a specimen of *K. glabrescens* along the same river. The latter species is nowadays very rare so far south and was probably collected higher up the river then the *K. spathulata* specimen.

Etymology: The epithet '*spathulata*' (Lat.) refers to spathulate bracteoles of this species.

Specimens examined

WESTERN AUSTRALIA: *R.J. Cranfield 959*, along road from Nannup to Bridgetown, 2.xi.1978 (AD, PERTH); *Mrs McHard* MEL 92781, Blackwood River, -.-.1892 (MEL); *V. Mann & A.S. George 77*, 42 km S Nannup, 11.xi.1969 (K, NSW, PERTH); *R.D. Royce 5414*, West Cape Howe, 7.iii.1956 (PERTH); *R. Tinetti s.n.*, Nannup - Pemberton road, 13.xi.1974 (PERTH); *H.R. Toelken 6442*, 35 km NW Pemberton, 5.x.1979 (AD, PERTH); *7893*, 5 km N Brockman Highway on road to Augusta, 25.ix.1988 (AD, PERTH); *D.J.E. Whibley 5083*, just west of Augusta, 6.xi.1974 (AD, PERTH).

6. **Kunzea clavata** Toelken, *sp. nov.*

K. spathulatae similis sed bracteis et bracteolis basipetis glabris, bracteis truncatis differt;

a *K. ericifolia* et *K. glabrescenti* foliis et ramis glabris, foliis clavatis differt.

Type: Western Australia, near Bornholm, *H.R. Toelken 7903* (*holo.*: AD; *iso.*: K, NSW, PERTH).

Shrubs or trees with several stems from the base, 2.5–4 m tall, much branched; young branches often strongly ridged, glabrous; early bark fibrous-mosaic becoming corky with

shallow fluting. *Leaves*: *petiole* 0.7–0.8 (–0.9) mm long, appressed to branches, not broadened towards the base; *lamina* linear, linear-oblanceolate to almost club-shaped, (2.7-) 2.8–4 (–4.8) × 0.6–0.75 mm, scarcely but gradually tapering into petiole, abruptly constricted into blunt apex, usually slightly convex above and strongly convex below, straight and recurved from petiole, glabrous. *Inflorescence* a sphaerical botryum with 22–34 spreading flowers in dense heads, terminal mainly on long shoots, with terminal vegetative growth rarely persisting; *perules* usually more than 5, depressed ovate to obovate, usually truncate or rounded, glabrous or minutely hairy, with 1 to few veins; *bracts* broadly obovate to obovate-spathulate, 3.2–3.4 × 3.1–3.4 mm, usually with 2 hyaline wings, rounded or truncate, rarely mucronate, with central vein pronounced and 2, rarely few, lateral ones from the base, glabrous or with a few long hairs particularly on upper parts of the inflorescence; *bracteoles* in pairs, oblanceolate-spathulate to obovate-spathulate, 2.3–3.2 × 1.5–1.7 mm, truncate or emarginate and rarely mucronate, with central vein often ridged, lateral wings hyaline, glabrous or with a few long hairs along the main vein. *Hypanthium* 2.8–3.2 mm long when flowering (free tube 1.2–1.3 mm), ridged and often with obvious veins towards the base, glabrous. *Calyx lobes* triangular, 1–1.1 mm long, bluntly acute, glabrous. *Corolla lobes* broadly elliptic to orbicular, usually without distinct claw, 1.6–2 (–2.2) mm long, pale yellow. *Stamens* (27–) 30–35 in more than one whorl; filaments 3.1–3.4 mm; anthers with small subterminal gland. *Ovary* 5-celled, with style slightly sunk into the upper surface; placenta a narrow-elliptic fleshy disc with short almost central attachment, scarcely 2-lobed except in the centre, each lobe with 1 row of ovules; ovules (9) 10 or 11 per locule, spreading but lowest 2 pendulous and often slightly longer; style 3.9–4.6 mm long; stigma usually more or less capitate. *Fruit* urn-shaped capsule with locules somewhat bulging, calyx erect. *Flowers:* (September) October. Fig. 6.

Distribution and ecology

Associated with lakes and marshy areas, but very restricted in its distribution and found only in a few coastal localities just east of Denmark. Map 2.

Conservation status

Locally common at present but the species needs to be monitored since it has a restricted distribution associated with marshy habitats.

Etymology: The epithet clavatus (= club-shaped, Lat.) is used here in the sense of a baseball club, which, as is sometimes found in the leaves of this species, increases gradually towards the apex and lacks a terminal knob.

Specimens examined

WESTERN AUSTRALIA: *R. Story 8259*, 25 km W Albany, 19.ix.1976 (CANB, PERTH); *H.R. Toelken 7902*, near Bornholm, 26.ix.1988 (AD, PERTH); *7903*, near Bornholm, 26.ix.1988 (AD, K, NSW, PERTH); *C.T. White 5398*, Hortons Siding on Denmark Railway, 8.xi.1927 (BRI).

Putative hybrids

6(i) ***K. clavata* × *K. ericifolia* subsp. *ericifolia***

Most characters agree with those of *K. clavata* but the organs tend to be somewhat larger and more robust. Since the bracts and bracteoles are velutinous as in *K. ericifolia*, and young branches and leaves are sparsely hairy unlike either species, these plants are

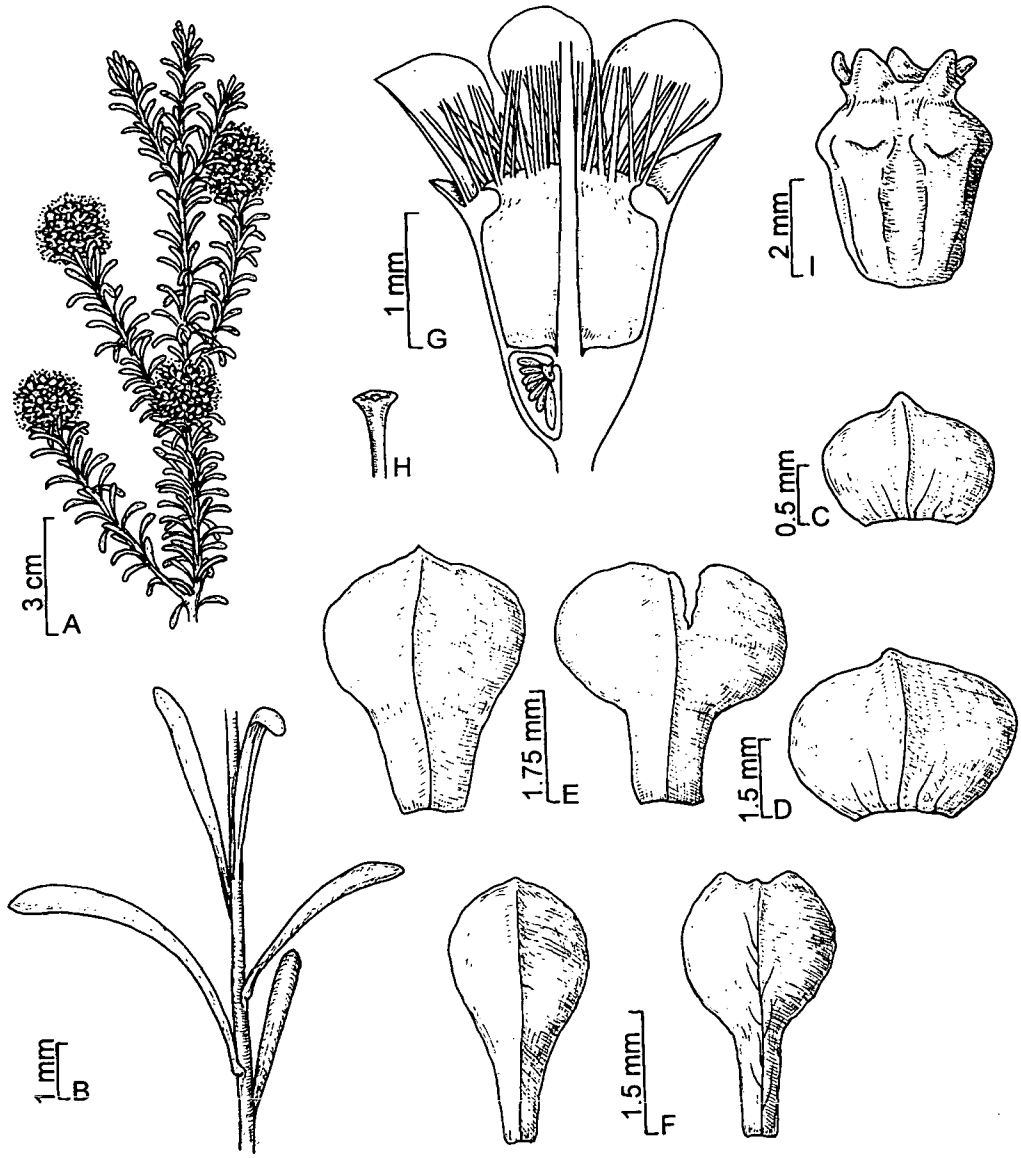


Fig. 6. ***K. clavata*** Toelken. A, flowering branch; B, glabrous branchlet; C, perule; D, lower bract; E, upper bract; F, bracteole; G, half flower; H, stigma; I, fruit. (A–I, *H.R. Toelken 7903*.)

somewhat intermediate. They were recorded from an area where the two species could theoretically have had extensive populations but due to extensive agricultural activity are now restricted to scattered plants along roadsides. It could therefore not be assessed whether this is merely a form of *K. clavata* or, indeed, a remnant hybrid population. It is interesting that the second specimen collected by Hügel at King George Sound in 1833 (cf. 5a, typification of *K. propinqua*) must be placed here.

Specimens examined

WESTERN AUSTRALIA: *E.M. Canning CBG 40063*, 11.3 mls E Young Siding towards Albany, 12.x.1968 (CBG); *K.A.A. Hügel s.n.*, King George Sound (W - annotated by Beck 'Kunzea ericifolia Rchb. var. glabrior (K. propinqua Schauer)'); *H.R. Toelken 7904*, ca 6 km SW of Albany, 26.ix.1988 (AD); *7905C*, ca 6 km SW of Albany, 26.ix.1988 (AD).

6(ii) *K. clavata* × *K. recurva*

The rounded to truncate apex of the bracts and bracteoles, the spathulate bracteoles, and the glabrous stems are all reminiscent of *K. clavata*. The pale pink or yellowish-pink petals, the broad flat leaves (although broad-elliptic not broad-obovate as usual in forms in that area), and the long stiff hairs on the base of the bracts and bracteoles indicate that *K. recurva* must have been the other putative parent. Plants of neither of the parent species were found in the immediate vicinity.

Specimens examined

WESTERN AUSTRALIA: *H.R. Toelken 7905A & B*, ca 6 km SW Albany, 26.ix.1988 (AD).

B. **Kunzea** subsect. **Globosae** Toelken, *subsect. nov.*

A subsect. *Arborescentibus* fruticibus rare ad 2.5 m altis, floribus roseis vel purpureis, rare candidis;

a subsect. *Floridis* (10–) 15–35 (–50) floribus in inflorescentia, staminibus petala superantibus differt.

Type species: *K. recurva* Schauer.

Shrubs 0.2–1.2 (–2.5) m tall, with few spreading or decumbent stems each with spreading branches and usually without short shoots; bark on young branches (5–15 mm diam.) usually more or less fluted and fibrous, rarely somewhat corky. *Leaves* oblanceolate to broadly elliptic or obovate, usually with horny margin which is more or less erose at least when young. *Inflorescence* with (10–) 15–35 (–50) flowers in globular to elongate heads, with vegetative growth after flowering from the terminal bud, but often not continued and main growth from unrelated buds. *Petals* obovate to orbicular or depressed obovate, shorter than stamens, rose-pink to deep purplish-pink, rarely pale pink mainly in hybrids or white in forms of *K. micrantha*.

Distribution and ecology

Of the species found in subsect. *Globosae* only *K. micrantha* is usually found in swampy areas or in localities which are flooded at least when plants are flowering; other members of the subsection are often associated with winter-wet depressions, but they usually grow on the margins of temporary swampy areas. A few species, such as, *K. ciliata*, *K. praestans* and *K. micromera* are often found on gravelly slopes. The subsect. *Globosae* has the widest distribution and covers most areas also covered by subsects. *Arborescens* and *Floridae*, viz. south-western Western Australia westwards from Stokes Inlet to Geraldton and Wubin in the north-west. All species, except occasionally for *K. micrantha*, mainly skirt the forested areas of southern Western Australia or, if they are found there, they occur in pockets of heath-like vegetation or have established themselves, it seems, secondarily as the result of clearing. Species of this subsection are, like those of the subsect. *Floridae*, often pioneer plants in wet disturbed areas.

Notes

In the subsect. *Globosae* there are two groups of species which, as in the subsect. *Floridae*, must be interpreted as divergent lines within this group. The first three species show a close resemblance to *K. recurva*, while the others are more similar to, or indirectly

linked through another species to *K. praestans*. It appears to be a natural group although it is described largely by the exlusion of subsections *Arborecentes* and *Floridae*.

The growth habit of species of subsect. *Globosae* is often even more untidy and inconsequent to those of subsect. *Arborescentes*. It is unknown whether the rather feeble, if any, continued growth from the apex of the inflorescence and the main growth's continuing from lateral (or other) buds, is 'suited' to or results from their usually very spreading to decumbent habit. Young plants do not usually develop inflorescences terminal to the main branches and, since these main branches continue growth during the flowering period, vegetative growth soon overtops the fruiting branches which do not contribute to vegetative growth (cf. Fig. 14A). Mature plants on the other hand are often reactivated from lower parts of branches which have since become decumbent. In such cases an axillary bud below an old inflorescence often forms a new erect branch system. The development of such new growth centres, except on young main branches, are often quite unpredictable and are not related to the inflorescences, or if they are then here, as in the subsect. *Arborescentes*, not all branches end in an inflorescence. Also, in contrast to the *Arborescentes* the *Globosae*, as with the *Floridae*, have mainly grey fibrous fluted bark.

The number of flowers per inflorescence is usually well above ten and in *K. micrantha* may even reach 50. The exception is *K. micromera* with (6–) 12–18 (–24) flowers, but this species was (unlike *K. similis*) not placed in the *Floridae,* because of its decumbent habit with a growth pattern as described above, and because of the very pronounced horny margins on the leaves. Clusters of botrya on short shoots below the terminal inflorescence are like short shoots in general, rarely found in the *Globosae*, and, if present, these are only represented by a few lateral botrya.

Key to the species, subspecies and hybrids of subsect. Globosae

N.B. The size and shape as well as tomentum of the first three leaves produced on each branch are often abnormal and should not be used.

1. Hypanthium hairy; calyx usually with some hairs, often becoming glabrous:
   2. Leaves with few hairs along the margin or glabrous:
      3. Calyx lobes glabrous, bluntly acute to rounded, greyish and with a prominent ridge ..... 12d. *K. micrantha* subsp. *hirtiflora*
      3: Calyx lobes sericeous, pointed, green to red and with a faint ridge towards the apex ..... 15. *K. acuminata*
   2: Leaves densely hairy at least below, becoming glabrous:
      4. Apex of bracts rounded to almost truncate; north of Perth:
         5. Leaf lamina gradually constricted into base without petiole; petals (2.5–) 2.8–4 (–5) mm broad ..... 11. *K. praestans*
         5: Leaf lamina abruptly constricted into petiole; petals 1.8–2.2 (–2.5) mm broad ..... 12b. *K. micrantha* subsp. *petiolata*
      4: Apex of bracts bluntly acute to cuspidate; south-east of Perth:
         6. Ovary 3-locular; calyx lobes pointed ..... 14. *K. similis*
         6: Ovary 5-locular; calyx lobes bluntly acute or rounded ..... 13(iii). *K. micromera* × *K. preissiana*
1. Hypanthium and calyx glabrous:
   7. Margins of shiny calyx lobes recurved ..... 7. *K. recurva*
   7: Margins of usually dull calyx lobes incurved or spreading:
      8. Leaf lamina with cuneate base in a straight line from the broadest point to compressed base (petiole absent) ..... 11. *K. praestans*
      8: Leaf lamina more or less abruptly constricted into bulging petiole:
         9. Young branches covered with blunt papillae or short hairs spreading at right angles ..... 9. *K. rostrata*
         9: Young branches glabrous or if with aciculate hairs then these more or less appressed:
            10. Lower flowers on inflorescence curved upwards:

11. Calyx lobes acute, stiffly erect after flowering, and with raised veins on hypanthium continued to their apex..... 12a. *K. micrantha* subsp. *micrantha*

11: Calyx lobes bluntly acute or rounded, incurved and closing the opening of the hypanthium after flowering, and with raised veins only on part of the hypanthium:

12. Floral axis glabrous except for stipuline bristles; hypanthium with vertical ridges ..... 12c. *K. micrantha* subsp. *oligandra*

12: Floral axis with short hairs hiding the stipuline bristles; hypanthium with vertical ridges on the ovary and then with horizontal bulge ..... 12c(i). *K. micrantha* subsp. *oligandra* × *K. micromera*

10: Lower flowers on the inflorescence straight or almost so:

13. Young branches with coiled or crisped hairs:

14. Calyx lobes greyish and incurved after flowering; ovary with 2,3(–5) locules ..... 12c(i). *K. micrantha* susbp. *oligandra* × *K. micromera*

14: Calyx lobes green and erect or spreading after flowering; ovary with 5 locules:

15. All branches woody and rigid..... 1(ii). *K. montana* × *K. recurva*

15: Lateral branches thin and wiry:

16. Leaves obovate to almost orbicular, (18-) 20–26 mm broad ..... 1(ii). *K. montana* × *K. micromera*

16: Leaves oblanceolate, 13–17 mm broad....13(iv). *K. micromera* × *K. recurva*

17. Lower bracts to 3 mm broad .....13. *K. micromera*

17: Lower bracts 4–4.6 mm broad..... 13(ii). *K. micromera* × *K. montana*

13: Young branches glabrous or with straight hairs:

18. Bracts glabrous except for marginal cilia:

19. Inflorescence elongate; bracts fleshy.....10. *K. ciliata*

19: Inflorescence globose; bracts coriaceous to membranous.....8. *K. newbeyi*

18: Bracts at least hairy dorsally along the central vein and with or without marginal cilia:

20. Lower bracts bluntly acute to cuspidate:

21. Calyx lobes greyish and incurved after flowering; leaves flat or slightly convex above, rounded ..... 12c(ii). *K. micrantha* subsp. *oligandra* × *K. recurva*

21: Calyx lobes green and erect or spreading; leaves concave to folded above, bluntly acute to acute.....4a(ii). *K. ericifolia* subsp. *ericifolia* × *K. recurva*

20: Lower bracts truncate to rounded:

22. Ovary with (2) 3–5 locules each with (3) 4–6 (–8) ovules; bracts shorter than hypanthium:

23. Petals 1.8–2.2 (–2.5) mm broad ..... 12b. *K. micrantha* subsp. *petiolata*

23: Petals 2–2.5 (–2.7) mm broad ..... 12b(i). *K. micrantha* subsp. *petiolata* × *K. praestans*

22: Ovary with 5 locules, each with 8–12 ovules; bracts longer than or rarely as long as hypanthium:

24. Calyx lobes greyish, incurved after flowering; petals pink ..... 12c(iii). *K. micrantha* subsp. *oligandra* × *K. recurva*

24: Calyx lobes green, erect to spreading after flowering; petals pale pink

25. Bracteoles spathulate-obovate; leaf lamina broadly elliptic ..... 6(ii). *K. clavata* × *K. recurva*

25: Bracteoles sessile obovate; leaf lamina obovate to broadly obovate ..... 7(vii). *K. recurva* × *K. sulphurea*

25: Bracteoles sessile obovate; leaf lamina oblong-oblanceolate..... ..... 7(iii). *K. glabrescens* × *K. recurva*

7. **K. recurva** Schauer in Lehm., Pl. Preiss. 1: 125 (1844); Benth., Fl. Austr. 3: 114 (1867); Domin, Mém. Soc. Sci. Bohême (1921) 22, 2: 87 (1923); Blackall & Grieve, West. Austr. Wildflow. edn 1, 1: 294 (1954); Beard, West Austr. Pl. 98 (1965); J. Green, Census Vasc. Pl. West. Austr. edn 2, 128 (1985); Rye in N.G. Marchant et al., Fl. Perth Region 1: 410 (1987), partly.

Type: Western Australia, 'in calculosis ad radices montium Darling's-range', *J.A.L. Preiss 290* (*lecto.* — selected here: LD; *isolecto.*: G, MEL 92342, 92343, W; *syn.*: *J. Drummond 27*, W).

K. recurva var. *melaleucoides* F. Muell. ex Benth., Fl. Austr. 3: 114 (1867), partly, excl. *A.F. Oldfield*, Vasse River; Domin, Mém. Soc. Sc. Bohême (1921) 22, 2: 87 (1923); Blackall & Grieve, West. Austr. Wildflow. edn 2, 3A: 98 (1980).

Type: Western Australia, Tone River, *A.F. Oldfield 353b* (*lecto.* — selected here: MEL 92348; *isolecto.*: K; *syn.*: Tone River, *A.F. Oldfield 356b*, K; Bald Island, *G. Maxwell s.n.*, MEL 92349; Cape Riche, *G. Maxwell s.n.*, MEL 92350).

K. spicata S. Moore, J. Linn. Soc., Bot. 45: 203 (1920); Blackall & Grieve, West. Austr. Wildflow. edn 1, 1: 294 (11954); Beard, West Austr. Pl. 98 (1965); Blackall & Grieve, West. Austr. Wildflow. edn 2, 3A: 98 (1980); J. Green, Census Vasc. Pl. West. Austr. edn 2, 128 (1985).

Type: Western Australia, 'on West Mt Barren, the Fitzgerald River', *G. Maxwell s.n.* (*holo.*: BM).

Shrubs 0.3–1.5 (–2) m tall, usually with several spreading, ascending or rarely almost decumbent main branches, usually much branched; young branches with decurrent flanges scarcely raised, more or less densely covered with forward-directed, straight hairs, particularly at the base of petioles and or near the inflorescences, sometimes glabrous or becoming so; early bark fibrous-mosaic, becoming fibrous-peeling and more or less coarsely fluted. *Leaves*: *petiole* (0.3–) 0.5–1 (–1.3) mm long, appressed, recurved to spreading at least in the upper part; *lamina* obovate, rarely obovate-spathulate to oblong-obovate, (1.3–) 1.9–2.6 (–4.2) × (1.3–) 1.7–2.7 (–3.6) mm, usually truncate and mucronate to bluntly acute, rarely acute or acuminate mainly when immature, usually abruptly tapering into petiole, flat to slightly concave above, flat to somewhat convex below, usually recurved from the middle when mature, glabrous. *Inflorescence* a spherical botryum, rarely elongate,with (12–) 15–27 (–39) flowers, terminal on long and short shoots and often clustered at the end of branches, sometimes with terminal growth after flowering but more often growth will continue from other branches or from the same branch below but not be related to the inflorescence; *perules* usually less than 5, ovate, with 1–3 veins, usually glabrous; *bracts* ovate-spathulate with stalk becoming longer on upper parts of the inflorescence, 2–3.4 × (1.8–) 2.4–3.2 mm, abruptly acute, bluntly acute, rounded or rarely almost truncate, with few to one vein, usually with few long hairs mainly from the base; *bracteoles* in pairs, linear-oblanceolate to oblanceolate, 2–3 × (0.8–) 1–1.8 mm, bluntly acute, with more or less hyaline margin, with few to many long hairs along the central vein and base. *Hypanthium* 2.8–3.3 mm long when flowering (free tube 1.6–1.8 mm), glabrous. *Calyx lobes* ovate to lanceolate or oblong-lanceolate, 1–1.6 mm long, bluntly acute or rounded, with recurved lateral margins, glabrous and shiny. *Corolla lobes* obovate-spathulate, 1.8–2.3 (–2.6) mm long, clawed, pink to rose purple. *Stamens* 21–34 (–40) in more than one whorl; filaments 3.5–4.9 mm long; anthers with almost terminal gland. *Ovary* with 5 locules, surmounted by a slightly broadened style base somewhat sunk into the upper surface; placenta narrowly elliptic, scarcely fleshy disc with conical attachment connected to the middle, with lobes connate on the outside margins, each lobe with two rows of ovules; ovules 8–12 (–14) per locule, spreading or lowest ones pendulous and slightly longer; style 3.8–5.2 mm long; stigma slightly broadened disc. Fruit an urceolate capsule with erect calyx lobes. *Flowers:* (August) September-November (December). Fig. 7.

Distribution and ecology

Widespread but usually only locally common from east of Bremer Bay in the south-east to near Augusta in the south-west and to near Perth in the north; growing in a wide variety of substrates usually in or near wet areas in depressions or lower slopes and very often with other species. Map 3.

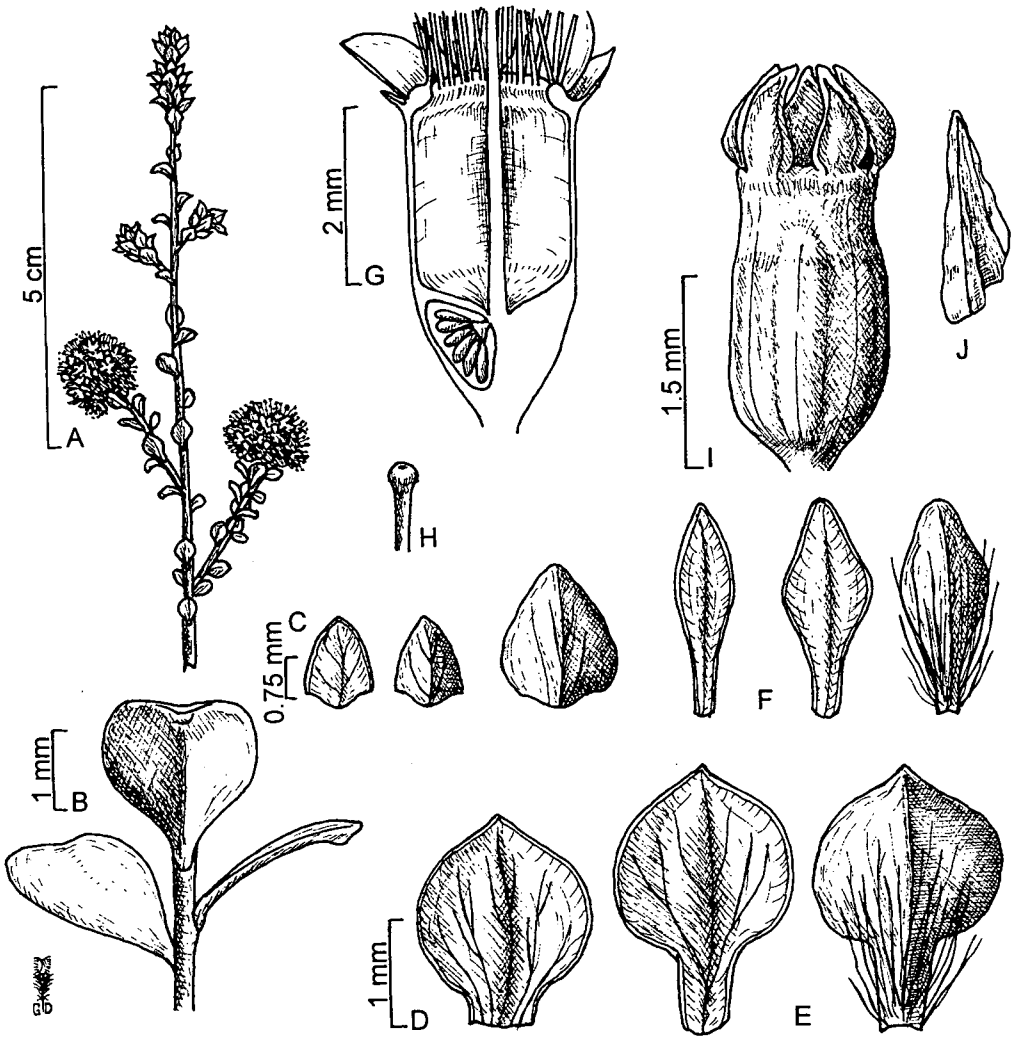


Fig. 7. ***K. recurva*** Schauer. A, flowering branch; B, branchlet; C, perules; D, lower bract; E, upper bract; F, bracteoles; G, half flower; H, stigma; I, fruit; J, recurved calyx lobe. (A–H, *H.R. Toelken 7171*; I, J, *J.W. Green 965*.)

Conservation status

K. recurva is not rare because it is widespread and often locally common.

Diagnostic features

Although *K. recurva* is similar to one or other form of most of the species in this subsection it is easily distinguished by the recurved lateral margins of the usually shiny calyx lobes. They may be flattened in flowers but are usually clearly visible in buds. Both of these characters are unique in this section of *Kunzea*, but one or usually both are lost in hybrids. The specific epithet is, however, not based on the recurved calyx lobes, but is thought to be based on recurved old leaves as the author changed the epithet from 'rotundifolia' to 'recurva'.

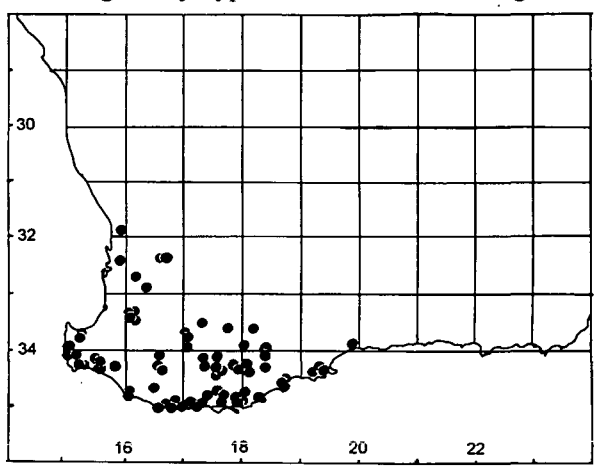
Variation

K. recurva being, next to *K. micrantha* and *K. micromera*, the species with the widest distribution, shows considerable variation, but the different forms usually remain extremely local and there are only a few characteristic of large areas.

1. The most obvious variant is a very broad-leaved form with more or less hairy branches and densely hairy inflorescences from the Stirling Range, this particular morphology might be due to some introgression with *K. montana*. It is, however, not treated as part of a hybrid swarm because of the presence of the typical recurved margin of the shiny calyx lobes characteristic of this species. Populations of this particular form that were investigated showed little variation.
2. To the south, between Albany and Bremer Bay, young branches especially when sprouting from a bud with perules usually produce delicate forward directed and more or less appressed hairs which are often also curved. These fine hairs are at least 0.5 mm long and never spreading at about right angles as in *K. rostrata*, which also has similar broad leaves.
3. Whereas leaves of the eastern forms mentioned above tend to be very broadly obovate to depressed obovate, plants from western populations usually have narrower leaves and glabrous branches.

Typification

Among the syntypes of *K. recurva* investigated only two were found to be inscribed in Schauer's handwriting, viz. *Preiss 290* (LD) and *Drummond 27* (W). While the specimens are very similar the former is here selected as the lectotype as the correction of the epithet from 'rotundifolia' to 'recurva' on that sheet indicates active work on it. Also, Schauer seem to have gleaned from that specimen 'frutex 4–5 ped., gracilis' and the detailed locality which, when provided on other specimens, is always accompanied by a reference to the publication indicating that they must have been distributed later. The Drummond specimen shows no such involvement in the drawing up of the protologue. Both specimens were probably collected in the Stirling Range, or very close to it, because they have unusually broad leaves and densely hairy inflorescences as is sometimes found in that area. They are, however, not considered part of the hybrid swarms between *K. recurva* and *K. montana* as explained above. Should future work nevertheless prove hybridity *K. spicata* must become the name for this species.



Map 3. *K. recurva* ●.

The type specimen of *K. spicata* has bracts and bracteoles, as well as the typical recurved margins of the calyx lobes as in *K. recurva* so that there seems to be little doubt that it must be a form of this species in spite of its spicate inflorescence. Elongate inflorescences are sometimes found under unusual environmental conditions, or late flowers in the season have been shown in other species to produce spicate inflorescences. Although this has not yet been recorded for *K. recurva*, the fact that no other such specimens could be found

underlines the likelihood that the type of *K. spicata* should be interpreted as an odd form of *C. recurva.*

Selection of specimens examined (129 seen)

WESTERN AUSTRALIA: *J.S. Beard 8200,* 16 miles N Kojonup, 26.x.1977 (PERTH); *R. & R. Belcher 406,* Tone River Valley along track to Mordaby from Muirs Hwy, 3.x.1967 (CANB, MEL); *B.G. Briggs NSW 124058,* Warrengup St. R., 8.x.1960 (NSW); *N.T. Burbidge 2407,* 1 ml N Boyerine Station, 10.ix.1947 (CANB); *E.M. Canning CBG 29194,* 1.1 mls Collia to Darkan, 2.x.1968, (CBG); *A.B. Cashmore 14,* near Normalup, 9.ix.1939 (PERTH); *J. Drummond 1, 132,* Swan River, s.d. (K); *A.L. Fairall 451,* Red Gum Springs, 8.x.1962 (KPBG); *D.B. Foreman 1535,* 3 km S Ambegate, 7.xii.1985 (AD, PERTH); *C.H. Gittens 1744,* Windy Harbour, -.ix.1967 (BRI, NSW); *C.A. Gardner 473,* Gnowangerup, 22.x.1920 (PERTH); *R. Helms NSW 124053,* Serpentine, 24.ix.1899 (NSW); *E.N.S. Jackson 3281,* 11 km ENE Augusta, 12.ix.1977 (AD); *Mrs McHard MEL 92792,* Blackwood River, -.1884 (MEL); *J.H. Maiden NSW 124055,* Margaret River, -.x.1909 (NSW); *N.G. Marchant 71/703,* Cheyne Beach, 26.x.1971 (PERTH); *A. Morrison 12075,* Tenterton, 24.ix.1902 (K); *F. Mueller MEL 92757,* Heathground towards the Hay River, -.x.1967 (MEL); *E.C. Nelson ANU 17314,* Scott River east of Augusta, 21.ix.1973 (PERTH); *S.P. Pfeiffer 7,* Cheyne Beach, -.vii.1969 (PERTH); *A. & E. Priess MEL 92828,* Busselton, s.d., (MEL); *E. Pritzel 784,* District Murray, Wellington, -.x.1901 (AD, K, PERTH); *R.A. Saffrey 128,* 16 miles NE Perth, 11.ix.1964 (PERTH); *A. Strid 20888,* 3.5 km N Borden, 22.x.1982 (PERTH); *H.R. Toelken 7107,* 20 km E Karridale, 23.x.1981 (AD, PERTH); *7153,* Fitzgerald River National Park, Hamersley Drive; 5 km S Telegraph Road, 31.x.1981 (AD, PERTH); *7168,* below Toompup HS, 1.xi.1981 (AD, PERTH); *Webb MEL 92728,* Bremer River, -.1884 (MEL); *D.J.E. Whibley 5106,* 50 km W Manjimup, 6.xi.1974 (AD, PERTH); *D.J.E. Whibley 5208,* E of Mt Manypeaks, 9.xi.1974 (AD, PERTH); *J.H. Willis MEL 92680,* Chester Pass, 4.ix.1949 (MEL); *J.W. Wrigley CBG 30389,* 6 mls N Denmark, 13.x.1968 (BRI, CBG).

Putative hybrids

7(i) *K. clavata* × *K. recurva* see 6(ii) *K. clavata*

7(ii) *K. ericifolia subsp. ericifolia* × *K. recurva* see 5a(ii) *K. ericifolia* subsp. *ericifolia*

7(iii) *K. glabrescens* × *K. recurva* see 3(i) *K. glabrescens*

7(iv) *K. micrantha* subsp. *oligandra* × *K. recurva* see 12c(ii) *K. micrantha* subsp. *oligandra*

7(v) *K. micromera* × *K. recurva* see 13(vi) *K. micromera*

7(vi) *K. montana* × *K. recurva* see 1(ii) *K. montana*

7(vii) ***K. recurva* × *K. sulphurea***

This hybrid has repeatedly been recorded probably because it is easily detected on account of the obvious colour differences in the flowers of the two parent species. Field studies, however, revealed a complete range of intermediates of all the characters of the two species as well as a possible introgressional character range in *K. sulphurea.* Since pollen sterility was found to be below 10% throughout the range of the hybrids an arbitrary delimitation of the two species and the hybrid is proposed. The pink and yellow colour of the petals and stamens are sufficiently well preserved in herbarium material to allow the use of these distinctions. The absence of recurved margins of the calyx lobes and the pale pink flowers of the hybrid distinguish it from the respective parent species.

Plants of the hybrid usually occur on drier areas together with *K. recurva* but are usually obvious by their paler pink flowers and often much taller shrubs than the latter, so that one does not need to investigate their calyx lobes.

Specimens examined

WESTERN AUSTRALIA: *A.M. Ashby 2702A,* near Windy Harbour, 22.x.1968 (AD, MEL, PERTH); *B.T. Goadby s.n.,* 'King George's Sound', -.x.1898 (PERTH); *J.W. Green 1120,* ca 5 mls SW Walpole, 3.xii.1956 (PERTH); *S.W. Jackson s.n.,* Bow River, -.xii.1912 (CAMB, PERTH); *H.R. Toelken 6448,* 10 km NW Bow River bridge, 6.x.1979 (AD, PERTH); *H.R. Toelken 6453,* 2.3 km E Bow River bridge, 6.x.1979 (AD, PERTH); *7181,* 1.5 km E Bow River bridge, 2.xi.1981 (AD, PERTH); *7895,* 46 km E Manjinup on road to Mt Barker, 25.ix.1988 (AD, PERTH); *J.W. Wrigley CBG 36394,* 28 mls from Denmark to Walpole, 14.x.1968 (CBG, BRI).

8. K. newbeyi Toelken, *sp. nov.*

A speciebus aliis foliis oblongo-ellipticis vel -oblanceolatis plerumque longioribus 4.8 mm manifeste erosis differt.

Type: Western Australia, near Pallinup River mouth, *H.R. Toelken 7909* (*holo.*: AD; *iso.*: B, BRI, G, K, LD, MEL, MO, NSW, NY, PERTH, S, W).

Robust shrubs 0.6–1.8 (–2.3) m tall, with several ascending stems each with spreading branches, often much branched; young branches with decurrent flanges scarcely raised, more or less densely covered with short forward-directed hairs, soon becoming glabrous; early bark fibrous becoming corky-fibrous and not peeling, more or less coarsely and irregularly fluted. *Leaves: petiole* 0.9–1.4 (–1.6) mm, appressed, recurved to spreading at least in the upper part; *lamina* oblong-elliptic to -oblanceolate, (2.8–) 4.8–5.6 (–6.5) × 1.7–2 (–2.2) mm, bluntly acute or rounded, rarely acute when folded, more or less abruptly constricted into petiole, folded at least when young to cymbiform or concave later, more or less convex below, usually recurving from the upper petiole, glabrous, with horny margin crenulate to erose. *Inflorescence* a spherical botryum with (14–) 17–32 (–38) flowers, terminal on long shoots but usually not on the main branches, without subterminal clusters, rarely with terminal growth after flowering but more often growth continuing from other branches; *perules* few to many, caducous, broadly ovate, with 3–5 veins, glabrous; *bracts* broadly ovate to ovate or sometimes oblong-ovate, with somewhat hyaline margins on the upper parts of the inflorescence, 3.4–5.2 × 2.6–3.8 mm, rounded rarely bluntly acute, with 1–5 main veins, glabrous; *bracteoles* in pairs, linear-oblanceolate to obovate, 3.9–4.6 × (1.6–) 2.5–3.3 mm, rounded, more or less hooded, with broad hyaline margins, with few hairs at the base or along the central vein. *Hypanthium* 3.8–5.3 mm when flowering (free tube 2.3–2.9 mm), glabrous. *Calyx lobes* ovate-triangular, 1.7–2.2 mm long, bluntly acute or rounded, glabrous. *Corolla lobes* broadly obovate to orbicular, 3.2–4 (–4.4) mm long, shortly clawed, mid to deep pink. *Stamens* 41–48 in more than one whorl; filaments 5.1–6.9 mm long; anthers with small subterminal gland. *Ovary* with 5 locules, surmounted by a slightly broadened style base somewhat sunk into the upper surface; placenta narrowly elliptic, fleshy disc with conical attachment connected to the middle, with lobes connate mainly on the outer margins, each lobe with usually one row of ovules; ovules 10–14, spreading to pendulous and slightly longer below; style 6.5–8.1 mm long; stigma slightly broadened and often obliquely placed. *Fruit* an urceolate capsule with erect calyx lobes. *Flowers*: October (November). Fig. 8.

Distribution and ecology

Known only from a restricted area in the breakaway associations on the lower Pallinup River where it grows on dry lower slopes. Map 4.

Conservations status

Since it is known only from one small locality it would seem to be in urgent need of conservation.

Diagnostic features

A robust shrub distinguished from other species in this subsection by the oblong leaves usually being more than 4.8 mm long and having characteristic erose horny margins often also found in other species of this subsection but then less pronounced and usually restricted to young leaves.

Variation: The species showed little variation within the only population investigated.

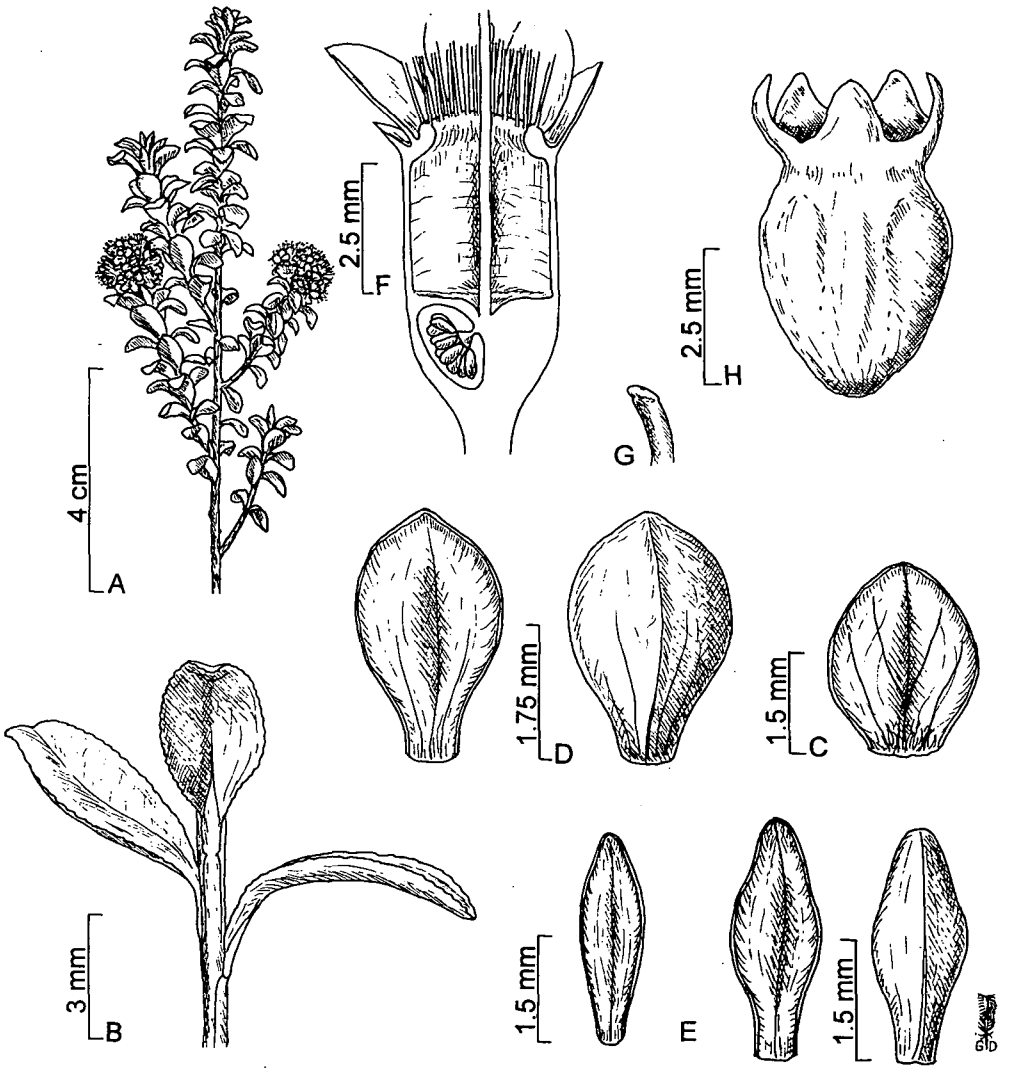


Fig. 8. *K. newbeyi* Toelken. A, flowering branch; B, branchlet; C, perule; D, bract; E, bracteoles; F, half flower; G, stigma; H, fruit. (A–H, *H.R. Toelken 7909*.)

Notes

The individual protuberances of the erose leaf margins can in this species not be shown to be derived from broadened hair bases (cf. *K. micromera*).

Etymology: The species is named in honour of Mr K. Newbey, who collected the species for the first time.

Specimens examined

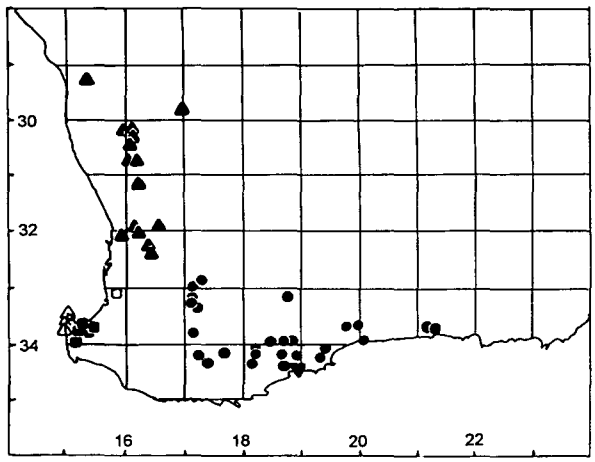
WESTERN AUSTRALIA: *E.M. Canning CBG 34442*, E Boat Harbour, 9.xi.1968 (CANB, NSW); *K. Newbey 1445*, E Boat Harbour, 18.x.1964 (PERTH); *H.R. Toelken 7909*, E Boat Harbour, 26.viii.1988 (AD, B, BRI, G, K, LD, MEL, MO, NSW, NY, PERTH, S, W).

9. K. rostrata Toelken, *sp. nov.*

K. recurva Schauer var. *melaleucoides* F. Muell. ex Benth., Fl. Austr. 3: 114 (1867), partly, as for *A.F. Oldfield s.n.*, Vasse River (K).

A speciebus aliis hujus subsectionis calicis lobis rostratis, papillis elongatis paene pilis per brevibus obtusissimis differt.

Type: Western Australia, 5 mls from Busselton towards Augusta, *J.W. Wrigley CBG 37578* (holo.: PERTH; iso.: CBG, n.v.)



Map. 4. *K. newbeyi* ▼; *K. rostrata* ■ (□ old record); *K. ciliata* △; *K. praestans* ▲; *K. micromera* ●.

Shrubs up to 1.6 m high, much branched; young branches with flanges raised but rarely decurrent for the whole length of an internode, densely covered with elongate papillae or very short erect hairs with blunt apices; early bark fibrous to fibrous-mosaic, scarcely fluted. *Leaves: petiole* (0–) 0.2–0.5 mm long, appressed; *lamina* broadly elliptic to elliptic-obovate, (1.8–) 2–2.8 (–3) × 1.8–2.3 mm, bluntly acute to rounded, sometimes mucronate, abruptly constricted into petiole, more or less flat above and below, recurved from about the middle, with distinct horny margin, glabrous. *Inflorescence* a sphaerical botryum with (5–) 11–15 (–18) flowers, terminal on usually lateral long shoots, rarely with terminal vegetative growth after flowering (dead twigs are retained for some time); *perules* few but rarely present, triangular to ovate, usually with 1 (3) veins, glabrous or with few marginal hairs; *bracts* ovate, broadly elliptic to almost orbicular, 2–2.6 × 2–2.2 mm, rounded, with one central vein, somewhat fleshy, glabrous but usually ciliolate; *bracteoles* in pairs, similar in size and shape to the bracts except sometimes spathulate-ovate, often caducous. *Hypanthium* 3.6–4 mm long when flowering (free tube 1.8–2 mm), glabrous, with vertical veins not raised. *Calyx lobes* triangular to lanceolate, 2–2.4 mm long, pointed to rostrate, ridged and usually with a subapical point, with incurved membranous margins, glabrous. *Corolla lobes* usually depressed obovate, 2.7–3.2 mm long, shortly clawed, 'rose pink'. *Stamens* 25–38 in more than one whorl; filaments 4.2–5.1 mm; anthers with a indistinct subterminal gland. *Ovary* with 5 locules, surmounted by a style slightly sunk into the upper surface; placenta narrowly elliptic, slightly fleshy, with conical attachment connected to the middle, lobes connate mainly on the outside margin, each lobe usually with one row of ovules; ovules 10 (–12) per locule, spreading to pendulous and slightly longer below; style 5–5.6 (–6.3) mm long; stigma slightly broadened with central depression. Fruit an urceolate capsule with erect calyx lobes. *Flowers*: October, November. Fig. 9.

Distribution and ecology

Known mainly from the vicinity of Busselton but also as far south as Mt Yates; one record from Harvey, north-east of Busselton, has not recently been confirmed. It has been recorded from 'peaty soil' and 'grey sandy soil'. Map 4.

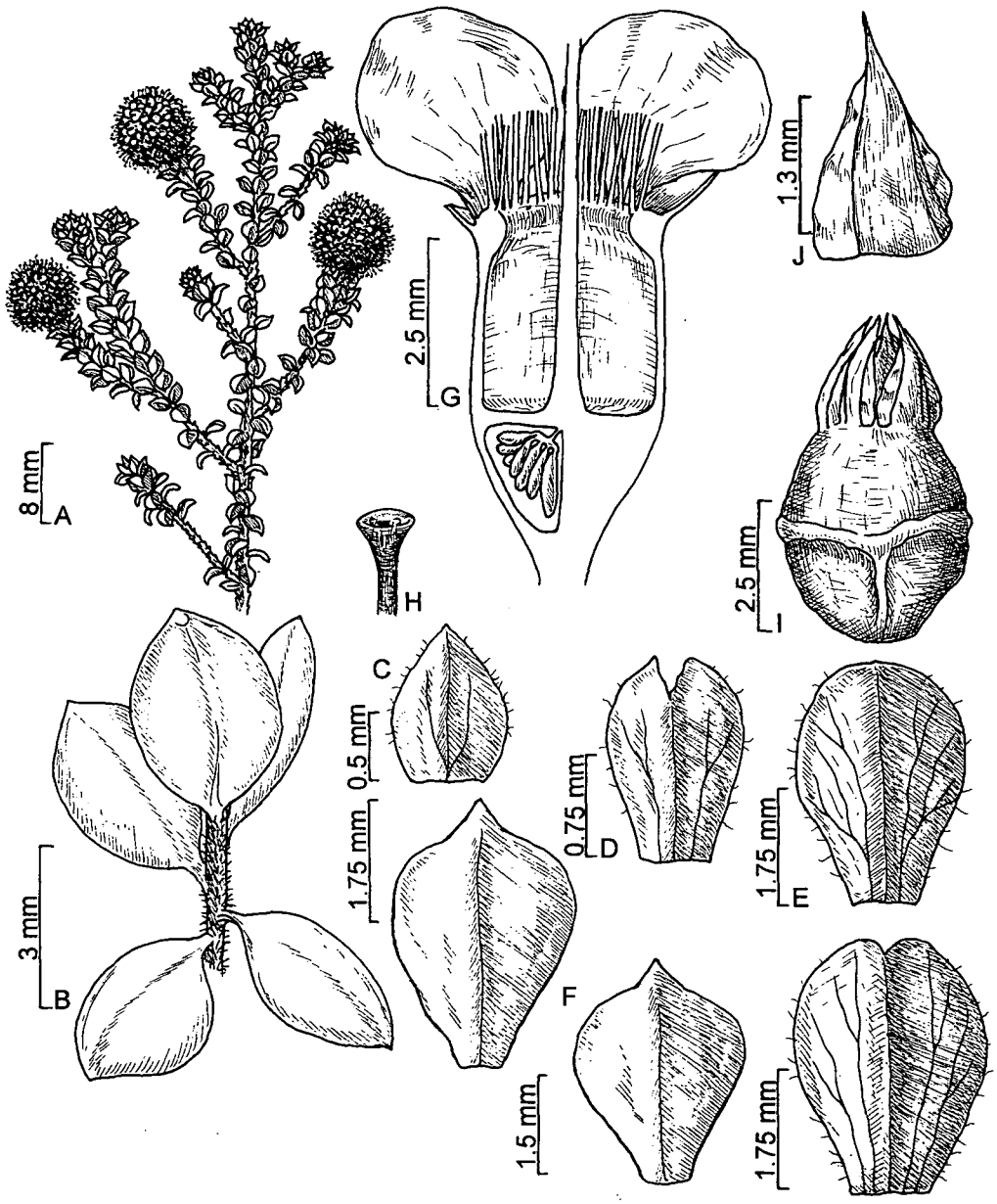


Fig. 9. *K. rostrata* Toelken. A, flowering branch; B, branchlet with spreading trichomes; C, perule; D, lower bract; E, upper bracts; F, bracteoles; G, half flower; H, stigma; I, fruit; J, incurved calyx lobes with menbranous margin. (A–J, *A.R. Fairall 780.*)

Conservation status

A little known species which could be endangered. It was not investigated by the author in the field.

Diagnostic features

Although in several respects it is similar to *K. recurva, K. rostrata* is not a hairy/papillose form of it, as it has neither the recurved margins nor the rounded apex of the calyx lobes. Their characteristicly pointed calyx lobes become more obviously beaked because the upper margins are often strongly incurved.

Etymology: The epithet 'rostrata' (beaked, Lat.) refers to pointed calyx lobes.

Specimens examined

WESTERN AUSTRALIA: *E.M. Bennett s.n.*, Busselton, -.-.1943, (PERTH); *1248*, 1 ml Metricup Road from Bussell Hwy, 20.ix.1966 (PERTH); *A.R. Fairall 780*, 142 mile peg on Augusta road, 17.x.1962 (KPBG, PERTH); *C.G. Gardner 5083*, Harvey, -.ix.1940 (PERTH); *G.J. Keighery 6830*, Mt Yates, SE Margaret River, 21.ix.1983 (PERTH); *A.F. Oldfield s.n.*, Vasse River, (K); 'nr Chuayna(?) Thicket Murchison', (K); *A. & E. Priess MEL 92742, 92836*, Busselton, s.d. (MEL); *R.D. Royce 3893*, Yoongarillup, 19.x.1952 (PERTH); *E.M. Scrymgeour 1248*, 0.9 mls on Metricup road from Busselton Hwy, 20.ix.1966, (PERTH); *J.W. Wrigley CBG 37578*, 5 mls Busselton to Augusta, 16.x.1968 (CBG, PERTH).

10. **K. ciliata** Toelken, *sp. nov.*

K. micranthae similis sed foliorum laminis ellipticis, bracteis bracteolisque lanceolatis saepe ciliatis, stigmate lato et 5 loculis quoque 9–12 ovulis differt.

Type: Western Australia, S Canal Rocks Caravan Park, *H.R. Toelken 7887* (*holo.*: AD; *iso.*: B, BRI, G, K, LE, MEL, MO, NSW, NY, PERTH, S).

Spreading shrubs (0.3–) 0.8–1.5 (–2.5) m tall, with few erect or ascending stems, much branched above young branches with flanges scarcely raised, more or less densely covered with short fine pointed hairs, soon becoming glabrous; early bark fibrous-mosaic, becoming somewhat corky and scarcely fluted. *Leaves: petiole* (0–) 0.2–0.4 (–0.6) mm long, appressed; *lamina* narrowly elliptic to elliptic-oblanceolate, (3.4–) 3.8–4.8 (–5.7) × (1–) 1.3–1.6 (–1.8) mm, bluntly acute to rounded, gradually tapering into short petiole, usually more or less flat above, usually distinctly convex below, stiffly erect, sometimes with scattered short hairs soon becoming glabrous. *Inflorescence* a spherical to elongate botryum with (9–) 12–18 (–26) flowers, terminal on mainly long shoots and rarely clustered at the apex, usually with terminal growth after flowering as well as growth unrelated to the inflorescence; *perules* often more than 5, caducous, triangular to lanceolate, acute, with one central vein, glabrous, more or less ciliate; *bracts* lanceolate to narrowly oblong-lanceolate or elliptic-oblanceolate and leaf-like, 2–3.2(–5.1) × 1–1.2 (–1.4) mm, bluntly acute, with one central vein, more or less ciliate, fleshy; *bracteoles* in pairs, similar to the bracts, rarely longer than 1.8 mm and more or less cymbiform. *Hypanthium* (2.7–) 3.2–3.8 (–4) mm long when flowering (free tube 1.9–2.3 mm long), glabrous. *Calyx lobes* triangular, (0.8–) 1–1.2 mm long, acute to pointed, rarely bluntly acute, thickened but not ridged, glabrous. *Corolla lobes* broadly obovate to orbicular, (2.9–) 3.2–3.4 mm, scarcely clawed, pink or pale pink. *Stamens* 43–48 in more than one whorl; filaments 3.7–4.9 mm long, inner ones often shorter and thinner; anthers with small subterminal gland. *Ovary* with (4) 5 locules, surmounted by a style slightly sunk into the upper surface; placenta narrowly elliptic, fleshy, abruptly constricted into centrally placed attachment, lobes mainly connate on the outer margins and each lobe with 1 or 2 rows of ovules; ovules 9–12 per locule, subequal, spreading to pendulous but scarcely longer; style 4.5–6.3 mm long; stigma distinctly broader than style but thin and with central depression. *Fruit* an urceolate capsule with spreading to somewhat erect calyx lobes. Flowers: mainly October, November but will respond quickly to favourable conditions. Fig. 10.

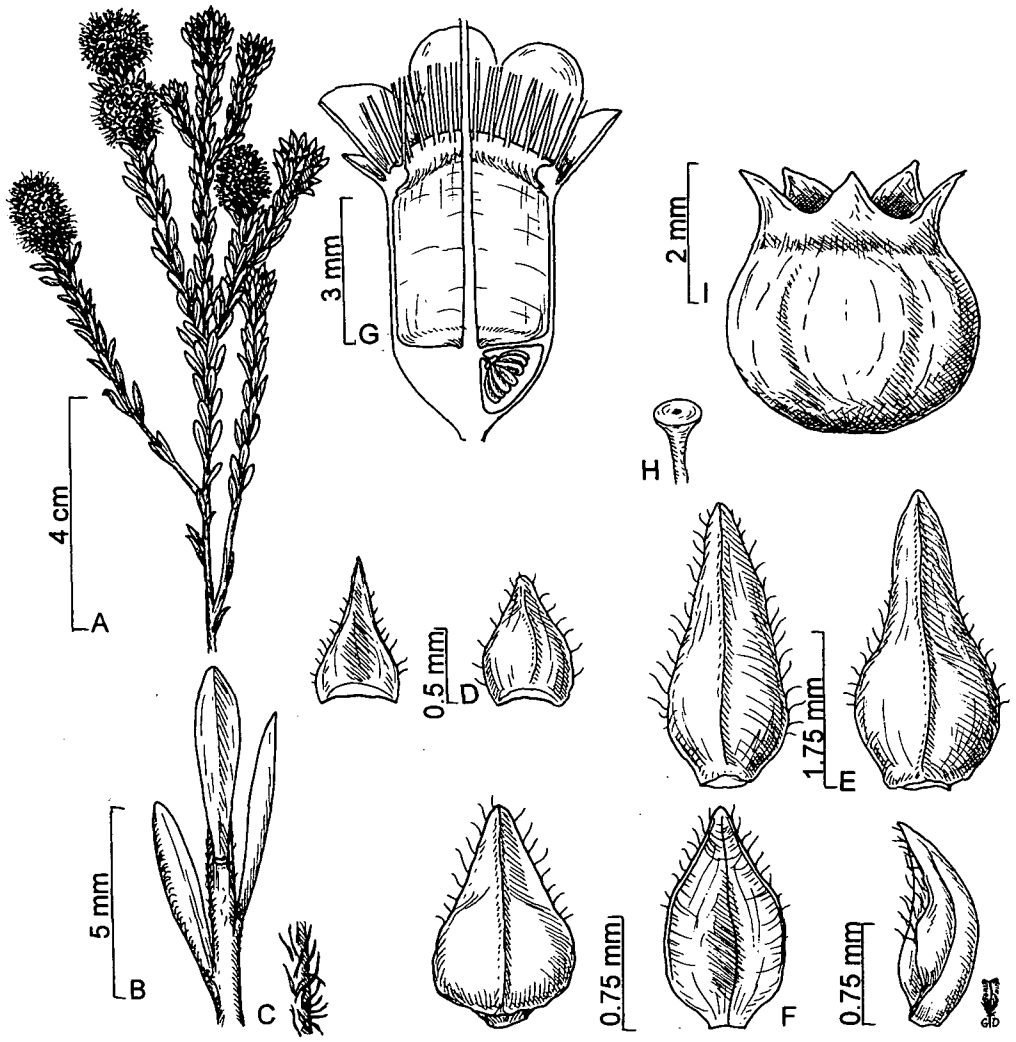


Fig. 10. *K. ciliata* Toelken. A, flowering branch; B, mature branchlet; C, section of young branchlet with pointed hairs; D, perule; E, bracts; F, bracteoles; G, half flower; H, stigma; I, fruit. (A–H, *H.R. Toelken 7887*.)

Distribution and ecology

Known only from Cape Naturaliste Peninsula to Gowaranup Bay; a record from 'between Augusta and Nannup' could not be confirmed. It is usually found on see page areas not far from the shore where it grows in association with granite or gneiss outcrops. Map 4.

Conservation status

Although observed in a number of localities it was common at none. Most of the plants are conserved since they grow in the Leeuwin-Naturaliste National Park.

Diagnostic features

Although superficially similar to *K. micrantha* it is easily distinguished by its more erect habit, fleshy leaves, and lanceolate leaf-like bracts and bracteoles. Superficially it also resembles *K. ambigua* from eastern Australia in its fleshy leaves, somewhat pointed calyx lobes particularly when young, and leaf-like bracts on often elongated inflorescences. However, the leaf venation, the slough-like abscission of the epidermis on young branches, and the small placenta with few ovules show that it belongs in section *Zeanuk*.

Etymology: The epithet '*ciliata*' (Lat.) refers to the ciliate bracts.

Specimens examined

WESTERN AUSTRALIA; *W.E. Blackall s.n.*, between Augusta and Nannup, -.12.1930 (PERTH); *H. Demarz 3739*, Cowaranup Bay, 2.vi.1972 (KPBG, PERTH); *L.W.J. Dodd s.n.*, Canal Rocks, -.2.1968 (PERTH); *A. & E. Priess MEL 92743, 92746, 92829*, Busselton, 1870 (MEL); *H.R.Toelken 7887*, S Canal Rocks Caravan Park, 25.ix.1988 (AD, PERTH); *7890*, near Moses Rock, 25.ix.1988 (AD, PERTH); *7891*, Cowaranup Bay, 25.ix.1988 (AD, PERTH).

11. **K. praestans** Schauer in Lehm., Pl. Preiss. 1: 124 (1844).

Type: Western Australia, *J. Drummond 184* (*lecto.* — selected here: W; *isolecto.*: ?K; *syn.*: *J. Drummond 29* – now identified as *K. micrantha* subsp. *petiolata*, W; *J. Drummond 186* — now identified as *K. micrantha* subsp. *micrantha*, W; Vasse River, *Mrs Molloy s.n.*, n.v.).

K. recurva var. *praestans* (Schauer) Benth., Fl. Austr. 3: 114 (1867); Blackall & Grieve, West. Austr. Wildflow. edn 2, 3A: 98 (1980), partly.

Shrubs (0.3–) 0.6–1.5 (–2.5) m tall, with few to several erect rarely spreading stems and rigid branches, then usually much branched; young branches with decurrent flanges scarcely raised, glabrous to more or less covered with crisped or coiled appressed hairs; early bark forming a fibrous mosaic, later fibrous to peeling in long strips, scarcely fluted. *Leaves: petiole* usually absent and main vein not bulging; *lamina* oblong-oblanceolate rarely -obovate, (3.4–) 4.5–6.8 (–11.2) × (1.3–) 1.8–2.5 (–3.4) mm, usually rounded, rarely with dorsal mucro, with long cuneate base tapering in a straight line from the broadest point to the base, usually with a sharp edge throughout, flat to slightly convex particularly below, stiffly erect and slightly curved outward from the base, rarely with apex slightly recurved, glabrous. *Inflorescence* an almost spherical to hemispherical botryum (usually broader than long in flower) with (8–) 14–20 (–30) flowers, terminal on short and long shoots and often clustered at the end of branches, with terminal growth at least on the long shoots; *perules* usually less than 5, caducous when flowering, oblong-ovate to ovate, usually with 1 vein, glabrous to densely hairy; *bracts* ovate to oblong-ovate or rarely ovate-spathulate on upper parts of the inflorescence, 3.5–4.2 × 2.1–2.5 mm, bluntly acute to rounded, boat-shaped, with some marginal hairs and hairs along the central vein dorsally to densely hairy; *bracteoles* in pairs, linear-oblanceolate to -elliptic, 3.3–4 × 1.2–2 mm, acute or bluntly acute, with more or less hyaline margin, with few to many usually crisped hairs mainly along the central vein dorsally. *Hypanthium* (3.6–) 3.8–5.8 mm long when flowering (free tube 2.4–3.3 mm), glabrous to densely covered with crisped hairs. *Calyx lobes* ovate, 1.4–1.8 mm, rounded or bluntly acute, often appearing acute because of incurved margins, glabrous. *Corolla lobes* depressed obovate, 2.8–3.6 × (2.7–) 3.1–3.8 (–4.4) mm, scarcely clawed, usually deep pink to rose. *Stamens* (50-) 70–90 (–106) in more than one whorl; filaments (4.8–) 5.1–6.2 mm; anthers with small almost terminal gland. *Ovary* with 5 locules, surmounted by a broadened style base slightly sunk into the upper surface; placenta an elliptic, scarcely fleshy disc with conical attachment connected to the middle, lobes connate mainly on the outside margin, each lobe with two rows of ovules; ovules (8–) 10–14 (–15), spreading or lowest ones pendulous and slightly longer; style 5.5–7.7 mm long;

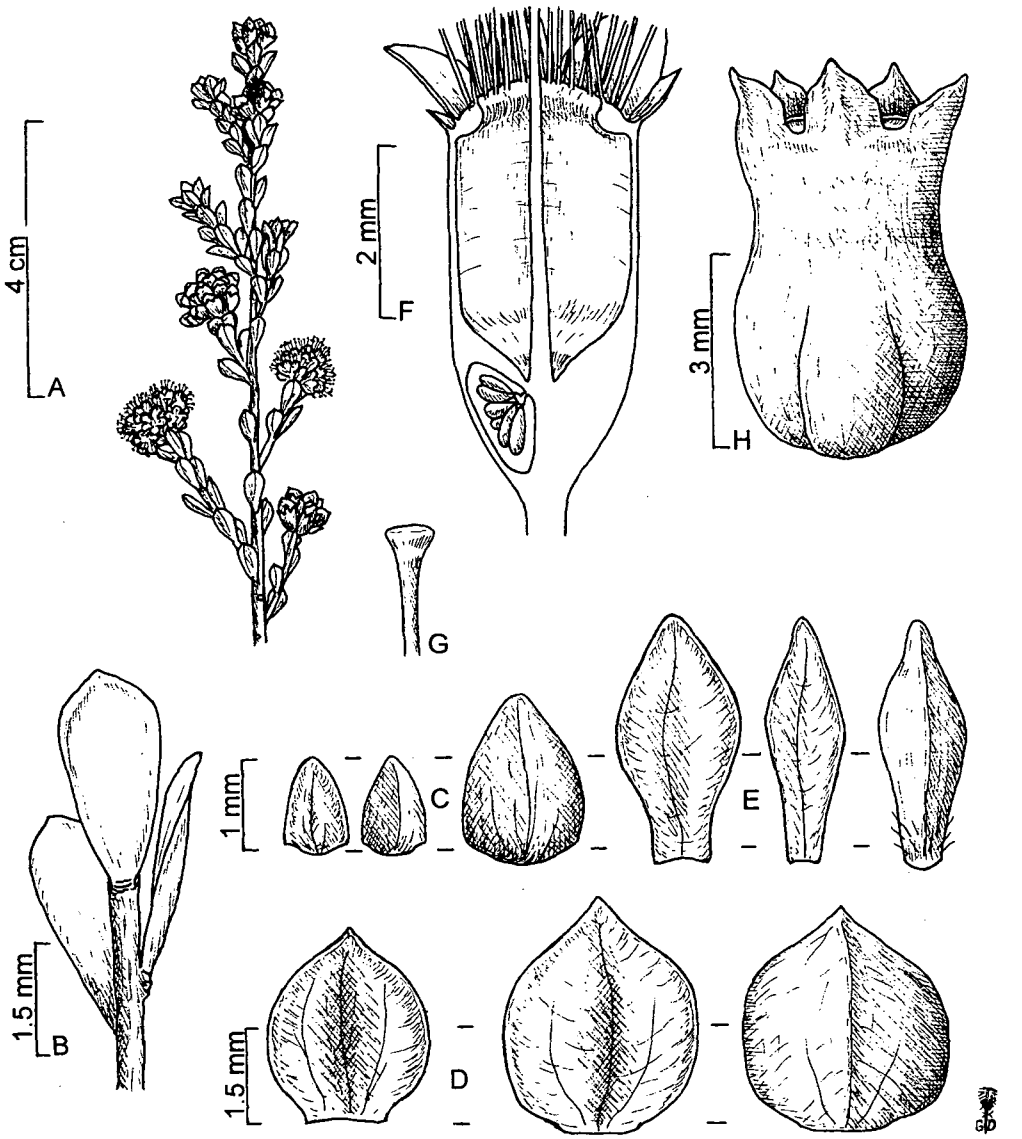


Fig. 11. ***K. praestans*** Schauer. A, flowering branch; B, branchlet; C, perules; D, bracts; E, bracteoles; F, half flower, G, stigma; H, fruit. (A–G, *H.R. Toelken 7112*; H, *D.J.E. Whibley 4887*.)

stigma distinctly broader than style. Fruit an urceolate capsule with erect calyx lobes. *Flowers*: September, October (November). Fig. 11.

Distribution and ecology

This species has been mainly recorded from gravelly slopes of the low mountain ranges, mainly the Darling Ranges, adjoining the coastal plains. Sometimes it has also been recorded from depressions in inland localities such as, near Moora. It is found in a broad triangle mainly along the escarpment from near Minginew in the north to near Wubin in the east and Mt Coke in the south. Map 4.

Conservation status

Although recorded from a wide area, *K. praestans* where found, is not common; it is conserved in a number of national parks.

Diagnostic features

This species is unique among broad-leaved species because the stiffly erect leaves have a long cuneate base tapering in a straight line from the broadest point near the apex to the base. The green tissue of the lamina usually continues to the base and the central vein, though visible at the base, does not bulge as is usually found in the petiole of other species. The petals are also broader, (2.5–) 3-5 mm, than in either *K. micrantha* subsp. *micrantha* or subsp. *petiolata.*

Variation

Plants from the northern parts of the distribution are hairy to tomentose on most parts including the hypanthium, while further south the plants tend to be glabrous. Specimens from near Perth tend have a more recurved apex of the leaves even when they are young than do plants from other areas. The leaf lamina of the southern form often does not continue its green tissue to the base although it is distinctly ridged, and the broadest point is often on the upper third whereas it is on the upper fifth or eighth of the lamina in the northern form.

Typification

The name *K. praestans* seems to be based on four specimens, viz. three *J. Drummond* specimens (W) annotated by Schauer and a specimen of *Mrs Molloy* from Vasse River, which has not yet been located. The last one should probably be excluded because *K. praestans*, as lectotypified, has not been recorded so far south. However, the three Drummond specimens also each belong to a different species and a case could be made for each of them being specificly referred to in the protoloque. It seems that Schauer's description was kept intensionally broad so as to accommodate all the specimens seen. Accordingly the one specimen, *J. Drummond 184*, was selected as the lectotype of *K. praestans*, while the other specimens are identified as follows:

J. Drummond 29 as *K. micrantha* subsp. *petiolata; J. Drummond 186* as *K. micrantha* subsp. *micrantha*; *Mrs Molloy*, Vasse River as probably either *K. micrantha* subsp. *micrantha* or *K. rostrata.*

Selection of specimens examined (41 seen)

WESTERN AUSTRALIA: *A.M. Ashby 2654*, Cairn Hill near Gunyidi, 2.x.1968 (AD, PERTH); *W.E. Blackall 2551*, between Moora and Watheroo, 13.ix.1932 (PERTH); *E.M. Canning CBG 28968*, 100.6 miles Perth to Moora, 29.ix.1968 (CANB, PERTH); *R.J. Cranfield 4233*, 15 km N of South Bindoon, 19.ix.1983 (PERTH); *J. Drummond MEL 92867*, Western Australia, s.dat. (MEL); *H. Eichler 15790*, C. 5 km NW Gleneagle, 29.viii.1959 (AD); *C.A. Gardner s.n.*, Coomberdale, ix.1963 (PERTH); *F. Lullfitz 5921*, 62 mile peg on Great Northern Highway, 22.x.1964 (PERTH); *J.H. Maiden s.n.*, Mingenew, x.1909 (BRI 273818, NSW); *F. Mueller MEL 92822*, Western Australia, s.d. (MEL); *M.E. Phillips 1934*, 40 miles S Perth along Albany Highway, 30.ix.1968 (CANB); *E.M. Scrymgeour 1358*, 125 miles Perth-Geraldton Rd, 29.ix.1966 (PERTH); *J. Seabrook 179*, Helena Valley, 3.ix.1977 (PERTH); *H.R. Toelken 7110*, 5 km N Mundorin Weir wall, 25.x.1987 (AD, PERTH); *7112*, below Glen Eagles picnic area, 27.x.1981 (PERTH); *D.J.E. Whibley 4887*, 15 km N Moora, 2.xi.1974 (AD); *E. Wittwer 812*, 6 miles N Watheroo, 4.ix.1969 (KPBG, PERTH).

Putative hybrid

11(i) *K. micrantha* subsp. *petiolata* × *K. praestans* see 12b(i) *K. micrantha* subsp. *petiolata.*

12. **K. micrantha** Schauer in Lehm., Pl. Preiss. 1: 125 (1844); 2: 223 (1848); Benth., Fl. Austr. 3: 112 (1867); Domin, Mém. Soc. Sci. Bohême (1921) 22, 2: 86 (1923), as 'micrandra', partly; Blackall & Grieve, West. Austr. Wildfow. edn 1, 1: 293 (1954); Beard, West Austr. Pl. edn 2, 76 (1970); Blackall & Grieve, West. Austr. Wildflow. edn 2, 3A: 98 (1980); J. Green, Census Vasc. Pl. West. Austr. edn 2, 128 (1985); Rye in N.G. Marchant et al., Fl. Perth Region l: 410 (1987).

Type: Western Australia, near Guildford, *J.A.L. Preiss 277* (*lecto.* — selected here: LD; *isolecto.*: G, MEL 92409, W).

Shrubs 0.25–1.2 (–2) m tall, usually with many spreading stems, little to moderately branched, with ultimate branches thin and wiry or rarely rigid; young branches with decurrent flanges scarcely raised, glabrous to more or less hairy with short appressed straight hairs, soon becoming glabrous; early bark splitting into slender strips, slightly peeling, becoming shallowly fluted and somewhat corky. *Leaves: petioles* (0.2–) 0.4–0.7 (–1) mm long, appressed at first then spreading to slightly recurved at least towards the apex; *lamina* linear-oblanceolate, oblanceolate or rarely obovate, (0.8–)1.3–6.5 (–7.8) × (0.4–) 0.6–2 (–3.2) mm, acute to cuspidate, rarely truncate and mucronate with apex more or less recurved at least when young, with cuneate base often long, slender and then abruptly constricted into bulging petiole, flat to slightly concave above, slightly convex below, older ones often recurved from the middle, glabrous or rarely with scattered hairs, soon becoming glabrous. *Inflorescence* a spherical to oblong botryum with (11–) 20–38 (–50) flowers being usually curved on the lower parts of the inflorescence, terminal mainly on long shoots, rarely clustered at the end of branches, sometimes with limited terminal growth after flowering while growth continues from major shoots; *perules* up to 5, usually caducous at flowering, ovate to oblong-ovate, usually with 1 vein, with a few hairs and/or marginal cilia; bracts ovate to commonly oblong-ovate or oblanceolate or rarely obovate, (1.4–) 1.6–2.7 (–3.3) × (0.8–) 0.9–1.4 mm, rounded to bluntly acute or cuspidate, curved, not keeled, central vein often raised to the apex at least on lower parts of the inflorescence, with scattered hairs to glabrous; *bracteoles* in pairs, linear-oblanceolate, 1.5–2.8 (–3.1) × 0.6–1.2 mm, rounded to truncate, with membranous to hyaline margin, with few scattered hairs or rarely marginal cilia to quite glabrous. *Hypanthium* 2.1–3.1 (–3.6) mm long when flowering (free tube 1.8–2.3 mm), typically curved (or almost straight in subsp. *petiolata*) on flowers of the the lower part of the inflorescence, glabrous. *Calyx lobes* ovate to ovate-triangular, 0.8–1 (–1.2) mm long, acute to bluntly acute, rarely pointed, with margins more or less incurved, glabrous. *Corolla lobes* oblanceolate- to obovate-spathulate, 1.4–1.8 (–2.5) × (1.3–) 1.5–1.8 (–2) mm, clawed, pink to white, rarely purple. *Stamens* (8–) 12–40 (–60) in more than one whorl; filaments 2.4–3.6 mm long; anthers with small subterminal gland. *Ovary* with 2 or 3 (–5) locules, surmounted by a slender style slightly or not sunk into the upper surface; placenta elliptic, scarcely fleshy disc with slender attachment connected to the upper half, small lobes mainly connate on the outer margins, each lobe with one row of ovules; ovules 2–6 (–14) per locule, more or less pendulous and elongate or at least the lowermost; style 2.9–4.1 mm long, stigma usually scarcely broader than style. *Fruit* an urceolate capsule with erect or incurved calyx lobes.

Variation

This very variable and widespread species complex is neither always easily distinguished from *K. praestans* and *K. micromera* on its northern and south-eastern end of its distribution nor does it lend itself to a clear delimitation into easily recognised taxa. The frame work provided here requires much more field work.

In the south-east the distributions of *K. micrantha* subsp. *oligandra* and *K. micromera* overlap in large areas. The latter is, though superficially very similar, usually readily distinguished by the broad green erect calyx lobes on its fruits and the ovary always being 5-loculed.

K. praestans, whose distribution borders onto *K. micrantha* subsp. *petiolata* north to north-east of Perth, is mainly distinguished because most of its sessile leaves have margins tapering in a straight line to its base, a phenomenon only rarely found on odd leaves of *K. micrantha*. This distinction is usually supported by the greater number of stamens (50–106) and broader petals (2.5–5 mm) in *K. praestans*.

However, *K. micrantha* subsp. *petiolata* appears intermediate in most characters between *K. micrantha* subsp. *micrantha* and *K. praestans* and occurs in the area between these two taxa. The perplexing thing about the variation observed is that *K. micrantha* subsp. *petiolata* is exceptionally variable and, because of its intermediate nature, one is tempted to interpret the variation as being due to hybridisation. Analysing this variation one observes, however, a clinal range orientated largely in a north to south direction, from 5 locules per ovary, each locule with 7–9 ovules near Jurien Bay to (2) 3 locules each with 2–4 ovules north of Perth. The latter condition is that also found in typical *K. micrantha* which is found in similar habitats along the coast southwards, but distinguished by its curved hypathium with veins being visible to the apex of the calyx lobes. Most plants of subsp. *micrantha* have a glabrous floral axis except for the stipuline trichomes, while they are densely hairy in subsp. *petiolata*. This apparent a cline has an extraordinary multiplicity of character changes from *K. praestans* to *K. micrantha* subsp. *petiolata* and then subsp. *micrantha*. Hybridisation could account for some local variation but only one population could be identified as such (cf. *H.R. Toelken 7109*: *K. micrantha* subsp. *petiolata* × *K. praestans*), so that the full significance of hybridisation on the variation found is not known. The intermediate character of this subspecies however, is not attributed to hybridisation, because one would expect much more variation due to backcrossing with *K. praestans*, but no plants of this species have been recorded from the swamps of the coastal plains. *Kunzea praestans* also shows little variation that could be related to hybridisation with *K. micrantha* subsp. *petiolata*.

In spite of its close resemblance to *K. micrantha, K. praestans* is here given species rank because it usually grows in dryer habitats often on dry gravelly slopes, unlike *K. micrantha*, which is throughout its range associated with wet or temporary marshy conditions. The apparent character gradient between the two species described above is not geographically in a single line, i.e. plants of subsp. *petiolata* from near Jurien Bay show closest similarity to those of *K. praestans* from south of the Swan River, so that their close resemblance probably to be explained by derivation from a common ancestor rather than from one another. Two unusual records from the Wongan Hills (*E.H. Ising AD 966030679, F.W. Went 198* – PERTH) must, according to their leaves, narrow petals and small placenta, be identified as *K. micrantha* subsp. *petiolata*, but they have (10–) 12–14 ovules per locule and occur well outside the distribution area of that taxon. This possible relic population seems also to indicate that the two taxa are derived from a common ancestor.

The transition from subsp. *petiolata* into subsp. *micrantha* is not clear from the few populations remaining in the area around the lower Swan River now occupied by the cities of Perth and Fremantle. It seems significant that a botanically observant collector like J. Drummond considered it appropriate to include specimens of all three taxa (*K. praestans, K. micrantha* subsp. *petiolata* and subsp. *micrantha* cf. typification of *K. praestans*) in what seem to be his first collection of Western Australian plants sent to J.D. Hooker in the early 1840s, and which Schauer (1844) included under *K. praestans* although he described *K. micrantha* in the same publication.

Kunzea micrantha subsp. *micrantha* is found from Perth to around Bunbury, while the closest occurrence of subsp. *oligandra* is of small populations in forested areas east of Manjimup. The calyx lobes of the specimens of these western populations are often bluntly acute and the flowers have more than fifteen stamens, while in the eastern populations the flowers often have fewer than 15. Their calyx lobes are usually rounded and become incurved after flowering.

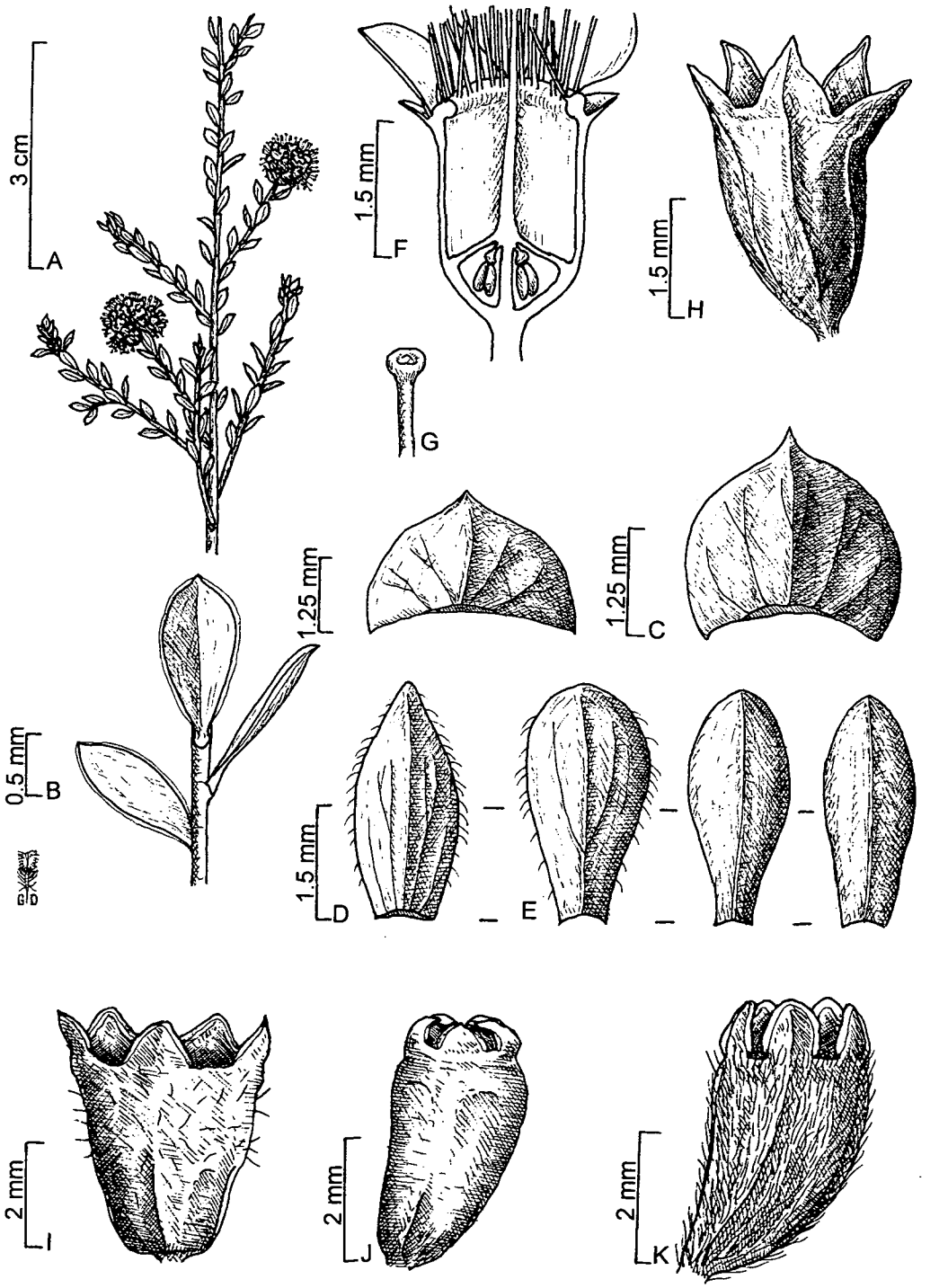


Fig. 12. ***K. micrantha*** Schauer subsp. ***micrantha***. A, flowering branch; B, branchlet; C, perule; D, bract; E, bracteoles; F, half flower; G, stigma; H, immature fruit. – subsp. ***petiolata*** Toelken. I, immature fruit. – subsp. ***oligandra*** (Turcz.)Toelken. J, immature fruit. – subsp. ***hirtiflora*** Toelken. K, immature fruit. (A–G, *H.R. Toelken 7105*; H, *W.E. Blackall s.n.*, -.xii.1930; I. *M.E. Phillips CBG28468*; J, *H.R. Toelken 7113*; K, *H.R. Toelken 7899*.)

Since numerous stamens and many ovules in each of the 5 locules are considered primitive characters in *Kunzea* the progressive reduction southwards and then eastwards indicates a direction of evolutional development of the taxa of *K. micrantha*. The subsp. *hirtiflora* must represent an early segregate in the development of subsp. *oligandra* that has become extremely localised.

Typification and nomenclature

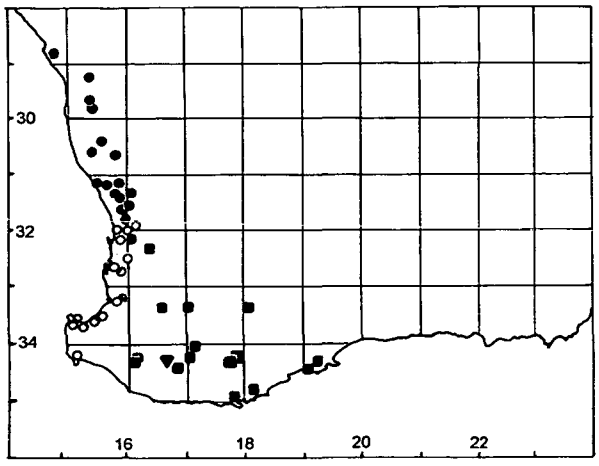
Although Schauer annotated only one specimen in what seems to have been Lehmann's herbarium (now in LD) this does not prove that he had only used that specimen from which to draw up the description. Since there is some uncertainty when authors examined the Preiss specimens i.e. before or after duplicates were distributed (K.L. Wilson 1983), the specimen selected here as a lectotype might be shown by future research to be the only specimen he saw at the time, i.e. the holotype (cf. introdution).

As no infraspecific taxa have been recognised since Bentham (1867), references to *K. micrantha* in most previous literature are cited under the species name because it is difficult to assess with certainty what different elements individual authors had included in their treatment.

13a. subsp. **micrantha.**

Kunzea micrantha Schauer in Lehm., Pl. Preiss. 1: 125 (1844).

Shrublets 0.3–1.5 (–2) m tall, with few erect wiry woody branches, sparsely and usually untidily branched. *Inflorescence* with 25–35 (–40) flowers, with axis usually glabrous, rarely sparsely to densely hairy so that stipuline trichomes are often not visible; *lower bracts* oblong-lanceolate to -oblanceolate, rounded rarely bluntly acute, with central vein scarcely raised, with or without hairs at the base. *Hypanthium* of lower flowers curved, with raised veins visible to the apex of the calyx lobes, as long as or longer than bracts. *Calyx lobes* ovate, often becoming triangular with incurved margins, usually acute, remaining more or less erect after flowering. *Stamens* 18–35. *Ovary* with (2) 3 locules each with 2, 3 (4) ovules. *Flowers*: (August) September, October. Fig. 12A–H.



Map 5. ***K. micrantha*** subsp. ***micrantha*** ○; subsp. ***petiolata*** ●; subsp. ***oligandra*** ■; subsp. ***hirtiflora*** ▼.

Distribution and ecology

Growing in temporary marshes usually with clay soil along the coastal plains from near Perth to the vicinity of Busselton, and apparently sporadically to near Augusta. Map 5.

Conservation status

Recorded from a wide area but all populations are small because of a limited number of swamps without tree canopy. It needs to be monitored to ensure conserving significant populations.

Diagnostic features

The acute, stiffly erect calyx lobes as well the distinctive raised veins to the apex of these lobes on the curved lower flowers are characteristics of this subspecies.

Variation

In northern populations the bracts and bracteoles are shorter than the hypanthium and the floral axis is densely hairy; they become respectively gradually longer and less hairy to the south. Although these changes do not seem to be linked they occur so gradually that they appear to be part of a clinal development and no meaningful taxonomic separation between the northern and southern populations could be effected.

Some specimens east of Bunbury sometimes have broad calyx lobes that resemble those of subsp. *oligandra*, however, they are spreading, and not incurved to cover up the inside of the hypanthium as in that subspecies.

In the vicinity of Busselton the calyx lobes show considerable variation from acute and often without obvious raised veins to pointed and often with a dorsal subapical point (also on the leaves) reminiscent of those of *K. rostrata*, but there is no other evidence to suggest that these are hybrids with the latter species.

Selection of specimens examined (69 seen)

WESTERN AUSTRALIA: *R. & R. Belcher 164*, Waterloo, 12 mls E Bunbury, 30.ix.1967 (MEL, PERTH); *W.E. Blackall s.n.*, near Augusta, -.xii.1930 (PERTH); *M.G. Corrick 9*, Mt Dale Road, SE Carinyah, 6.xi.1983 (AD); *H. Demarz 11404*, Kenwick swamp, 9.x.1986 (PERTH); *J. Drummond 2, 133*, Western Australia, -.-.1843 (BM, K, MEL); *C.A. Gardner s.n.*, Busselton, 27.ix.1944 (PERTH); *R. Helms s.n.*, Guildford, 15.x.1897 (PERTH); *G.J. Keighery 1032*, Ruabon, 17.ix.1977 (PERTH); *1837*, Ellen Brook Tortoise Reserve, 19.x.1978 (KPBG); *M. Koch 2650*, Picton Junction, -.xii.1922 (MEL); *A.H.S. Lucas NSW 124011*, -.x.1928 (NSW); *Mrs McHard MEL 92722*, Blackwood River, -.-.1882 (MEL); *J.H. Maiden NSW 124008*, Welshpool to Kalamunda, ix.1909 (NSW); *A. Morrison s.n.*, Kelmscott, 11.ix.1817 (CANB, MEL, PERTH); *8120 & 8121*, lower Vasse River, 22.iii.1898 (K); *F. Mueller MEL 92818*, Serpentine River, 1.xii.1877 (MEL); *F. Mueller MEL 92834*, Prestons River, 5.xii.1877 (MEL); *A. & E. Priess MEL 92820*, Busselton, s.d. (MEL); *J.M. Powell 3039*, 2.9 km N Dunsborough, 8.xi.1985 (AD); *R.D. Royce 2633*, Welshpool road, Busselton, 15.ix.1948 (PERTH); *R.D. Royce 2673*, Capel, 24.ix.1948 (PERTH); *Sargent & C.A. Gardner 695*, Picton Junction, x.1920 (PERTH); *A. Steffanoni ADW 16087*, Gosnells, 18.ix.1927 (AD); *F. Stoward NSW 124006*, Serpentine, -.x.1911 (NSW); *H.R. Toelken 6441*, 4 km W Coolup Station, 4.x.1979 (AD, PERTH); *W. Webb MEL 92715*, Upper Blackwood River, -.-.1893 (MEL); *J.H. Willis MEL 92682*, North Dandalup, 10.ix.1947 (MEL); *Wilson & Herbert s.n.*, North Dandalup, -.xi.1920 (PERTH).

12b. subsp. **petiolata** Toelken, *subsp. nov.*

K. praestans Schauer in Lehm., Pl. Preiss. 1: 124 (1844), partly, as for *J. Drummond 29*.

K. praestanti similis sed laminis foliorum abrupte constrictis ad petiolos tumescentes, hypanthiis brevioribus staminibusque (30–) 35–45 (–60) differt.

K. micranthae subsp. *micranthae* similis sed hypanthio recto et sine venis prominentibus ad apices obtusos loborum calicis differt.

Type: Western Australia, 23 mls from Jurien Bay to Moora, *M.E. Phillips CBG 26892* (holo.: CANB; iso.: NSW).

Shrublets (0.6–) 1–1.5 (–2) m tall, with erect to spreading, usually with rigidly woody branches, much branched. *Inflorescence* with (11–) 15–24 (–35) flowers, axis hairy so that stipuline trichomes are not visible; *lower bracts* obovate, obtuse to rounded. *Hypanthium* with raised veins but not visible or incompletely visible on calyx lobes, straight, usually longer than bracts. *Calyx lobes* ovate to ovate-triangular, with slightly incurved margins, usually bluntly acute, remaining erect after flowering. *Stamens* (30–) 35–50 (–60). *Ovary* with 3, 4 (–5) locules each with 4–10 (–14) ovules. *Flowers*: September, October (November). Fig. 12I.

Distribution and ecology

Usually growing in clay depressions with temporary swampy conditions on the coastal plains from just north of the Swan River to near Jurien Bay. Map 5.

Conservation status

Widespread and locally frequent but needs to be closely monitored because of a reduction of localities due to urban and agricultural development.

Diagnostic features

Kunzea micrantha subsp. *petiolata* is distinguished from subsp. *micrantha* by its straight (not curved) hypanthium without or with only faint veins visible up to the apex of the calyx lobes, while *K. praestans* is distinguished by the long-cuneate base of its leaf lamina with the margins usually continued in a straight line to the base and without a petiole. Occasionally the latter distinction needs to be supported by the supplementary character of petals being 1.8–2.2 (–2.5) mm broad in subsp. *petiolata*, while they are (2.5–) 2.8–4 (–5) mm broad in *K. praestans*, which has usually also more than 60 stamens.

Variation

The subsp. *petiolata* includes much local variation which is not clearly understood because it grew in an area now largely occupied by the urban development of Perth and Fremantle as discussed under the species.

Typification

A specimen from near Jurien Bay was chosen as the type although it might prove to be an extreme form. The southern more common forms were avoided because they were more likely to be involved in hybrid swarms. The northern form seems to be more or less isolated geographically from subsp. *micrantha* and *K. praestans*, as no specimens of those taxa from near Jurien Bay have been seen.

Etymology: The epithet '*petiolata*' (Lat.) refers to the presence of a petiole on leaves in contrast to its absence on leaves of the very similar *K. praestans*.

Specimens examined (45 seen)

WESTERN AUSTRALIA: *N. Byrnes 3970*, 11 km N Gingin, 2.x.1980 (BRI); *J.B. Cleland NSW 124049*, York, -.xii.1907 (NSW); *D. Churchill s.n.*, Chittering, 6.x.1954 (PERTH); *R. Coveny 3095*, 19.3 km NE Bullsbrook, 29.viii.1970 (NSW, PERTH); *R.J. Cranfield 5040*, Muchea Townsite, along Carl Street, 6.xi.1984 (PERTH); *L.A. Craven & C. Chapman 6884*, 3 km S Three Springs, 2.x.1981 (PERTH); *A.S. George 1692*, 31 mls N Perth, 28.x.1960 (PERTH); *J.W. Green 5465*, 24 km E Eneabba on E boundry of Tathra National Park, 17.ix.1981 (PERTH); *R.J. Hnatiuk 780163*, 10 km N Mullering Brook, 17.x.1978 (PERTH); *780164*, ca 10 km N Mullering Brook, 17.x.1978 (PERTH); *790034*, ca 8 km S Gingin, 27.ix.1979 (PERTH); *E.H. Ising AD 966030679*, Wongan Hills, 13.ix.1926 (AD); *G.J. Keighery 5252*, Serpentine, 29.ix.1982 (PERTH); *F. Lullfitz 5612*, 11.1 mls S Gingin Cemetery, 22.x.1960 (KPBG, PERTH); *F. Mueller MEL 92832*, Upper Irwin River, -.xi.1877 (MEL); *M.E. Phillips CBG 28458*, 10 mls from Gingin to Regans Ford, 28.ix.1968 (CANB, MEL, NSW); *R.D. Royce 9453*, Moore River National Park, 2.x.1971 (PERTH); *Miss Julia Sewell MEL 92801, MEL 92848*, Upper Swan River, 1885 (MEL); *E.M. Scrymgeour 559*, Cannington Swamp, 3.ix.1966 (PERTH); *A. Strid 20653*, 1.5 km N Bullsbrook, 30.ix.1982 (B, G, PERTH); *F.W. Went 198*, between Wubin and Wongan Hills, 10.ix.1962 (PERTH); *P.G. Wilson 3794*, 13 km WNW Badgingarra, 1.xi.1965 (MEL, PERTH); *T. & J. Whaite W21*, Geraldton area, 22.ix.1976 (NSW); *D.J.E. Whibley 3204*, 15 km W Moora on road to Dandaragan, 8.x.1969 (AD); *C.T. White 5201*, between Darlington and Bellevue, 1.xi.1927 (BRI).

Putative hybrid

12b(i) ***K. micrantha*** subsp. ***petiolata*** × ***K. praestans***

Specimens with the leaf lamina continued in a straight line to the base can be separated as *K. praetans*, but all the others are included in *K. micrantha* subsp. *petiolata*, a subspecies not clearly separable from this hybrid (cf. variation above), which is mainly distinguished by its somewhat broader petals (2–2.6 mm).

A similar wide variation of plants has been recorded from the vicinity of Gingin, which is also situated close to the escarpment, but no population studies have been conducted in that area.

Specimen examined

WESTERN AUSTRALIA: 3 km N Stoneville Post Office, *H.R. Toelken 7109* (AD — mass collection).

12c. subsp. **oligandra** (Turcz.) Toelken, *comb. nov. et stat. nov.*

K. oligandra Turcz., Bull. Cl. Phys.-Math. Acad. Imp. Sci. Saint-Pétersbourg 10: 336 (1852); F. Muell., Fragm. 8: 183 (1874).

Type: Western Australia, *J. Drummond 5, 139* (*holo.*: KW - PERTH, photo.; *iso.*: BM, K (2×), MEL 92410, NSW, PERTH).

K. micrantha auct. non Schauer: Benth., Fl. Austr. 3 : 112 (1867), partly, as for *J. Drummond 5, 139*, and *G. Maxwell s.n.*, Salt River (K).

Shrubs up to 0.6 m tall, with several woody spreading stems from the base. *Inflorescence* with 25–48 flowers, axis glabrous except for the bristle-like stipuline trichomes; *lower bracts* obovate, cuspidate to mucronate, with central vein more or less raised to the apex, with few long hairs towards the base. *Hypanthium* of lower flowers curved, with raised veins to the base of the calyx lobes, distinctly shorter than bracts. *Calyx lobes* ovate, bluntly acute to rarely rounded, with papillose surface greyish-green, incurved and more or less closing flower after flowering. *Stamens* 7–14 (–20). *Ovary* with 2 (3) locules each with 2, 3 (4) ovules. *Flowers*: (August) September, October. Fig. 12J.

Distribution and ecology

Growing in temporary marshy depressions and often partly submerged when flowering. It is found in a broad belt mainly inland from the southern coast of south-western Western Australia from near Manjimup to Porongorup and again near Bremer Bay. Map 5.

Conservation status

More observations are required as this widespread subspecies is never common and only small populations are conserved in the Stirling Range National Park and in the south-western part of the Fitzgerald River National Park.

Diagnostic features

The subsp. *oligandra* is easily recognised by the broad greyish calyx lobes, which are incurved after flowering so as to close the hypanthium. The raised veins on the hypanthium, typical of *K. micrantha*, do not continue to the apex of the calyx lobes so that *K. micromera* is mainly distinguished from the above subspecies by its widely spaced short calyx lobes which usually remain stiffly erect after flowering, the bulging hypanthium immediately above the ovary, and its five locules per ovary.

Although the bracts and bracteoles of subsp. *oligandra* might bear a few scattered hairs along the margins of the central vein dorsally, the floral axis is without hairs, and if hairy, the plant is interpreted here as one of the following two hybrids, but this interpretation requires more field studies before it can be confirmed: (a) *K. micrantha* subsp. *oligantha* × *K. micromera* with very short hairs about as long as the stipuline bristles or (b) *K. micrantha* subsp. *oligantha* × *K. recurva* with longer hairs and thick rigid branches.

Variation

This subspecies is incompletely known probably because it is never as common as the typical one and consequently fewer specimens were available for this study. Hence also the variation and the delimitation of the putative hybrids are not clearly understood.

While the number of stamens in populations from eastern localities tend to be fewer than 15 per flower they are often up to 20 in western populations. Here this subspecies is distinguished from subsp. *micrantha* only by the broad greyish calyx lobes which are incurved after flowering.

Typification

Turczaninov described *K. oligandra* as having three locules per flower, however, this has been found to be the exception even in isotypes of *J. Drummond 5, 139.* Most of the specimens examined have two locules.

Specimens examined

WESTERN AUSTRALIA: *C. Andrews s.n.*, near Albany, -.x.1900 (PERTH); *A.M. Ashby 2010*, W Rocky Gully, 14.x.1966 (AD, K, PERTH); *M. Camb s.n.*, Porongorup plains, 20 miles E Karri Bank, 9.v.1968 (PERTH); *M.G. Corrick 7713*, Dillon Bay, 4.x.1981 (PERTH); *H. Doing s.n.*, NE Porongorup Range, 10.ix.1966 (CANB); *J. Drummond 5, 139*, Western Australia, -.-.1849 (BM, K, MEL, NSW, PERTH); *A.R. Fairall 417*, 236 mile peg on Albany Highway, 7.x.1962 (KPBG, PERTH); *J. Galbraith 944*, Albany, 7.x.1964 (MEL); *A.S. George 9659*, 11 mls S Arthur River, 10.x.1969 (PERTH); *M. Koch 2666*, Palgarup, N Manjimup, xi.1922 (K, MEL, NSW, PERTH); *F. Mueller MEL 92785*, Porongorup, s.d. (MEL); *K. Newbey 2761A*, 10 mls W Bremer Bay, 28.ix.1968 (PERTH); *M.E. Phillips 4012*, 14 miles from Darham to Collie, 1.x.1968 (CANB); *M.E. Phillips CBG 22750*, between Tambellup & Kandenup, 7.x.1962 (AD, CANB); *R.D. Royce 7667*, Cranbrook, 23.x.1962 (PERTH); *H.R. Toelken 7165*, 4 km N Manjimup, 22.x.1981 (AD, PERTH); *7113*, below Glen Eagles Picnic area, 27.x.1981 (AD, PERTH); *7120*, 7 km E Many Peaks, 28.x.1981 (AD, PERTH); *J.H. Willis MEL 92680*, Chester Pass, 4.ix.1949 (MEL); *P.G. Wilson 4217*, 25 km W Chester Pass, 28.ix.1966 (K).

Putative hybrids

12c(i) ***K. micrantha* subsp. *oligandra* × *K. micromera***

K. recurva Schauer var. *melaleucoides* auct. non F. Muell. ex Benth.: Domin, Mém. Soc. Sci. Bohême (1921) 22, 2 : 87 (1923), partly, as for specimen cited.

Specimens are superficially similar to those of *K. micrantha* subsp. *oligandra* in their spreading habit, the bluntly acute incurved calyx lobes and fewer than 5 locules per ovary. However, the floral axis is densely covered with short hairs, the apices of lower bracts are usually rounded and without a raised central vein and, most significantly, the developing fruits show the characteristic bulging of the hypanthium immediately above the ovary, which are all characters of *K. micromera.*

Most of the specimens identified as this putative hybrid are from areas south-east of Ongerup where there are very few records of *K. micrantha* subsp. *oligandra*, so that all or some of the putative hybrid specimens may be variants of the latter. The taxon was treated here as a hybrid because of its straight or almost straight flowers and because it is usually being found in association with *K. micromera.*

Specimens examined

WESTERN AUSTRALIA; *B. Barnsley 510*, 38 km S Ravensthorpe, 21.viii.1979 (PERTH); *B. Cockman 9*, Moingup Spring, Stirling Range 7.ix.1987 (PERTH); *H. Demarz 508*, Bremer Bay road at turnoff to Gairdner River, 23.x.1968 (PERTH); *A.A. Dorrien-Smith s.n.*, Bridgetown to Kojonup and Slab Hut Gulley, -.-.1910 (K); *F. Stoward 40*, Cranbrook, 22.ix.1917 (PERTH); *H.R. Toelken 6480*, S Ongerup, 7.x.1979 (AD, PERTH); *7128*, N Bremer Bay, along Gorden Inlet Road, 29.x.1981 (AD, PERTH); *7130*, corner of Devils Creek and Gairdner Road, 29.x.1981 (AD, PERTH); *7135*, 4 km S Qualup HS, 29.x.1981 (AD, PERTH); *7139*, 3 km N Bremer Bay Road turnoff along Devils Creek South Road, 30.x.1981 (AD, PERTH).

12c(ii) ***K. micrantha* subsp. *oligandra* × *K. recurva***

K. sprengelioides Turcz., Bull. Cl. Phys.-Math. Acad. Imp. Sci. Saint-Pétersbourg 10: 336 (1852); F. Muell., Fragm. 8: 183 (1874), **pro species**.

Type: Western Australia, *J. Drummond 5, 138* (*holo.*: KW — PERTH photo.; *iso.*: BM, MEL 92346, NSW, PERTH, W).

Plants appear as if they were particularly vigorous specimens of subsp. *oligandra* but the broader and rigid branches, the long hairs on the floral axis, the straight longer hypanthium of lower flowers as well as the broader petals (1.8–2.4 mm), indicate *K. recurva* as being the other putative parent. This hybrid is also usually easily recognised by its rather longer than broad calyx lobes, a character often found in *K. recurva*, but unlike the lobes in that species they have no recurved margins.

Specimens examined

WESTERN AUSTRALIA: *W.E. Blackall 4326*, Lake Clockerup, 20.xii.1939 (PERTH); *E.M. Canning CBG 37998*, 35 mls from Albany to Borden, 25.x.1968 (CANB); *CBG 51671*, 1.4 mls Jerramungup to Albany, 1.xi.1968 (CANB); *B.T. Goadby 92*, Hay River, -.x.1898 (NSW); *A. Meebold 10444*, Albany, -.viii.1933 (PERTH); *K. Newbey 1166*, 2 mls S Tambellup, 20.x.1963 (PERTH); *H.R. Toelken 6465*, 1 km S turnoff to Toompup, 7.x.1979 (AD, PERTH); *P.G. Wilson 4321*, 3 km W Bremer Bay township, 1.x.1966 (PERTH).

12d. subsp. **hirtiflora** Toelken, *subsp. nov.*

Subsp. *oligandrae* similis sed hypanthio axeque florali piloso et lobis calicis porcatis differt.

Type: Western Australia, NE Lake Muir, *H.R. Toelken 7899*, 25.ix.1988 (*holo.*: AD; *iso.*: K; PERTH).

Spindly shrublets 0.6–1 m tall, usually with erect stem, sparsely and untidily wiry branched, with fine appressed hairs when young. *Inflorescence* with 28–45 flowers, axis with dense spreading hairs obscuring stipuline trichomes; *lower bracts* obovate to -spathulate, bluntly acute to rounded, central vein more or less raised to the apex and with few long hairs towards the base. *Hypanthium* of lower flowers slightly curved, without raised veins, densely covered with forward-directed hairs, as long as or longer than bracts. *Calyx lobes* ovate, rounded to bluntly acute, papillose surface greyish-green except for broad membranous margins, distinctly ridged, erect or spreading after flowering. *Stamens* 14–17. *Ovary* with 2 locules each with 2, 3 (4) ovules. Flowers: September. Fig. 12K.

Distribution and ecology

Growing in temporary marshes and often partly submerged when flowering; known only from near Lake Muir. Map 5.

Conservation status

Probably in need of conservation but known only from two collections without many observations from the northern part of Lake Muir.

Diagnostic features

The subsp. *hirtiflora* is very similar to subsp. *oligantha*, but may be distinguished by its spindly erect habit, hairy hypanthium and floral axis, as well as its distinctly ridged calyx lobes.

Variation

This subspecies is only known from two collections which are remarkably uniform, so that a separate taxon is described here. The hairy hypanthium is so distinctive that the plants

were at first thought to be a hybrid between subsp. *oligandra* and *K. preissiana*, but the latter species has never been recorded that far west and hybrids with that species usually also have hairy leaves. Young leaves of subsp. *hirtiflora* are, however, glabrous except for some fine marginal cilia.

Etymology: The epithet '*hirtiflora*' (= with hairy flowers, Lat.) refers to the hairy hypanthium and calyx of flowers of this subspecies.

Specimens examined

WESTERN AUSTRALIA: *W.R. Barker 2346*, E of north end of Lake Muir, 13.ix.1977 (AD, PERTH); *H.R. Toelken 7899*, NE Lake Muir, 25.ix.1988 (AD, K, PERTH).

13. **K. micromera** Schauer in Lehm., Pl. Preiss. 2: 223 (1848); Benth., Fl. Austr. 3: 114 (1867), partly, excl. *J. Drummond 5, 135* and *G. Maxwell 211*; Domin, Mém. Soc. Sci. Bohême (1921) 22, 2: 87 (1923), partly, excl. *Pericalymma roseum*; Blackall & Grieve, West. Austr. Wildflow. edn 1, 1: 294 (1954); Beard, West Austr. Pl. edn 1, 77 (1965), partly; Blackall & Grieve, West. Austr. Wildflow. edn 2, 3A: 99 (1980); J. Green, Census Vasc. Pl. West. Austr. edn 2, 128 (1985).

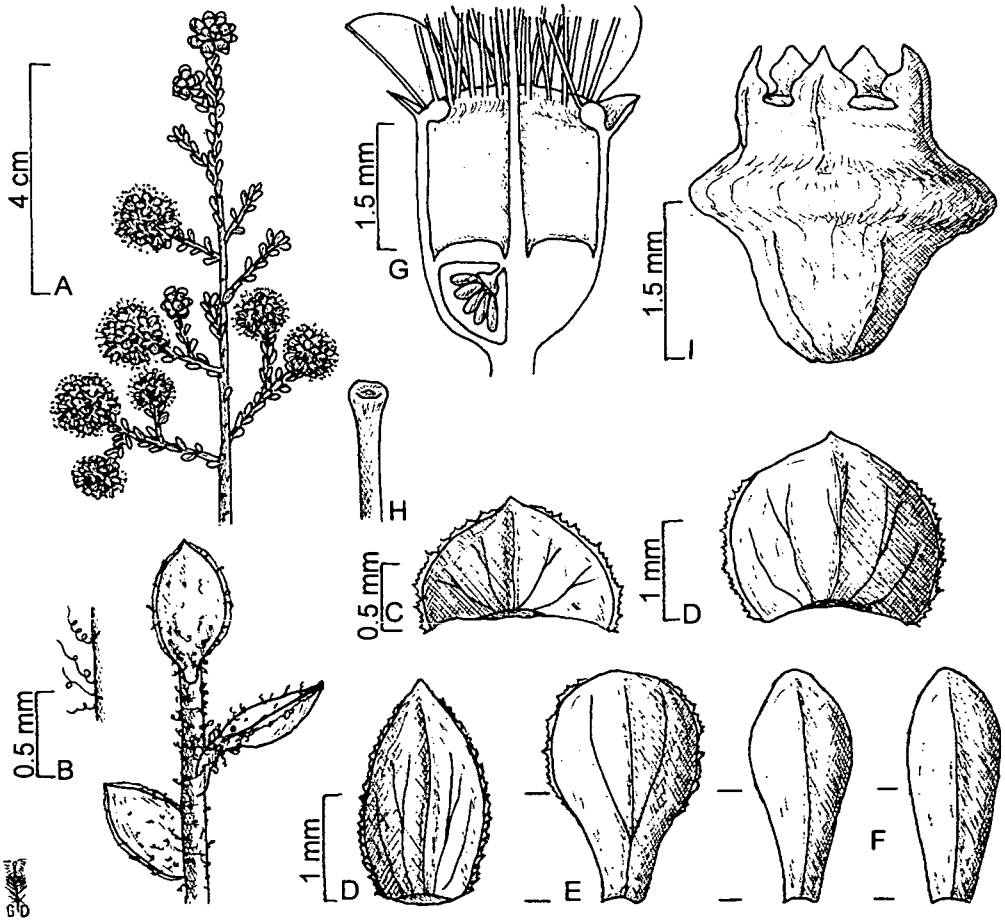


Fig. 13. *K. micromera* Schauer. A, flowering branch; B, branchlet showing coiled hairs; C, perule; D, lower bracts; E, upper bract; F, bracteole; G, half flower; H, stigma; I fruit. (A, G, H, *K. Newbey 478*; B, *A.S. George 6877*; C–F, I, *H.R. Toelken 7127*.)

Type: Western Australia, near ?Guildford, *J.A.L. Preiss 277* (*holo.*: MEL 92304).

Sparse shrublets (15–) 20–60 cm tall, with one to few wiry to somewhat woody stems, usually little branched; young branches with decurrent flanges scarcely raised, more or less densely covered with coiled, crisped or almost straight, short hairs soon becoming glabrous; early bark fibrous-mosaic, becoming more or less peeling and only slightly corky at least at first, shallowly fluted. *Leaves: petiole* 0.2–0.4 mm long, appressed; *lamina* oblanceolate to more or less elliptic, rarely broadly elliptic, (1–) 1.6–2.8 (–3.4) × 0.6–0.9 (–1.6) mm, bluntly acute to rounded or acute when immature, gradually or rarely abruptly constricted into petiole, above flat to slightly convex, usually distinctly convex below, with scattered coiled or rarely straight hairs often on both surfaces, soon becoming glabrous, with distinct horny margin often somewhat erose. *Inflorescence* a spherical botryum with (6–) 12–18 (–24) flowers, terminal on few long shoots, not clustered at the ends of branches, sometimes with terminal growth after flowering, others not continued on that branch often due to gall formation; *perules* depressed ovate to broadly ovate, acute to bluntly acute, rarely cuspidate or rounded, with 5–7 (–9) veins, glabrous or with short marginal cilia, or a tuft of hairs towards the apex; *bracts* broadly ovate at the base, becoming obovate-spathulate towards the apex of the inflorescence, 2–2.6 × 1.6–2.3 mm, rounded to bluntly acute, rarely truncate, with one to few veins, rarely with few hairs mainly along the midrib, cilia if present very short; *bracteoles* in pairs, oblanceolate to -spathulate, 1.5–2 × 0.6–1.3 mm, rounded and somewhat hooded, more or less hyaline, glabrous or with scattered hairs along the central vein, usually without marginal cilia. *Hypanthium* 2.6–3.2 mm long when flowering (free tube 1.4–2 mm), usually glabrous, with veins usually visible but rarely raised at base. *Calyx lobes* ovate, 0.8–1.1 mm long, rounded or rarely bluntly acute when margins incurved, glabrous. *Corolla lobes* obovate to orbicular, 1.4–1.9 (–2.2) mm long, pink or rarely magenta. *Stamens* 14–22 in more than one whorl; filaments 2.6–3.3 mm long; anthers with small subterminal gland. *Ovary* with 5 locules, surmounted by broad style base somewhat sunk into the upper surface; placenta a narrowly elliptic and scarcely fleshy disc with conical attachment connected to its centre, lobes connate mainly outside margins, each lobe with one row of ovules; 4–6 or up to 8 per locule in lower flowers, subequal, spreading to almost pendulous; style 3.2–4 mm long; stigma slightly broadened with central depression. *Fruit* an urceolate capsule with angular base often surmounted by obvious bulge, with erect calyx lobes. *Flowers*: October, November. Fig. 13.

Distribution and ecology

Plants have been recorded from clay, tillite or sandy substrate and are usually found in temporary moist depressions often in association with *K. recurva*; widespread but never common from near Stokes Inlet near Esperance to just east of Albany and in the north to near Narrogin and Newdegate. Map 4.

Conservation status

A rare species because although it has been recorded from such a wide area it is no where common. Conserved in Stirling Range National Park.

Diagnostic features

Although vegetatively very similar to *K. micrantha*, *K. micromera* is easily distinguished by its rounded short calyx lobes and smooth upper hypathium, which in *K. micrantha* is angular and usually has raised veins. The calyx lobes usually remain erect and green after flowering (rarely they become somewhat incurved possibly due to drying but even then do not cover the opening of the free hypanthium), while they are opaquely grey and incurved to close the opening of the hypanthium in its hybrid with *K. recurva*. These hybrid plants usually have much more robust main branches and 20–40 flowers per inflorescence.

Domin (1923) included *Pericalymma roseum* in the synonomy of *K. micromera*, but the type of that species is now included in 18(iii) *K. jucunda* × *K. preissiana*. The latter is distinguished from *K. micromera* by its hairy hypanthium and by the initially hairy calyx lobes, which tend to become glabrous.

Small plants of *K. praestans* might also be confused with *K. micromera* especially as they often also have short crisped hairs, but they produce rigid erect branches, leaves with straight margins, and have more than 30 stamens per flower.

Variation

Although *K. micromera* is widespread and populations often occur widely separated they show limited local variation. Plants from north of the Stirling Range and often those from south-east of Ongerup have coiled or crisped hairs on both sides of the leaves. These plants, and plants with glabrous leaves, or at the most with some long marginal cilia, often seem to occur in separate populations of a particular form, but they cannot be separated by any other character. Throughout most of the distribution range young branches are sparsely hairy and soon become glabrous. In the southern parts of the Stirling Range some plants are quite glabrous as even the floral axis may be without hairs except for the stipuline bristles (cf. *E. Wittwer 2082*). The hairy floral axis usually found in *K. micromera* should therefore not be used to distinguish it from *K. micrantha* subsp. *oligandra*.

As in the case of *K. micrantha*, young leaves are linear-oblanceolate with a long straight cuneate base which, in slow-growing plants, may become abruptly constricted into the petiole, while on actively growing branches the long gradual cuneate base is retained. Both forms can be seen on the same plant, or only one form is found on a plant, e.g. shade forms only have linear-oblanceolate leaves (*H.R. Toelken 7160*). In senescent plants the leaves are very small and somewhat convex below so that they become reminiscent of those of *K. jucunda*. Since these plants also usually produce very few flowers per inflorescence, it is tempting to refer them to hybrids but no plants with any other evidence of hybridisation between the two species could be found. The distinct horny margin and bulging fruit of *K. micromera* distinguish specimens where the individual habits are not apparent.

In mature vegetation one occasionally finds plants with long sinuous branches. These senescent plants tend to have very few branches and even fewer inflorescences so that they are rarely collected. They cannot be confused with plants of *K. micromera* × *K. recurva* with the rigid branches and many inflorescences (see below).

The horny margin usually found at least on relatively young leaves is often erose, which, when compared with very young leaves, shows that these unevennesses are persistent hair bases.

Beard (1967) in describing the height as '2–4 ft' seems to have followed Bentham (1867) in including some specimens of *K. jucunda*, as *K. micromera* has not been seen higher than 60 cm. Even an unusually robust specimen from near Newdegate (*J.M. Koch N115*) is described as 'woody shrub 40 cm'.

Typification

Since its discovery *K. micromera* has been confused with *K. micrantha*. Even Preiss, who had collected the types of both species, included them under the same collecting number, although it does not seem likely that *K. micromera* was ever found at a locality as far north as Guildford. Schauer (1844) described *K. micrantha* but must have realised later that the description did not fit the specimen in front of him at that time as he (Schauer 1848, p. 223) instructed the reader to delete *K. micrantha* from the list of species and to incorporate *K. micromera* in a different order before *K. recurva*, i.e. *K. micromera* was not regarded as being the same as *K. micrantha*. It would seem that he had examined and annotated at the

time the type of *K. micromera* in Sonder's herbarium – the only Preiss specimen of this species which is now in MEL — without having access to the specimens he previously described as *K. micrantha.* Inscriptions on *Kunzea* specimens relating to Schauer's descriptions were found with a few exceptions in the Vienna herbarium on specimens in Lehmann's herbarium now at LD (cf. K.L. Wilson 1983). The lack of an opportunity to make a direct comparison would also explain why he considered replacing *K. micrantha,* which he had seen only in bud, with *K. micromera.* This was confirmed by his writing on the later type: 'Kunzea micromera Schauer - fruher nach n. 277 in Knospen als K. micrantha beschr.'(earlier described as K. micrantha from No 277 in bud).

It is therefore argued here that *K. micromera* is not a later superfluous name for *K. micrantha.* Schauer (1848) attempted to clarify the circumscription of *K. micrantha* with the aid of another specimen of the type collection and in the process he inadvertently but by implication based the second name on a different type specimen (article 52.2d of the International Code of Botanical Nomenclature 1994). That is, the apparent contradictions of habit a foot high and not a compressed base of the hypanthium as opposed to a broader one, and significantly the 3-locular ovary compared with a 5-locular one respectively are no longer points of contention. In an attempt to clarify the circumscription of *K. micrantha* with the aid of mature flowering material Schauer described a new species based on a different type because he was unaware that the type collection (*Preiss 277*) consisted of two elements. This interpretation is accepted here and supports general usage of the two names since Bentham (1867).

The type of *K. micromera* consists of two small twigs with a few flowers showing the distinctive short rounded calyx lobes. Since only one specimen of *Preiss 277* of *K. micromera* was found and it contained Schauer's explanation for the problem encountered, it is assumed that this is the holotype, and that he examined only this one specimen (cf. lectotypification in the introduction).

Selection of specimens examined (48 seen)

WESTERN AUSTRALIA: *C.R.P. Andrews s.n.*, near Hopetoun, -.x.1903 (NSW, PERTH); *J.S. Beard 7460,* Chester Pass to Bluff Knoll, 25.ix.1975 (NSW); *P.E. Conrick 1664,* 5 km S Borden, 18.ix.1983 (AD, PERTH); *M. Cronin MEL 92786,* Bunbin near Lake Wagin, -.-.1890 (MEL); *A.A. Dorrien-Smith s.n.*, Bridgetown to Kojonup and Slab Hut Gulley, -.-.1910 (K); *H. Eichler 15944,* 1 km S Wansbrough, 31.viii.1959 (AD); *A.R. Fairall 481,* near Red Gum Springs, 9.x.1962 (KPBG, PERTH); *N. Hoyle 963,* 8 km W Kojonup, 21.x.1985 (PERTH); *E.N.S. Jackson 1295,* 8 km NW Young River crossing, 26.ix.1963 (AD, K); *J.M. Koch N115,* 20 km W Newdegate, 6.ii.1978 (PERTH); *F. Mueller MEL 92837*, Shannon, 12.xii.1877 (MEL); *K. Newbey 508,* 1 ml. W Needilup, 30.ix.1962 (PERTH); *523,* 11 mls E Jerramongup, 30.ix.1962 (PERTH); *A.F. Oldfield 351,* Kalgan River, s.d. (MEL 92543, K); *A.E. Orchard 1208,* 13 km N Stokes Inlet, 26.ix.1968 (AD, PERTH); *M.E. Phillips CBG 128387,* 13 mls S Narrogin, 1.x.1968 (CANB); *E. Pritzel 685,* District NW Plantagenet, 1.x.1901 (AD, G, K, NSW); *H.R. Toelken 6470,* Hill N Toompup HS, 7.x.1979 (AD, PERTH); *7129,* N Bremer Bay, 29.x.1981 (AD, PERTH); *7160,* 27 km W Raventhorpe on road to Jerramungup, 31.x.1981 (AD, PERTH); *W. Webb MEL 92713,* Bremer River, -.-.1884 (MEL); *E. Wittwer 2082,* Stirling Range road, 11.x.1977 (PERTH); *J.W. Wrigley CBG 30703,* between Red Gum Pass and Chester Pass, 10.x.1968 (AD, CANB).

Putative hybrids

13(i) *K. micrantha* subsp. *oligandra* × *K. micromera* see 12c(i) *K. micrantha* subsp. *oligandra.*

13(ii) ***K. micromera* × *K. montana***

The apparently decumbent habit, wiry branches which are villose with coiled hairs when young, shorter oblanceolate, usually stiff-erect ridged leaves with short petioles and coiled hairs which are also on the bracts, suggest *K. micromera* as one of the parents. The very broad spathulate bracts (4–4.6 mm broad), bracteoles with hairs along the central ridge, and altogether larger inflorescence and flowers (hypanthium 3.8–4.1 mm long) as well as 'flowers light pink' indicate *K. montana* as the second parent.

A specimen of *K. micromera* (*Wrigley CBG 30703*) was found by the same collector on the same day close to the locality where the above hybrid was found.

Specimen examined:

WESTERN AUSTRALIA: *J.W. Wrigley CBG 28334*, Mt Helen Powell near Redgum Springs, 10.x.1968 (CAMB; pollen sterility: 37%).

13(iii) *K. micromera* × *K. preissiana*

All parts of the plants including the hypanthium are more or less densely covered with hairs (but often become glabrous with age). The few flowers per inflorescence and the many short shoots on the plants are similar to *K. preissiana*, while the rounded lower bracts and the coiled hairs and the more or less decumbent habit are reminiscent of *K. micromera*. Both putative parents were found close by (e.g. *K. micromera*: *H.R.Toelken 7913*; *K. preissiana*: *H.R. Toelken 7915*).

Less hairy specimens (*B.G. Briggs NSW 124065, A.S. George 6877*), which agree except for rather narrow leaves with characteristics of *K. micromera*, are included here because of their scattered hairs on the hypanthium.

Other specimens, e.g. *H.R. Toelken 7127 & 7144*, which are also densely hairy on young branches and both sides of the leaves but not on the hypanthium, must be interpreted as variants of *K. micromera*.

Specimens examined

WESTERN AUSTRALIA: *A. Ashby 155*, Kulin, -.ix.1946 (PERTH); *B.G. Briggs NSW 124065*, 20 mls N Wagin, 7.x.1960 (CANB, NSW); *N.T. Burbidge 2401*, Lime Lake Siding, 10.ix.1947 (BRI, CANB); *J. Drummond 5, 135*, Swan River Colony, s.d. (K); *A.S. George 6877*, SE Ongerup, 26.x.1965 (PERTH); *K. Newbey 550*, 14 mls W Ongerup, 1.x.1962 (PERTH); *H.R. Toelken 6466*, 1 km S turnoff to Toompup,7.x.1979 (AD, PERTH); *6469*, hill above Toompup H.S., 7.x.1979 (AD, PERTH); *7165*, 1 km on road to Toompup, 1.xi.1981 (AD, PERTH); *7914*, 43 km N Boxwood Hill junction on road to Borden, 27.ix.1988 (AD, PERTH).

13(iv) *K. micromera* × *K. recurva*

The robust spreading habit, the larger leaves (up to 4 mm long), usually glabrous stems or in one case (*J.S. Beard 3650*) pubescent with straight hairs (except for floral axes which have usually long but crisped hairs as in *K. micromera*), and the shiny somewhat elongate calyx lobes are reminiscent of *K. recurva*. Although plants of this hybrid superficially resemble *K. recurva* they were never found to have the typical recurved calyx lobes of that species. They are also usually widely spaced and bluntly acute as in *K. micromera*, and unlike the similar *K. micrantha* subsp. *oligandra* they remain erect after flowering while the ovary has five locules. In several cases one or both putative parents have been recorded from the same locality as the hybrid.

Specimens examined

WESTERN AUSTRALIA: *J.S. Beard 3650*, 12 mls E Gairdner River, 18.x.1964 (KPBG, PERTH); *K. Newbey 503*, 10 mls E Ongerup, 30.ix.1962 (PERTH); *H.R. Toelken 6477*, Toompup, 7.x.1979 (AD, PERTH); *7116*, 2 km N Tunny, 27.x.1981 (AD, PERTH); *7166*, 1 km from turnoff to Toompup, 1.xi.1981 (AD, PERTH); *J.H. Willis MEL 92679*, 65 mls W Ravensthorpe, 3.ix.1947 (MEL).

C. **Kunzea** subsect. **Floridae** Toelken, *subsect. nov.*

A subsect. *Arborescentibus* fruticibus rare ad 2 m altis, (1–) 2–10 (–15) floribus in inflorescentia, floribus roseis vel purpureis;

a subsect. *Globosis* (1–) 2–10 (–15) floribus in inflorescentia, staminibus petala rare superantibus differt.

Type species: *K. affinis* S. Moore.

Shrubs (0.3–) 0.5–1.5 (–2.5) m, with usually few erect stems, each developing one to few main axes in the form of long shoots but being surrounded by more or less short shoots; bark on young branches (5–15 mm diam.) usually more or less fluted and fibrous, rarely slightly corky. *Leaves* usually linear, rarely oblanceolate, without horny margin. *Inflorescence* with (1–) 2–10 (–15) usually erect flowers, usually with vegetative growth after flowering from the terminal bud, rarely from axillary buds of the perules. *Petals* almost orbicular to obovate, usually rose-pink, often as long as or longer than stamens.

Distribution and ecology

Species of subsect. *Floridae* are, like those of subsect. *Globosae*, sometimes found in moist depressions which may even be prone to seasonal flooding, but more often they occur in dry scrub vegetation usually on sandy or gravelly soils mainly to the east, but some species extend to the south-east, of the Darling Range. Their distribution overlaps in the western part with some of the species of subsect. *Globosae* up to a line more or less between Bremer Bay and Jerramungup, but some species of the *Floridae* extend eastwards to east of Israel Bay, though they are then widely scattered. Species of subsect. *Floridae* were not found in the immediate vicinity of those of subsect. *Arborescentes*, which could be attributed to their different habitat preferances.

Notes

The epithet *Floridae* may seem a misnomer for a group of plants in which an important distinguishing feature is the low number of flowers in the inflorescence. The name was chosen, however, to draw attention to the tendency in this group towards an overall increase in the total number of flowers on each plant by the production of innumerable inflorescences terminal to most branches. This is particularly found in, for example, *K. affinis* and *K. jucunda* (cf. fig 14). These species also show well the development of lateral shoots, which by repeatedly branching form the intricate branching system around the main branches characteristic of this subsection.

Since the actual number of flowers per inflorescence may be affected in species of subsections *Floridae* and *Globosae* by conditions, such as, age or season, overlap in flower number has been observed between these subsections. The common development of subterminal short shoots with inflorescences as well as the intricate branching system in subsect. *Floridae* are therefore additional discriminating characters. All branches of species in subsections *Arborescentes* and *Globosae* are long shoots with at least 10 internodes, except for an occasional subterminal inflorescence on a shot branch. Long shoots of species of subsect. *Floridae* elongate considerably each year and usually terminate in an inflorescence or sometimes, as in species of the other subsections, even remain vegetative under particularly favourable conditions. The long shoots in all three subsections branch normally but in species of the subsection *Floridae* they usually also produce subterminal short shoots with inflorescences. Although some of these lateral long and short shoots in the *Floridae* may subsequently again become activated as part of the main branch system, most remain short and branch regularly to form an intricate branch system around the main branches. The subterminal short shoots have fewer than six internodes but this depends on the vigour of the whole plant, being determined by either the season or the age of the plant. Equally the long shoots may become reduced so that the two types of shoots can often not be clearly distinguished.

In some species (e.g. *K. similis* and *K. preissiana*) the lower intricate branches remain vegetative, while in others (e.g. *K. affinis* and *K. jucunda*) most shoots of the intricate branching system develop inflorescences as do most side branches formed on them. Later the number of flowers on individual inflorescences become fewer and ultimately not all branches bear terminal inflorescences at all. Herbarium specimens representing only the upper parts of plants do not permit long term morphological analyses. To heighten the effect of this intricate branching habit many of the shoots branch either immediately after

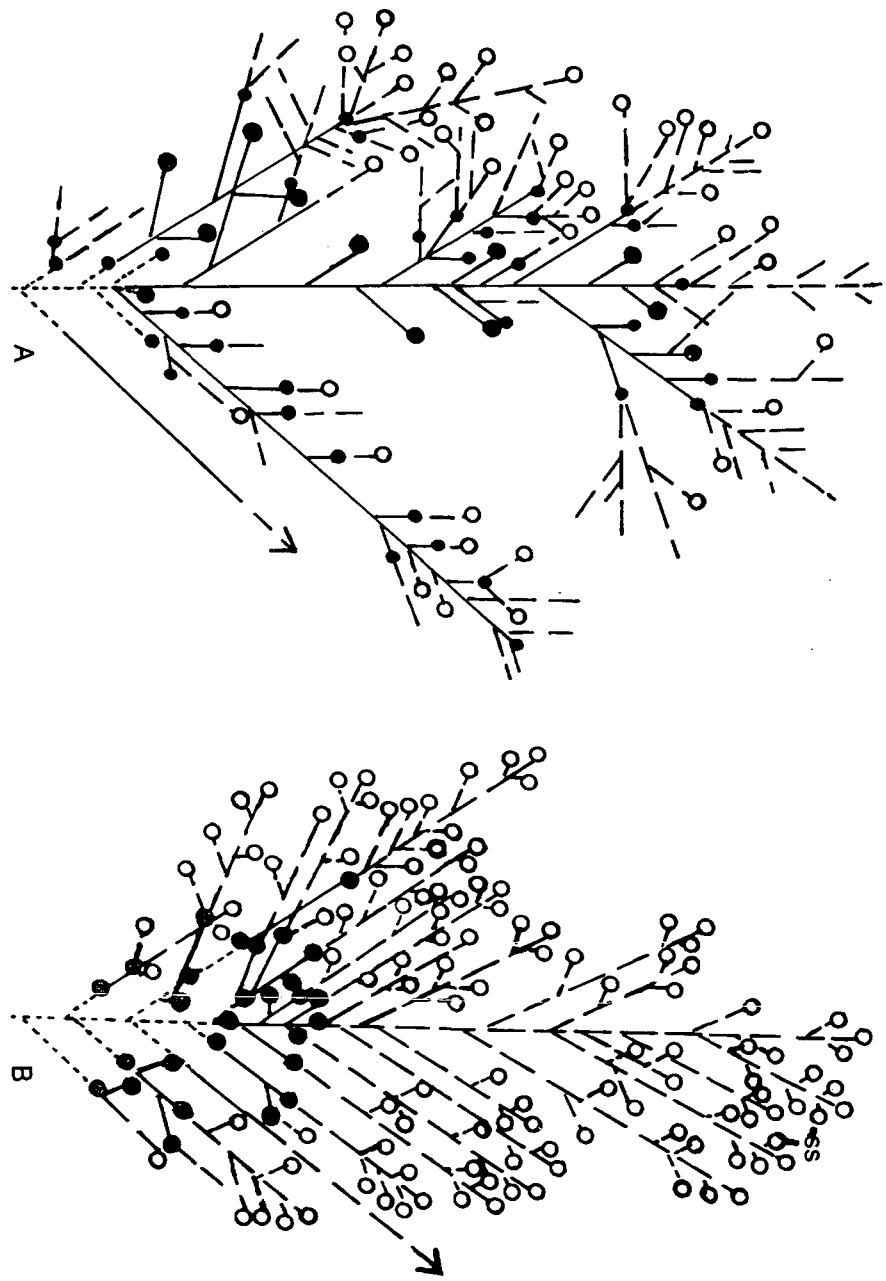


Fig. 14. Diagram of three years' growth. A, *K. recurva* Schauer (subsect. *Globosae*) showing few inflorescences on irregular branching of mainly long shoots rarely with subterminal short shoots (*H. Eichler 16111*). B, *K. jucunda* Diels (subsect. *Floridae*) showing development of numerous inflorescences terminal on long shoots and commonly with subterminal short shoots (ss), and repeated branching of lateral branches to form an intricate branch system around the main branch (*F. Lullfitz 3369*). First year –; 2nd year –; 3rd year ···; present O and past inflorescences ●; past vegetative buds •.

the terminal vegetative bud of the inflorescence starts growing, or several axillary buds below the inflorescence grow into branches particularly, but not necessarily, if gall development has severed the terminal bud. The development of galls in perennating terminal buds is common in most species of subsect. *Floridae* but has also been recorded in some species of subsect. *Globosae*.

In subsect. *Floridae* inflorescence production is not only generally restricted to short shoots but these branches also continue to produce terminal inflorescence for several years. Species of subsect. *Globosae* and *Arborescentes* rarely produce inflorescences on short shoots and if so these do not continue to produce inflorescences (cf. fig. 14A).

It is noteworthy that a similar habit is found in *K. parvifolia*, a species widespread in eastern Australia and otherwise bearing little resemblance to the Western Australian species except in often occuring in drier areas or on very shallow soil on rocks.

Another characteristic of subsect. *Floridae* is the relatively large corolla so that the stamens are not or are only marginally longer than the petals. Although no field observations have been made there are indications that the flowers possess a different pollination syndrome from the other two subsections. This is best shown in the low number of hybrids produced with species of subsect. *Globosae* although these species often grow next to one another. Hybridisation is, however, possible as two specimens were investigated which are considered to be a hybrid of *K. micromera* and *K. preissiana*. The second indication of a different pollination system in subsect. *Floridae* stems from several records of scented flowers in *K. affinis* which, however, occupies an extreme position in this subsection. Personal observations have confirmed that scented flowers also occur on some plants of *K. preissiana* and *K. jucunda*. The flower biology of the genus needs to be studied as it does not follow a broad spectrum pollinating agent syndrome as reported for much of the Myrtaceae in Australia.

The three species, *K. similis, K. acuminata* and *K. pauciflora*, which were placed together at the beginning of the subsection have little in common other than the pointed calyx lobes, which immediately distinguish them from the remaining species with rounded ones. These three have been recorded from very restricted distributions widely separated from one another. They should probably be seen as relics each with a very restricted distribution and are now not closely related to one another or the main group of species although they obviously belong in this subsection. These three species could be considered early evolutionary divergents as they often have larger flower heads which are often not borne on short shoots.

Key to species and hybrids of subsect. *Floridae*

N.B. The size and shape as well as tomentum of the first three leaves produced on each branch are often abnormal and should not be used.

1. Ovary with 2 locules, each with 1 or 2 ovules; leaves club-shaped and with straight appressed hairs ..... 21. *K. eriocalyx*

1: Ovary with 5 rarely 3 locules each with 6 or more ovules; leaf lamina linear, elliptic or if oblanceolate then ± flat, or if somewhat club-shaped then with coiled hairs:

2. Young leaves hairy on both surfaces; calyx lobes densely hairy at least when young:

3. Hairs on leaves and branches coiled; near Ravensthorpe:

4. Leaves club-shaped, (2.8–) 3.5–6.4 (–7.3) mm long ..... 20. *K. cincinnata*

4: Leaves dorsiventrally compressed, linear-elliptic, 2.1-3.2 mm long ..... 20(i). *K. cincinnata* × *K. juncunda*

3: Hairs on leaves and branches straight or irregularly twisted; widespread:

5. Ovary 3-locular; calyx lobes pointed ..... 14. *K. similis*

5: Ovary 5-locular; calyx lobes bluntly acute to rounded:

6. Hairs on upper surface of leaves shorter and fewer ..... 19(ii). *K. affinis* × *K. preissiana*

6: Hairs on both leaf surfaces equally long and dense:
7. Bracts acute to acuminate, densely covered with spreading hairs; hairs on leaves and inflorescence 0.4–1.2 mm long ..... 17. *K. preissiana*
7: Bracts rounded rarely with bluntly acute or mucronate apex, with hairs dense to becoming patchy and ± appressed; hairs on leaves and inflorescence 0.15–0.25 mm long ..... 13(iii). *K. micromera* × *K. preissiana*

2: Young leaves glabrous on upper surface; calyx lobes glabrescent to glabrous:
8. Calyx lobes acute:
9. Hypanthium and bracts glabrous ..... 16. *K. pauciflora*
9: Hypanthium and calyx hairy ..... 15. *K. acuminata*
8: Calyx lobes bluntly acute to rounded unless folded:
10. Hypanthium and calyx glabrous:
11. Young branches with long appressed hairs:
12. Leaf lamina linear; bracts usually beaked ..... 19. *K. affinis*
12: Leaf lamina elliptic; bracts rounded rarely mucronate ..... 19(i). *K. affinis* × *K. jucunda*
11: Young branches glabrous or with a few spreading hairs ..... 18. *K. jucunda*
10: Hypanthium and/or calyx glabrescent (tomentum of calyx often varying from lobe to lobe):
13. Bracts acute to acuminate; leaf lamina (3–) 4–6 (–8) times longer than broad ..... 19(ii). *K. affinis* × *K. preissiana*
13: Bracts rounded, rarely mucronate; leaf lamina (1.5–) 2–2.5 (–3) times longer than broad ..... 18(iii). *K. jucunda* × *K. preissiana*

14. **K. similis** Toelken, *sp. nov.*

K. capitatae persimilis sed foliis uninervibus et ovariis ovulis paucis biserialibus differt.

K. preissianae similis sed saepe inflorescentiis multifloribus quibus terminalibus sunt, calicis lobis longis acutissimis, ovariis trilocularibus differt.

Type: Western Australia, East Mt Barren, 8.x.1979, *H.R. Toelken 6500* (*holo.*: AD, *iso.*: G, K, MO, NSW, PERTH, S).

Shrubs (0.3–) 0.5–1 (–1.5) m tall, with several erect main stems, moderately to little branched, with basal lateral branches spreading and usually without flowers; young branches with decurrent flanges scarcely raised, densely covered with long and short spreading hairs becoming very long and silky (up to 1.3 mm) below inflorescences and at the beginning and end of growth flushes; early bark fibrous-mosaic, unequally splitting, becoming fibrous-peeling and scarcely corky. *Leaves*: *petiole* 1.3–1.5 mm long, appressed; *lamina* oblanceolate to linear-oblanceolate, (3.2–) 4–5 (–5.4) × 1.4–2.8 (–4) mm, bluntly acute often becoming rounded, gradually constricted into petiole, concave above particularly below the apex becoming almost flat, slightly convex below and with pronounced but rounded subterminal point, with scattered fine hairs or glabrous above, silky hairy below becoming glabrous. *Inflorescence* a spherical or rarely hemispherical botryum with (3–) 4–10 (–12) mature flowers (often up to 4 aborted flowers at base), terminal on long and short shoots, never clustered at the end of branches, with terminal vegetative growth after flowering; *perules* 5, 6 or if more then bracts with a rudimentary flower, ovate to broadly ovate, acuminate with long or short beak, with numerous but indistinct veins, covered with long silky hairs outside; *bracts* ovate to lanceolate at the apex of the inflorescence, 3.8–4.3 × 1.6–2.5 mm, acuminate to almost cuspidate with several often indistinct veins, densely covered with long silky hairs outside; *bracteoles* in pairs, linear to linear-oblanceolate, often falcate, 3.2–3.5 × 0.4–0.6 mm, acute to rounded, with central vein, densely covered with long silky hairs. *Hypanthium* 4.5-6 mm long when flowering (free tube ca 3–3.5 mm), densely covered with long silky hairs. *Calyx lobes* triangular, 1–1.3 mm long, acute, ridged at least towards the apex, densely covered with silky hairs. *Corolla lobes* obovate-spathulate, 3–3.5 mm long, clawed, pink. *Stamens* 32–44 in more than one whorl; filaments 5.6–6.4 mm long; anthers with small almost terminal

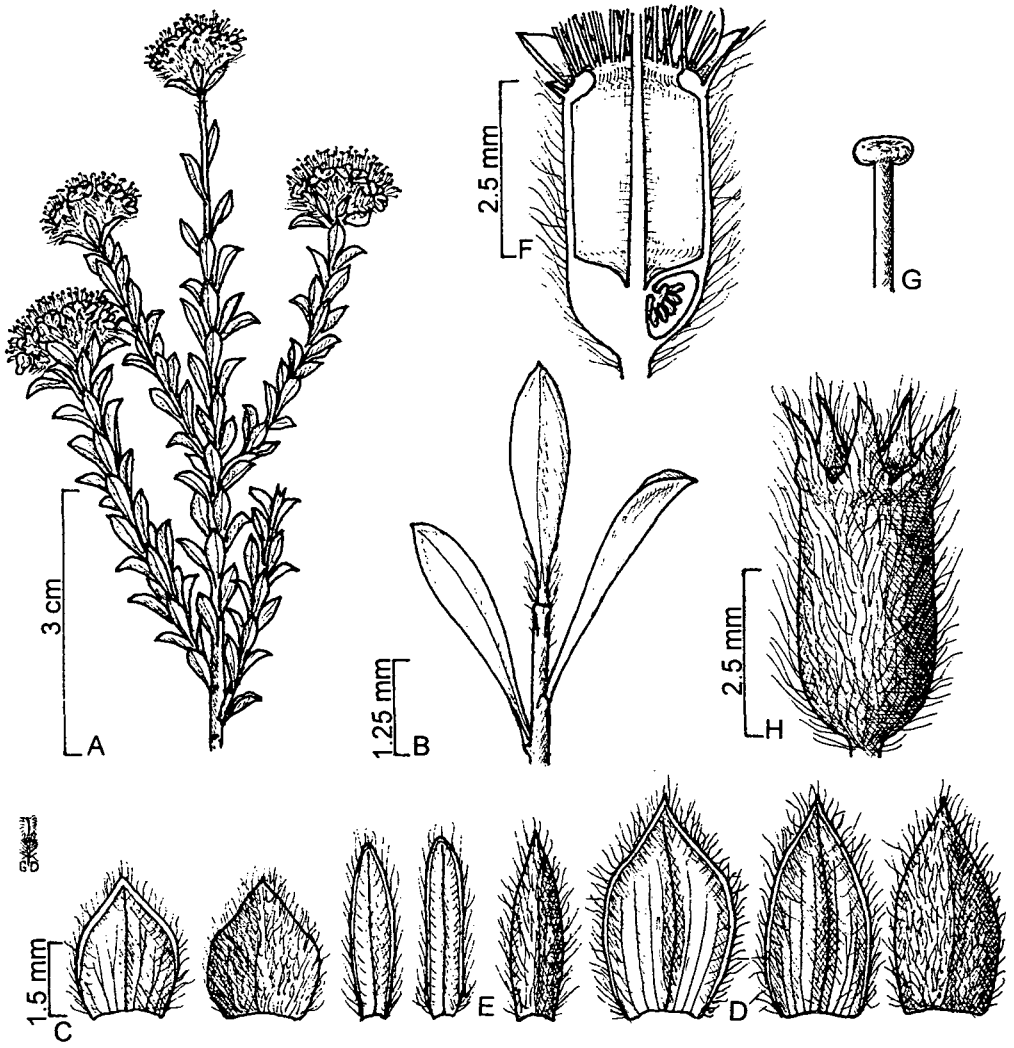


Fig. 15. ***K. similis*** Toelken. A, flowering branch; B, branchlet; C, perule; D, bracts; E, bracteoles; F, half flower; G, stigma; H, fruit. (A–H, *H.R. Toelken 6500.*)

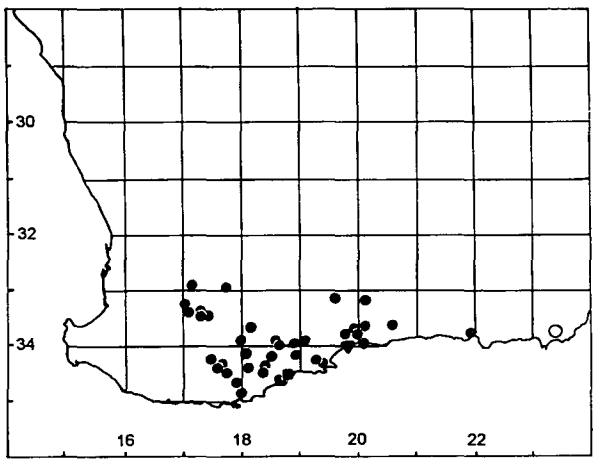
gland. *Ovary* with 3 locules, with style slightly sunk into the upper surface; placenta an elliptic disc with short thin attachment from the middle, with lobes connate mainly along the margins, each lobe with 1 or 2 rows of ovules; ovules 8 (–10) per locule, spreading or 2 lowest ones pendulous and slightly longer; style 4–4.7 mm long, slightly broadened towards base; stigma enlarged disc with central depression. *Fruit* an elongate urceolate capsule more or less constricted below the erect calyx calyx lobes. *Flowers*: October. Fig. 15.

Distribution and ecology

Known only from one very localised population growing on sandy soil in Fitzgerald River National Park near Hopetoun. Map 6.

Conservation status

The very restricted known distribution makes *K. similis* a vulnerable species, which is, however, conserved in the Fitzgerald River National Park.



Map 6. ***K. similis*** ▼; ***K. acuminata*** O; ***K. pauciflora*** ■; ***K. preissiana*** ●.

Diagnostic features

K. similis is superficially very similar to *K. capitata* (sect. *Kunzea*) because of the stiffly erect wiry branches producing lateral branches mainly at the beginning of each new growth flush, and because of the long silky hairs on and below the inflorescences. It is, however, easily distinguished, and the single-veined leaves and small number of ovules show that it should be placed in the sect. *Zeanuk*, and more specifically in subsect. *Floridae* because of its close similarity to *K. preissiana* in spite of its sometimes producing more than ten flowers (including sterile ones) per inflorescence, mainly terminal growth above the botryum and long stamens.

Specimens examined

WESTERN AUSTRALIA: *A.R. Fairall 2391*, near Hopetoun 11.x.1967 (KPBG, PERTH); *H.R. Toelken 6500*, near Hopetoun, 8.x.1979 (AD, G, K, MO, NSW, PERTH, S); *7152*, near Hopetoun, 31.x.1981 (AD, PERTH).

15. **K. acuminata** Toelken, *sp. nov.*

K. simili similis sed foliis linearo-oblanceolatis, perulis et bractis acuminatis, stylis pubescentibus ad basim differt.

K. affini apperenter similis sed hypanthio caliceque sericeo, bracteis acuminatis, longioribus hypanthiis, ovariis trilocularibus differt.

Type: Western Australia, 45 km W of Israelite Bay, 21.ix.76, *R.J. Hnatiuk 761251* (*holo.*: PERTH; iso.: PERTH).

Shrubs up to 2 m tall, with few spindly upper branches; young branches with decurrent flanges slightly raised, sericeous with mainly long hairs but also some shorter ones, becoming tortuous before wearing off; early bark fibrous to fibrous-mosaic, becoming slightly corky but remaining fibrous. *Leaves: petiole* 1.1–1.5 mm long, more or less appressed to branch; *lamina* linear-oblanceolate, rarely linear-elliptic, (4.3–) 6.3–7.2 (–7.6) × (0.8–) 0.9–1.1 (–1.3) mm, usually bluntly acute, with slightly recurved apex, gradually tapering into the petiole, concave above, more or less convex below, with long appressed hairs along margins. *Inflorescence* a spherical botryum with 8–15 flowers terminal on mainly long shoots, rarely clustered at the end of branches, with terminal vegetative growth as well as lateral from below the inflorescences after flowering; *perules* usually more than 5, obovate-acuminate with many veins, sericeous; *bracts* obovate, acuminate or rostrate to oblanceolate, with a beak about as long as broad base of bract, (4.8–) 5.6–7 (–7.5) × 1.8–2.9 mm, with many veins from the base, sericeous; *bracteoles* in pairs, linear-subulate, 4.40–5.20 × 0.3–0.5 mm, with one central vein, sericeous. *Hypanthium* ca 4.5 long when in bud (free tube ca 2.5 mm long) scarcely angular, sericeous. *Calyx lobes* ovate, 1.2–1.6 mm

long, acute to acuminate, slightly ridged towards the apex, sericeous. *Corolla lobes* obovate, ca 1.6 mm (immature), clawed, pink. *Stamens* 50–55 in more than one whorl; filaments ca 4.5 mm long (immature); anthers with small subterminal gland. *Ovary* with 3 locules, with style slightly sunk into the upper surface; placenta an elliptic disc with short attachment from near the middle, lobes connate mainly along the margins, each with one row of ovules; ovules 8–10 per locule, spreading or 2–4 lowest ones pendulous and slightly longer; style broadened towards the base and with scattered hairs; stigma immature. *Fruit* not seen. *Flowers*: September. Fig. 16.

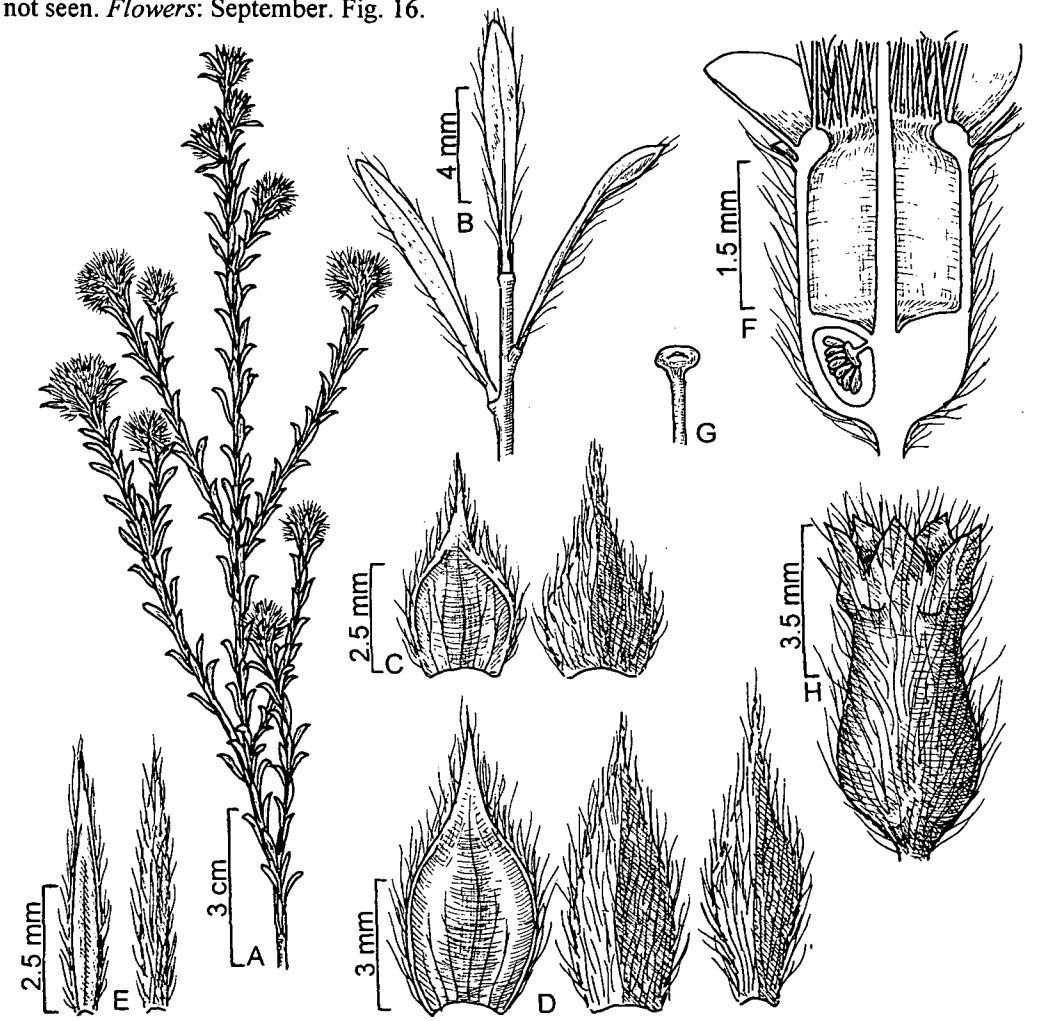


Fig. 16. ***K. acuminata*** Toelken. A, flowering branch; B, branchlet; C, perule; D, bracts; E, bracteole; F, half flower; G, stigma; H, fruit. (A–H, *R.J. Hnatuik 761251*.)

Distribution and ecology

Known only from one collection where it was growing in sandy soil over granite in 'open heath' vegetation 45 km west of Israelite Bay. Map 6.

Conservation status

The type collection does not give any indication of how common the plant is. Since this record is from much further east than of any other species of subsect. *Floridae*, it is assumed that *K. acuminata* is a vulnerable relict with a restricted distribution.

Diagnostic features

K. acuminata is similar to *K. similis* in its sparse though more woody habit, inflorescences with more flowers than usual in the subsection, sericeous flowers and bracts and trilocular ovary. The acuminate perules and bracts with a beak about as long as the base are characteristic and hence the choice of epithet. They are longer than the flower buds in contrast to those of *K. affinis* which are also sometimes acuminate but always distinctly shorter than the hypanthium.

Specimen examined

WESTERN AUSTRALIA: *R.J. Hnatiuk 761251*, 45 km W Israelite Bay, 21.ix.76 (PERTH).

16. **K. pauciflora** Schauer in Lehm., Pl. Preiss. 1: 124 (1844); Benth., Fl. Aust. 3: 114 (1867); F. Muell., Syst. Census Austr. Pl. edn 1: 5 (1882); edn 2: 93 (1884); Blackall & Grieve, West. Austr. Wildflow. edn 1: 294 (1954); Beard, West Austr. Pl. edn 1: 77 (1965); Blackall & Grieve, West. Austr. Wildflow. edn 2, 3A: 100 (1980); J. Green, Census Vasc. Pl. West. Austr. edn 2: 128 (1985).

Type: Western Australia, Konkoberup, Cape Riche, *J.A.L. Preiss 259, (lecto.* — selected here: LD; *syn*: G, MEL (2×), W).

Pericalymma teretifolium Turcz., Bull. Cl. Phys.-Math. Acad. Imp. Sci. Saint-Pétersbourg 10: 334 (1852); F. Muell., Fragm. 8: 183 (1874).

Type: Western Australia, *J. Drummond 5, 134* (*holo.*: KW — PERTH photo; *iso.*: BM, K, MEL, NSW, PERTH, W).

Shrubs (0.35–) 0.5–1.2 (–1.5) m tall, with few to many stems from the base, each becoming densely branched towards the apex, flowers usually only at the top; young branches with decurrent flanges scarcely raised, glabrous; early bark fibrous-mosaic, unequally splitting, becoming fibrous-peeling. *Leaves*: *petiole* 0.4–0.9 (–1.2) mm long, appressed; *lamina* linear, rarely linear-elliptic, (3.2–) 3.4–6.5 (–8.8) × 0.4–0.8 (–1.0) mm, bluntly acute to rounded, rarely acute below inflorescence, scarcely constricted into petiole, flat or convex above, strongly convex below, sometimes with few marginal hairs when very young. *Inflorescence* an often hemispherical botryum with 1–3 (–5) slightly pedicellate flowers, terminal on mainly long shoots but sometimes clustered at the end of branches, with usually several vegetative branches from below the inflorescence or rarely with terminal growth after flowering; *perules* (0) 1 or 2, often caducous, lanceolate to broadly ovate, rostrate with beak often longer than broad base of perule, with numerous but usually indistinct veins particularly on the hyaline basal margins, glabrous except for some marginal cilia; *bracts* ovate to ovate-oblong, (2.3–) 2.6–3.5 (–4.6) × 1.2–1.6 mm, acuminate to rostrate, with several often indistinct veins on broad hyaline margins, glabrous except for marginal cilia at least below the beak; *bracteoles* in pairs, lanceolate to oblong-lanceolate or often obviously constricted towards the base, often somewhat falcate, 2.7–3.2 (–4) × 0.8–1.4 (–1.6) mm, acuminate, with central vein between hyaline lobes, glabrous or with few scattered cilia. *Hypanthium* (3.2–) 3.4–4.4 mm long when flowering (free tube 2–2.3 mm), glabrous. *Calyx lobes* triangular or linear-triangular because margins are incurved, 2–2.6 mm long, acute to pointed, scarcely ridged towards the apex, glabrous. *Corolla lobes* orbicular or depressed ovate, 3.6–4 mm long, shortly clawed, pink. *Stamens* (33–) 39–46 in more than one whorl; filaments 3.3–4.1 mm long; anther with small, almost terminal gland. *Ovary* with (4) 5 locules, style slightly sunk into the upper surface; placenta an elliptic disc

with short attachment from just above the middle, lobes connate mainly along the margins, each lobe with 1 or 2 rows of ovules; ovules (8–) 10–13 per locule, spreading or lowest ones pendulous and scarcely longer; style slightly broadened towards the base, 6–6.4 mm long; stigma enlarged disc. *Fruit* urceolate with erect calyx lobes. *Flowers*: October. Fig. 17.

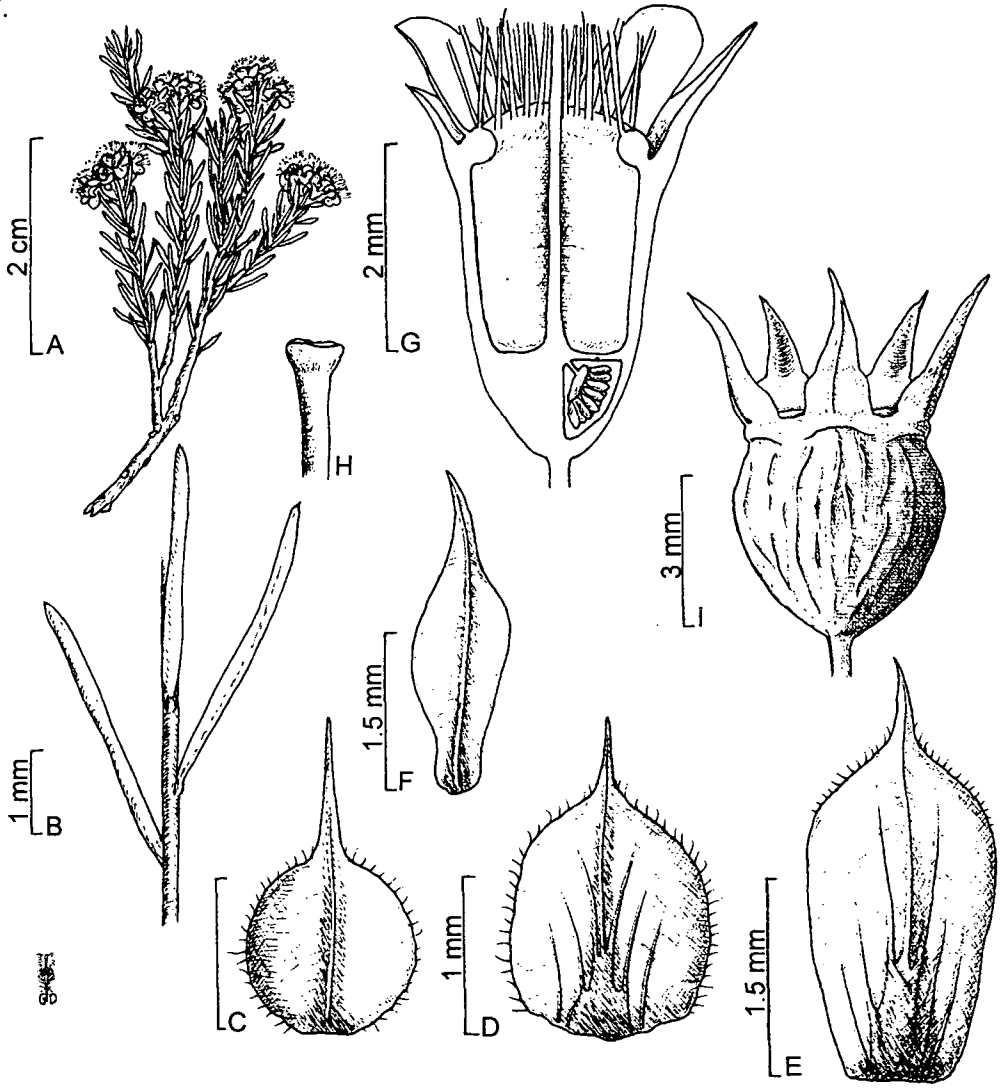


Fig. 17. ***K. pauciflora*** Schauer. A, flowering branch; B, branchlet; C, perule; D, lower bract; upper bract; F, bracteole; G, half flower; H, stigma; I, fruit. (A, *A.S. George 6902*; B–I, *J.W. Wrigley CBG 36319*.)

Distribution and ecology

Known only from the vicinity of Cape Riche where it grows in rocky to gravelly soil. Map 6.

Conservation status: 2V (Briggs & Leigh 1988).

Diagnostic features

The robust habit and long hypanthium (3–4 mm) as well as the long, pointed calyx lobes (2–2.6 mm) distinguish *K. pauciflora* from other species in this subsection. It agrees with most characteristics of this subsection although it has an unusually robust habit and larger flowers more typical of subsect. *Globosae.* The relatively large flowers are, however, also found in the similarly coastal species *K. similis* and *K. acuminata.*

Typification

The specimen of *Preiss 259* at LD was selected as the lectotype because it was the only specimen annotated by Schauer.

Specimens examined

WESTERN AUSTRALIA: *J. Drummond 3, 39,* Swan River Colony (K); *4?, 56,* Konkoberup Hills towards Cape Riche (K); *5, 134,* Konkoberup (BM, K, MEL, NSW, PERTH, W); *Miss Franklyn 5,* Mungden? -.12.1884 (MEL); *C.A. Gardner 2165,* Cape Riche, 9.x.1928 (PERTH); *6525,* Konkoberup Hills, 11.x.1942 (PERTH); *C.A. Gardner & W.E. Blackall s.n.,* Cape Riche, -.x.1928 (PERTH); *A.S. George 6902,* Mt Melville, 26.x.1965 (PERTH); *s.n.,* Cape Riche, (K); *K. Newbey 2934,* Mt Melville, -.x.1969 (PERTH); *A.F. Oldfield s.n.,* (K); *J.A.L. Preiss 259,* Konkoberup, -.xi.1840 (G, LD, MEL, W); *H.R. Toelken 7123,* Cape Riche, 28.x.1981 (AD, PERTH); *J.W. Wrigley CBG 36319,* Cape Riche, 25.x.1968 (CANB).

17. **K. preissiana** Schauer in Lehm., Pl. Preiss. 1: 125 (1844); Benth., Syst. Fl. Austr. Pl. 3: 113 (1867); F. Muell., Syst. Census Austr. Pl. edn 1: 54 (1882); edn 2: 93 (1884); Blackall & Grieve, West. Austr. Wildflow. edn 1, 2: 294 (1954); Beard, West Austr. Pl. edn 1: 77 (1965); Blackall & Grieve, West. Austr. Wildflow. edn 2, 3A: 100 (1980); J. Green, Census Vasc. Pl. West. Austr. edn 2: 128 (1985).

Type: Western Australia, without precise loc., *Preiss 276* (*lecto.* — selected here: LD).

K. villiceps Schauer in Lehm., Pl. Preiss. 1: 125 (1844); Domin, Mém. Soc. Sci. Bohême (1921) 22, 2: 87 (1923).

Type: Western Australia, arid plains near Gordon River, *Preiss 275* (*lecto.* — selected here: LD).

K. preissiana Schauer var. *villiceps* (Schauer)Benth., Fl. Austr. 3: 114 (1867).

K. villiceps Schauer var. *glabrior* Domin, Mém. Soc. Sci. Bohême (1921) 22, 2: 87 (1923).

Type: Western Australia, Slab Hut Creek to Cranbrook, *A.A. Dorrien-Smith s.n.* (*holo.*: K).

K. preissiana Schauer var. *glabra* Blackall & Grieve, West. Austr. Wildflow. edn 1: 2: 294 (1954), nom. inval.

Shrubs 0.5–1.2 (–1.8) m tall, with few erect stems each with spreading branches from the base; young branches with flanges indistinct and often only along part of the internodes, usually densely covered with fine (long and short) spreading hairs; early bark irregularly fissured, fibrous-peeling, grey. *Leaves*: *petiole* 0.2–0.7 mm long, more or less appressed; *lamina* oblanceolate to linear-oblanceolate, rarely elliptic or elliptic-lanceolate, (2.2–) 3–6 (–7.6) × (0.2–) 0.4–1.2 mm, acute, often becoming bluntly acute to rounded, gradually constricted into petiole, more or less concave, often becoming flat above, slightly convex to ridged below, appressed on long shoots, spreading on short ones, more or less densely covered with long fine hairs on both surfaces, spreading at about right angles when old. *Inflorescence* a botryum with (2–) 3–7 (–12) flowers, terminal on long and short shoots, with mainly terminal growth after flowering, sometimes especially on short shoots immediately branching; *perules* usually few (ca 3), often caducous, ovate, cuspidate, rarely almost truncate, with one central vein, densely covered with short cilia and spreading hairs often longer towards the apex; *bracts* broadly obovate-spathulate, 2.2–3.8 × 1.8–2.4 mm, cuspidate to rarely truncate, mucronate, usually with 3 veins from the base, more or less densely covered with spreading hairs that often wear off towards the apex; *bracteoles* in pairs, linear-oblanceolate to linear, 2.8–4.1 × 0.4–1 mm, acute, with one central vein, densely covered with long spreading hairs. *Hypanthium* 2.8–3.7 mm long when flowering

(free tube 1–1.5 mm long), densely covered with spreading forward-directed hairs. *Calyx lobes* ovate to lanceolate, 0.9–1.3 mm long, bluntly acute to rarely rounded, margins slightly incurved, densely covered with long, forward-directed hairs rarely becoming glabrous towards the apex. *Corolla lobes* obovate to orbicular-spathulate, 2.5–2.9 (–3.3) mm long, with short claw, pink to mauve. *Stamens* 18–32 in more than one whorl, as long as or scarcely longer than corolla lobes; filaments 2.2–2.7 (–3) mm long; anthers with large subterminal gland. *Ovary* with 5 locules, surmounted by a broad style base partly sunk into the upper surface; placenta a narrowly elliptic disc, little fleshy, with ascending attachment connected to middle, lobes only connate on the outside margins, each lobe with one row of ovules; ovules 10–12 (–14) per locule, spreading or lower ones pendulous; style 2.7–4.1 mm long, broadened towards the base; stigma scarcely capitate and little depressed at apex. *Fruit* an urn-shaped capsule usually with 5 vertical ridges partly hidden in the tomentum, with calyx lobes spreading at about right angles. *Flowers*: (August) September, October. Fig. 18.

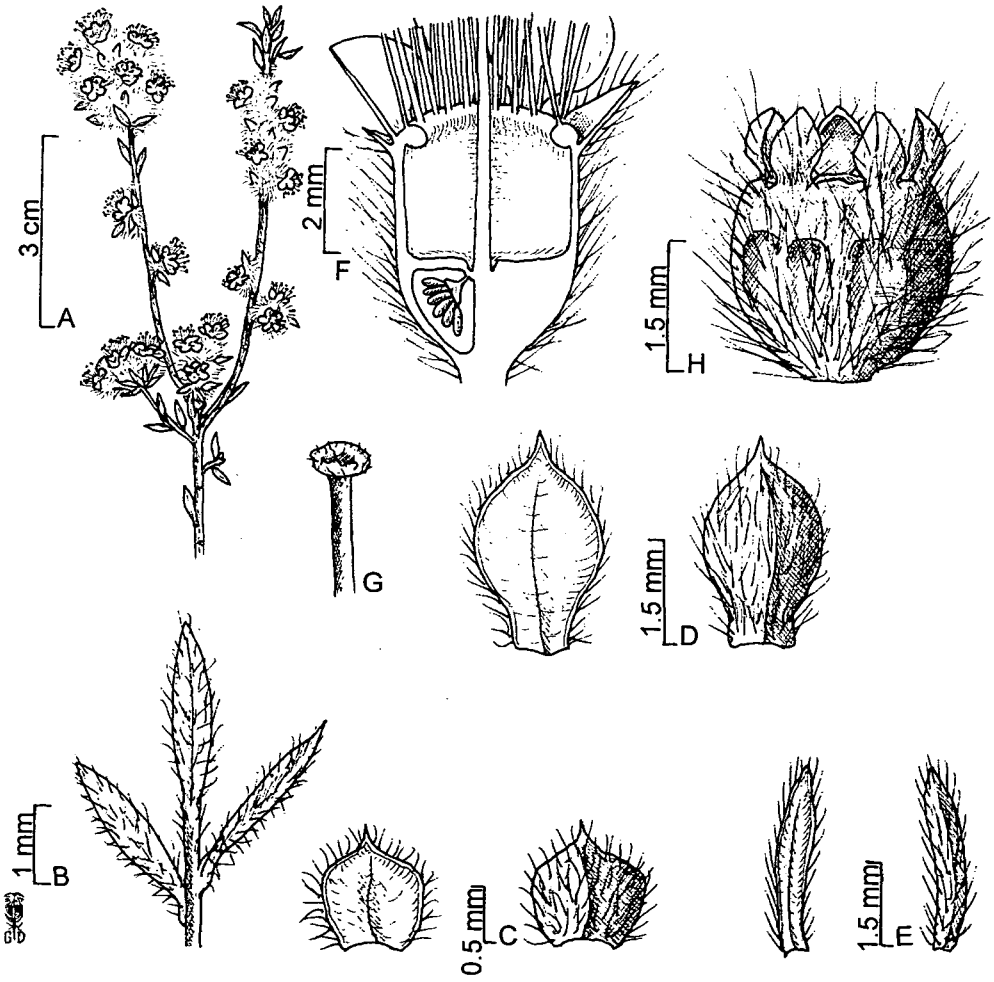


Fig. 18. ***K. preissiana*** Schauer. A, flowering branch; B, branchlet showing leaves with spreading hairs above and below; C, perule; D, bract; E, bracteole; F, half flower; G, stigma, H, fruit. (A, *J.W. Wrigley CBG 28382*; B, H, *H.R. Toelken 7134*; C–E, *A.M. Ashby 113*; F, G, *D.J.E. Whibley 3322*.)

Distribution and ecology

Locally common on usually gravelly lateritic soil on the plain or on gravelly lower slopes; from near Narrogin to near the coast at Albany and eastwards to east of Hopetoun. Map 6.

Conservation status: A widespread species which is often locally common.

Diagnostic features

K. preissiana is distinguished from other species in this subsection by having almost flat leaves with usually spreading hairs on both surfaces, and flowers with bluntly acute calyx lobes. On older leaves the characteristic silky hairs often wear off in parts of one or both surfaces.

It is similar to *K. similis* since the vegetative growth continues terminally above the fruiting inflorescence, but usually without an initial flush of lateral branches, in contrast to short lateral branches that often immediately produce lateral branches, with the result that it produces an intricate branching pattern similar to that found in other species of this subsection. In *K. similis* similar lower lateral branches usually remain vegetative so that it does not produce an intricate branching system.

Variation

This widely distributed species shows much variation often presented as local forms of which the most important ones are:

1. Plants from south of, but also from parts of the Stirling Range, have rather long hairs (up to 1.2 mm long) on flowers and leaves, and have for that reason been described as *K. villiceps*. Although their inflorescences often have more than eight flowers and their petals are often longer than 3 mm, these characters seem to intergrade into those of other forms.
2. To the north of the Stirling Range the plants are less hairy and leaves are usually narrower to linear-oblanceolate as in the type of the species. Within this form the hairs on older leaves often wear off. The bracts are also often lanceolate with a well developed beak.
3. To the north-east of the Stirling Range and especially in the vicinity of Ongerup, the leaves are often small (ca 2.4 mm long) and soon become glabrous.

In the last area the delimitation of *K. preissiana* may seem artificial since its distinction from its hybrids with *K. affinis* and *K. jucunda* become blurred. Both of these hybrids are distinguished here by the young leaves being glabrous or distinctly less hairy on the upper surface and the hairs on the leaves being usually more or less appressed. Most specimens of these hybrids are recognised by some or all calyx lobes being glabrous or glabrescent while in *K. preissiana* hairs are retained on the calyx for a long time. *K. preissiana* has young leaves with more or less spreading hairs of about the same size on the upper and lower surfaces of the leaves. 'Young leaves' are defined here as those on long shoots, mainly so as to avoid the first three leaves of a new branch which are often abnormal in shape, size and tomentum. At present it cannot be fully evaluated whether some natural variation of *K. preissiana* has been included in the circumscription of these two common putative hybrids. There are some localities where they have been found without the presence of both parents, or herbarium specimens have been recorded from localities from where both parents, have not been collected. The delimitation of these two hybrids is, however, based on observations of some populations in the field.

Typification

Both *K. preissiana* and *K. villiceps* were lectotypified here on the basis of specimens annotated in Schauer's hand. The specimen of *K. preissiana* was selected in spite of its absence of flowers, because the long spreading hairs on both surfaces of the leaves leave no doubt about the taxon concerned. No duplicates of these specimens were seen in the present study so they might be a holotype, but equally isotypes could be discovered.

The name *K. preissiana* must be used over *K. villiceps* as Bentham (1867) had established its priority with his combination of *K. preissiana* var. *villiceps* (A.11.6).

Selection of specimens examined (ca 75 seen)

WESTERN AUSTRALIA: *T.E.H. Aplin 2038*, E Cranbrook, 16.x.1962 (AD, MEL, PERTH); *A.M. Ashby 1969*, Red Gum Pass Road, 28.ix.1966 (AD, K, PERTH); *M.A. Burgman 2164 & S. McNee*, 21.5 km SE Muckinwobert Rock, 6.ix.1983 (PERTH); *N.T. Burbidge 2450*, N Pootenup, 11.ix.1947 (CANB); *R.J. Cranfield 1007*, 66 km N Raventhorpe, 4.xi.1978 (PERTH); *Miss Cronin s.n.*, Lake Wagin, -.1890 (MEL); *E.M. Canning CBG 31774*, 35 mls Albany to Borden, 25.x.1968 (CANB); *A.A. Dorrien-Smith s.n.*, Bridgetown to Kojonup and Slab Hut Gully, -.1910 (K); *J. Drummond 3, 39*, Swan River Colony, -.1845 (K, MEL, NSW, PERTH); *H. Eichler 21110*, near Hopetoun, 9.ix.1971 (AD); *J. Galbraith 1064*, Raventhorpe, 16.x.1964 (MEL); *C.A. Gardner 494 (FH 994)*, Gnowangerup, 22.x.1920 (PERTH); *A. Meebold 1124*, Normalup, -.xi.1928 (K, PERTH); *A. Morrison s.n.*, between Yetemerup & Warrungup, 15.x.1902 (PERTH); *F. Mueller MEL 92729*, S. Stirling Range, -.x.1867 (MEL); *E.C. Nelson ANU 16917*, Dryandra State Forest, Narrogin, 10.xi.1972 (PERTH); *A.F. Oldfield 356*, Stirling Range, s.d. (MEL); *M.E. Phillips CBG 19054*, 7 mls S Wagin, 7.x.1962 (CANB, MEL); *J.M. Powell 32833*, 5.3 km NW Boxwood Hill, 16.xi.1985 (AD, NSW); *R.H. Rechinger 59129*, 16 km S Tincurrin, 26.x.1982 (G); *N.H.Speck s.n.*, Esperance, 9.x.1952 (PERTH); *H.R. Toelken 6484*, 12 km NW Gairdner Station, 7.x.1979 (AD, PERTH); *6503*, 30 km S Lake King shop, 8.x.1979 (AD, PERTH); *7132*, NE Bremer Bay, 29.x.1981 (AD, PERTH); *7143*, 12 km NE Boxwood Hill, 30.x.1981 (AD, PERTH); *E.B.J. Smith s.n.*, 146.7 mls along Narrogin-Wagin road, 13.10.1964 (PERTH); *Strid 20893*, 3.5 km N Borden, 22.x.1982 (G, K); *D.J.E. Whibley 3322*, 5 km E Ongerup, 21.x.1969 (AD); *J.W. Wrigley CBG 28382*, 3 mls from Arthur to Williams, 8.x.1968 (AD, CANB).

Putative hybrids

17(i) *K. affinis* × *K. preissiana* see 19(ii) *K. affinis*

17(ii) *K. jucunda* × *K. preissiana* see 18(iii) *K. jucunda*

17(iii) *K. micromera* × *K. preissiana* see 13(iii) *K. micromera*

18. **Kunzea jucunda** Diels, Bot. Jahrb. Syst. 35: 424 (1905); Blackall & Grieve, West. Austr. Wildflow. edn 1, 1: 294 (1954); 'jocunda'; Beard, West Austr. Pl. edn 1: 77 (1965), 'jocunda'; Blackall & Grieve, West. Austr. Wildflow. edn 2, 3A: 99 (1980); J. Green, Census West. Austr. edn 2: 128 (1985).

Type: Western Australia, Mongerup near Salt River, *F.L.E. Diels 4719 (holo.*: B†; *iso.*: PERTH).

K. micromera auct. non Schauer: Benth., Fl. Austr. 3: 114 (1867), as for Gardiner Ranges, *Maxwell 211* (MEL).

Shrubs 0.6–1.2 (–2) m tall, with few stiffly erect stems from the base, each becoming densely covered with many short lateral branches which in turn are usually much-branched; young branches with decurrent flanges, glabrous to sparsely covered with appressed forward-directed hairs especially around inflorescences and terminal buds; early bark fibrous-mosaic, scarcely to well fissured, peeling in long fibrous strips. *Leaves*: *petiole* (0.3–) 0.4–0.7 (–0.9) mm long, appressed; *lamina* elliptic to broadly elliptic, rarely almost orbicular or narrowly elliptic to oblanceolate, (1.2–) 2–2.7 (–3.5) × (0.9–) 1.1–1.5 mm (rarely up to 3 times longer than broad), rounded or bluntly acute, abruptly constricted into petiole, usually concave or rarely flat above, convex below, spreading or more or less appressed when young, glabrous or rarely with a few hairs on lower parts adaxially. *Inflorescence* a botryum with (1–) 2–4 (–6) flowers, terminal mainly on short shoots, with vegetative growth continuing from the terminal bud, rarely from lateral buds below the fruiting inflorescence; *perules* often more than 5, broadly ovate to semi-circular, rounded to

mucronate, rarely cuspidate, with broad membranous margins, with one central vein, marginal cilia often restricted to the lower two-thirds; *bracts* broadly obovate to obovate-spathulate, 1.8–2.2 × 2–2.3 mm, rounded, bluntly acute, rarely mucronate, glabrous or with marginal cilia mainly on the sides, sometimes with a tuft of hairs towards the apex; *bracteoles* in pairs, oblanceolate- to obovate-spathulate, 1.6–2 × 1–1.3 mm long, acute to cuspidate often becoming bluntly acute, with single vein, marginal cilia longer along the sides. *Hypanthium* 2.1–3.2 mm long when flowering (free tube 1.2–1.5 mm long), glabrous. *Calyx lobes* lanceolate, 0.9–1.3 mm long, bluntly acute or rounded, rarely acute, margins slightly incurved, usually not ridged above the main vein, glabrous. *Corolla lobes* orbicular-spathulate, 1.7–2.2 (–2.5) mm long, scarcely clawed, pink to deep mauve. *Stamens* 18–24, usually in two whorls; filaments 2.2–3.2 mm long; anthers with small terminal gland. *Ovary* with 5 locules, surmounted by a broad style base which is scarcely sunk into the surface; placenta narrowly elliptic, scarcely fleshy disc with ascending attachment connected to the upper third, lobes only connate on the outside margins, each lobe with one row of ovules; ovules 7, 8 (–10) per locule, spreading or lower ones pendulous and slightly longer; style 3.1–3.4 mm long, broadened towards the base; stigma discoid to slightly funnel-shaped above. *Fruit* an urn-shaped capsule usually with 5 vertical ridges and erect, slightly incurved calyx lobes. *Flowers*: August–October (November). Fig. 19.

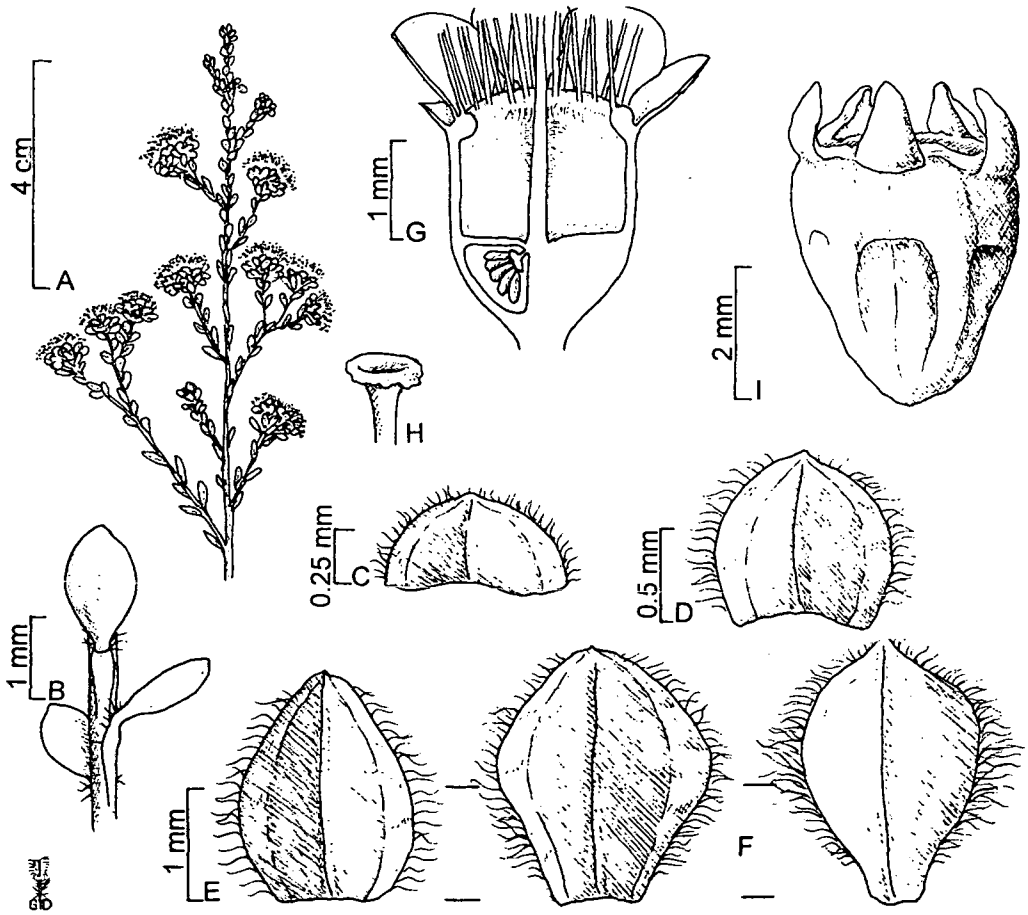


Fig. 19. *K. jucunda* Diels. A, flowering branch; B, branchlet; C, perule; D, lower bract; E, upper bract; F, bracteoles; G, half flower; H, stigma; I, fruit. (A–H, *R.D. Royce 3689*; I, *K. Beamish s.n.*, 2.x.1971.)

Distribution and ecology

Growing usually on sandy but also on rocky soils. It is never common although recorded over a wide range from north-east of the Stirling Ranges near Borden to Lake Magenta, Jerramungup and Bremer Bay, and also near Hopetoun. Map 8.

Conservation status: 3RCa (Briggs & Leigh 1988).

Diagnostic features

K. jucunda is usually easily recognised by its short and broad elliptic leaf blades (up to 3:1), which are glabrous when mature as is most of the plant. The repeated branching of the short lateral branches is very often accentuated by frequent gall development in perennating buds.

Specimens examined

WESTERN AUSTRALIA: *A.M. Ashby 545*, plains north of Stirling Range, 3.x.1963 (AD); *P.H. Barret 7*, Hopetoun Plain, 8.xi.1952 (PERTH); *K. Beamish s.n.*, 10 mls W Ongerup, 2.x.1971 (PERTH); *W.E. Blackall 3087*, S Lake Grace, 23.ix.1933 (PERTH); *M.G. Corrick 7731*, Gairdner River, 5.x.1981 (PERTH); *F.L.E. Diels s.n.*, E of Stirling Range, s.d. (PERTH); *C.A. Gardner s.n.*, West Mt Barren, -.viii.1940 (PERTH); *13729*, near Hamersley River, 24.x.1961 (PERTH); *G.F. Craig 1999*, 11.45 km N Ravensthorpe-Esperance Hwy on West Point Road, 30.viii.1992 (AD, PERTH); *3109*, ca 19 km SSW Ravensthorpe, 18.ix.1994 (PERTH); *R. Hnatiuk 800102*, ca 15 km NE Lake King, 1.x.1980 (PERTH); *F. Lullfitz 3369*, Bremer Bay turnoff on Borden Rd, 16.viii.1964 (KPBG); *3525*, 30 mls W Ravensthorpe, 25.viii.1966 (PERTH); *G. Maxwell 30*, on tributaries to the Salt and Gardner Rivers, s.d. (MEL); *211*, Gardiner Ranges, s.d. (MEL); *R. & E.F. Melville & A.S. George 71.212*, Fitzgerald River National Park, 8.ix.1971 (K); *K. Newbey 6217*, 8km WSW Lake Cronin, 3.ix.1979 (PERTH); *R.D. Royce 3689*, Jerramungup, 13.viii.1951 (PERTH); *6691*, 12 mls W Pingrup, 14.ix.1961 (PERTH); *C.I. Stacey 814*, 27.5 km E Raventhorpe to Esperance, 28.x.1985 (PERTH); *F. Stoward NSW 124064*, Katamung, -.ix.1914 (NSW); *H.R. Toelken 6468*, hill above Toompup H.S., 7.x.1979 (AD); *6487*, 22 km E Jerramungup, 7.x.1979 (AD, PERTH); *6509*, 43 km E Lake King shop, 9.x.1979 (AD, PERTH); *E. Wittwer 186*, m. peg 299 Ravensthorpe Road, 24.ix.1963, (KPBG, PERTH).

Putative hybrids

18(i) *K. affinis* × *K. jucunda* see 19(i) *K. affinis*.

18(ii) *K. cincinnata* × *K. jucunda* see 20(i) *K. cincinnata*

18(iii) ***K. jucunda* × *K. preissiana***

Pericalymma roseum Turcz., Bull. Cl. Phys.-Math. Acad. Imp. Sci. Saint-Pétersbourg 10: 334 (1852); F. Muell., Fragm. 8: 185 (1874); Domin, Mém. Soc. Sci. Bohême (1921) 22, 2: 87 (1923), **pro species**.

Type: Western Australia, Swan River, *J. Drummond 5, 135* (*holo.*: KW — PERTH, photo.; *iso.*: BM).

K. micromera auct. non Schauer: Benth., Fl. Austr. 3: 114 (1867), partly as for *J. Drummond 5, 135*.

This hybrid is distinguished from *K. preissiana* by its very broad lower bracts (rounded or bluntly acute, rarely mucronate), appressed hairs on the lower surface of the leaves only and some or all calyx lobes glabrous or glabrescent. The broad bracts and the majority of leaves being elliptic and relatively short shows that *K. jucunda* is a probable putative parent. The hairy bracts and hypanthium, which often have spreading hairs (but not always as also in *K. affinis* × *K. preissiana*), indicate that *K. preissiana* is likely to be the other parent. The distinction between this putative hybrid and *K. preissiana* sometimes becomes blurred mainly in a broad area around Ongerup (cf. variation of *K. preissiana*). The very broad bracts, which are stressed above as the main distinguishing feature between this hybrid and *K. affinis* × *K. preissiana* as well as *K. preissiana*, may represent an artificial separation (cf. variation of *K. preissiana*), but can be used as a broad guide to establish the identity of the taxa involved.

Specimens examined

WESTERN AUSTRALIA: *E.M. Bennett 960*, 2 mls E Hamersley River on Ravensthorpe-Esperance road, 12.ix.1966 (PERTH); *B. Doing s.n.*, E Ongerup, 10.ix.1966 (CANB); *J. Drummond 5, 135*, Swan River Colony, —. 1849 (MEL, NSW, PERTH); *C.A. Gardner 12146*, Young River, 30.x.1959 (PERTH); *K. Newbey 501*, 10 mls E Ongerup, 30.ix.1962 (PERTH); *2490*, 7 mls NW Corrigin, 15.x.1966 (PERTH); *A. Strid 20991*, 16 km S Jerramungup, 24.x.1982 (K); *H.R. Toelken 6504*, Lake King, 8.x.1979 (AD, PERTH); *6467*, 1 km S turnoff to Toompup, 7.x.1979 (AD, PERTH); *6468A*, above Toompup H.S., 7.x.1979 (AD, PERTH); *6487*, 22 km E Jerramungup, 7.x.1979 (AD, PERTH); *6502A*, 30 km S Lake King shop, 8.x.1979 (AD, PERTH); *6509A*, 43 km E Lake King shop, 9.x.1979 (AD, PERTH); *7149A*, 20 km N Boxwood Hill, 30.x. 1981 (AD, PERTH); *7167*, 1 km on Toompup Road from Ongerup, 1.xi.1981 (AD, PERTH); *J.H. Willis MEL 15032*, 38 km E Ongerup.

19. **K. affinis** S. Moore, J. Linn. Soc., Bot. 45: 202 (1920); Blackall & Grieve, West. Austr. Wildflow. edn 1, 1: 294 (1954); Beard, West Austr. Pl. edn 1: 77 (1965); Blackall & Grieve, West. Austr. Wildflow. edn 2, 3A: 100 (1980); J. Green, Census West. Austr. edn 2: 128 (1985).

Type: Western Australia, arid plains, Gardner and Fitzgerald Rivers, *G. Maxwell 211* (*holo.*: BM).

K. pauciflora auct. non Schauer: Benth., Fl. Austr. 3: 115 (1867), as for *G. Maxwell s.n.* & s.loc. (MEL 92471, MEL 92472) and 'at base of Mt Bland", *G. Maxwell s.n.* (MEL 92473).

Shrubs 0.6–1.5 (–2.5) m high, with few erect stems each surrounded by an intricate branching system of short branches; young branches with flanges scarcely raised, more or less densely covered with usually appressed forward-directed hairs, becoming glabrous; early bark fibrous-mosaic, scarcely fluted, peeling in long, usually narrow strips. *Leaves*: *petiole* 0.6–0.8 mm long, appressed; *lamina* linear, 3.5–6 (–8) × 0.4–0.8 (–1.1) mm, rounded or rarely with acute apex when young, usually grooved above, strongly convex below, erect to more or less appressed when young, with scattered long forward-directed hairs mainly along the margin. *Inflorescence* a botryum with (1) 2–4 (5) flowers, terminal mainly on short shoots, with vegetative growth continuing mainly from the terminal bud which then often branches immediately, rarely growth is also from one bud below the fruiting inflorescence; *perules*, if present, usually more than 5, often absent on inflorescences with few flowers, broad-ovate, cuspidate to mucronate, with long marginal cilia, woolly outside but often wearing off on exposed surfaces; *bracts* broadly ovate, 1.3–1.6 × 1–12 mm, acuminate, with stiff central veins continued into a mucro or beak, woolly outside; *bracteoles* in pairs, oblanceolate to linear, one usually broader than the other, 1–1.5 × 0.5–0.6 mm, pointed, with one central vein, woolly. *Hypanthium* 2–3 mm long when flowering (with free tube 1.3–1.5 mm long), glabrous. *Calyx lobes* broadly ovate, 1–1.3 mm long, bluntly acute to rounded, rarely acute, margins slightly incurved, a slight ridge above central vein, glabrous. *Corolla lobes* orbicular-spathulate, 2.4–2.8 (–3) mm long, scarcely clawed, pink to magenta. *Stamens* 20–25, in more than one whorl; filaments 2.4–3 mm long; anthers with a small terminal gland. *Ovary* with 5 locules, surmounted by broad style base which is scarcely sunk into the upper surface; placenta narrowly elliptic, scarcely fleshy disc with ascending attachment connected at the upper third, lobes only connate on the outside margins, each lobe with one row of ovules; ovules 8–10 (–12), subequal, spreading or lower ones pendulous; style 3.5–4.2 mm long; stigma discoid to slightly funnel-shaped above. *Fruit* an urn-shaped capsule usually with 5 vertical ridges and erect slightly incurved calyx lobes. *Flowers*: (August), September, October. Fig. 20.

Distribution and ecology

Growing in a wide range of habitats but usually on sandy soils and normally associated with scrub vegetation but also often found in clay soils in depressions or along rivers. Found from east of the Stirling Range, with localities becoming fewer and far between east of Ravensthorpe. Recorded as far north as Lake King and as far south as Cape Riche. Map 7.

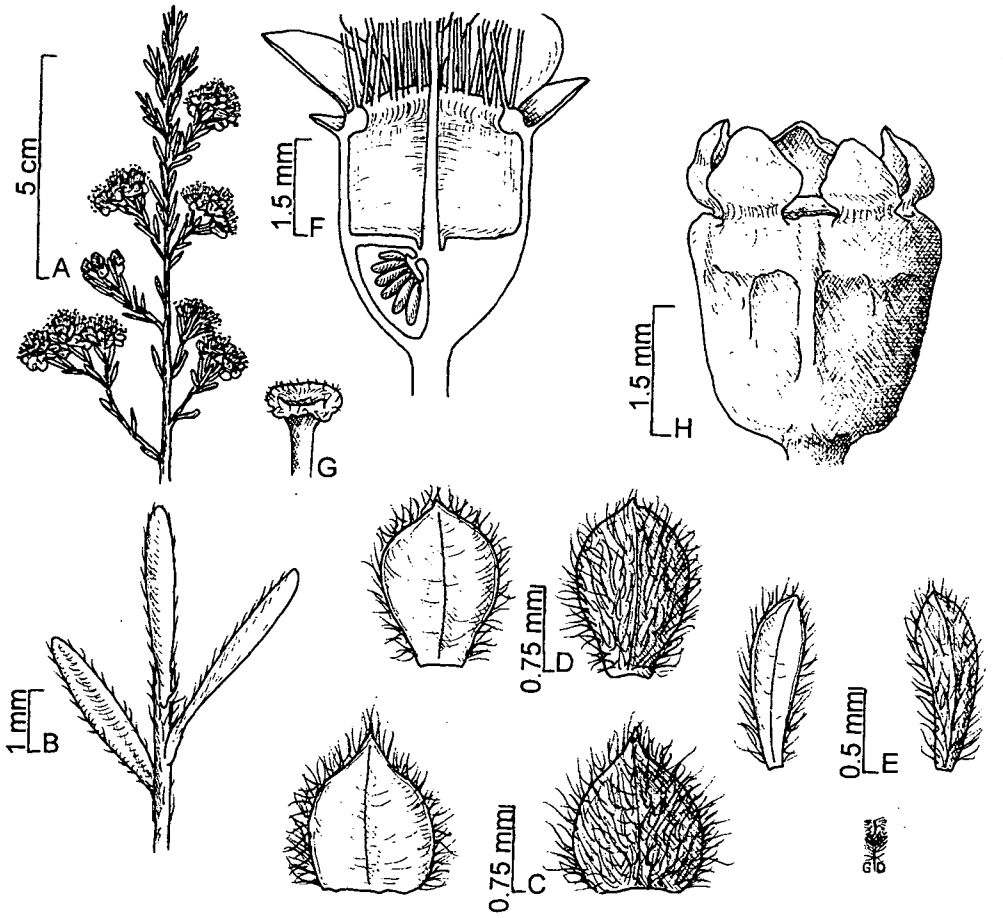


Fig. 20. ***K. affinis*** S.Moore. A, flowering branch; B, branchlet; C, perule; D, bract; E, bracteole; F, half flower; G, stigma; H, fruit. (A–G, *E. Wittwer 191*; H, *C.A. Gardner & W.E. Blackall 1042*.)

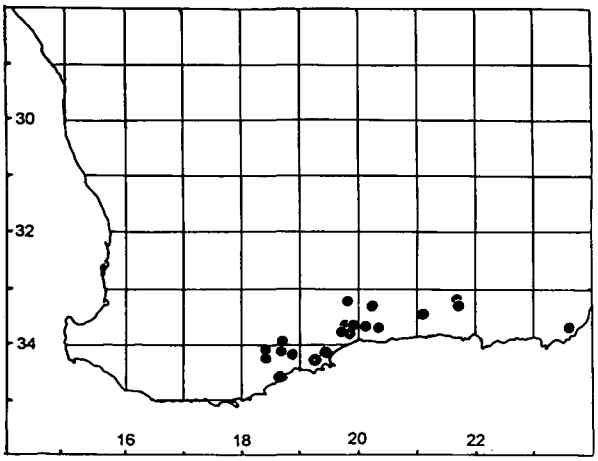
Conservation status: A widespread and locally common species.

Diagnostic features

Kunzea affinis most closely resembles *K. jucunda* in its habit, inflorescences, and frequent galling of apices of branchlets. *K. affinis* has, however, indistinct flanges, the leaves are usually linear, the bracts are densely hairy at least when young, the bracteoles are linear and the flowers usually pedicelled. Occasionally the hairs on the bracts and bracteoles wear off prematurely, but the bracts are acuminate and the young branches have long appressed hairs which distinguish such specimens from *K. affinis* × *K. jucunda*.

The flowers are scented, but this has also been recorded for a few other species in this subsection, although the scent is not obvious.

Bentham (1867) included three *Maxwell* specimens of *K. affinis* under *K. pauciflora* and two of them could be isotypes of the former. However, the latter species is easily distinguished by its habit as well as its long, acute calyx lobes and glabrous bracts which bear only a few marginal cilia.



Map 7. *K. affinis* ●.

Selection of specimens examined (ca 45 seen)

WESTERN AUSTRALIA: *J.S. Beard 7586*, Growellen Road, 28.ix.1975 (PERTH); *E.M. Bennett 2748*, 20 mls W Raventhorpe, 2.ix.1968 (PERTH); *W.E. Blackall 1042*, 4 mls S Truslove, 15.x.1931 (PERTH); *M.A. Burgman 2662 & S. McNee*, 47.5 km W Bald Rock, 3.x.1983 (PERTH); *A.J. Cough 11*, Grass Patch, 18.ix.1962 (PERTH); *G.F. Craig 2078*, 5.4 km S Rollands Road on Edwards Road, 12.ix.1992 (AD, PERTH); *A.R. Fairall 2283*, near Cape Riche, 7.x.1967 (PERTH); *C.A. Gardner 12898*, near Young River, 20.x.1960 (PERTH); *12916*, near Israelite Bay, 21.x.1960 (PERTH); *13999*, Mt Madden, 28.viii. 1962 (PERTH); *E. Gauba 475*, W. Ravensthorpe, 14.x.1955 (CANB); *A.S. George 5725*, Mt Short, 31.viii.1963 (PERTH); *7051*, 30 mls W Ravensthorpe, 30.x.1965 (PERTH); *10954*, W lower Fitzgerald River, 8.ix.1971 (PERTH); *G. Maxwell MEL 92473*, base of Mt Bland, s.d. (MEL); *K. Newbey 506*, 1 mile W Needilup, 30.ix.1962 (PERTH); *L.J. Nunn 328*, 0.2 km from Rockhole Road along Rawlinson Road, 26.ix.1985 (PERTH); *J. Taylor et al. 758*, 56 km ENE Ravensthorpe, 21.ix. 1979 (PERTH); *H.R. Toelken 6474*, 6 km S Toompup H. S., 7.x.1979 (AD, PERTH); *6483*, 12 km W Gairdner Station, 7.x.1979 (AD, PERTH); *7126*, 12 km E Wellstead, 28.x.1981 (AD, PERTH); *7141*, 12 km NE Boxwood Hill, 30.x.1981 (AD, PERTH); *7146*, 20 km NW Bremer Bay, 30.x.1981 (AD, PERTH); *7156*, 19.5 km N Telegraph Road on Hamersley Drive, 31.x.1981 (AD, PERTH); *J. Tonkinson s.n.*, 10 mls E Jerramungup, 8.ix.1965 (PERTH); *F. Uther-Baker s.n.*, Toompup, -.x.1964 (PERTH); *J.H. Willis MEL 92470*, 10 mls W Ravensthorpe, 3.ix.1947 (MEL); *E. Wittwer 191*, 3 mls W Phillips River, 25.ix,1963 (KPBG, PERTH).

Putative hybrids

19(i) *K. affinis* × *K. jucunda*

The hybrid usually superficially resembles *K. affinis* because of its relatively long leaves and very short bracts which are more or less hairy. However, the leaves are never linear and are usually distinctly concave above, the bracts are very broad and are usually rounded or rarely mucronate and the short hairs on young branches are often more or less spreading as in *K. jucunda*.

Specimens examined

WESTERN AUSTRALIA: *D. Clyne NSW 124057*, Raventhorpe to Ongerup, -.x.1969 (NSW); *C.A. Gardner s.n.*, S Ravensthorpe, -.ix.1925 (PERTH); *J. Taylor 758 et al.*, 56 km ENE Ravensthorpe, 21.ix.1979 (CANB); *H.R. Toelken 7162*, 27 km W Ravensthorpe on road to Jerramungup, 31.x.1981 (AD, PERTH).

19(ii) *K. affinis* × *K. preissiana*

K. preissiana auct. non Schauer: Blackall & Grieve, West. Austr. Wildflow. edn 2, 3A: 100 (1980).

K. affinis × *K. preissiana* and *K. jucunda* × *K. preissiana* are quite common and distinguished from *K. preissiana* (spreading hairs on both surfaces of the leaves as well as on bracts and flowers) by appressed hairs on the lower leaf surface (or if rarely on the upper surface in *K. affinis* × *K. preissiana* then the hairs are distinctly shorter than those on the lower) as well as glabrous or glabrescent calyx lobes which often varies from flower to flower. Although *K. affinis* × *K. preissiana* is distinguished from *K. affinis* by a more or less hairy hypanthium and a hairy abaxial surface of the leaves, some specimens superficially resemble *K. affinis* in its linear leaves and very short bracts. This hybrid in its broad circumscription as used here, varies greatly in leaf shape and bracts so as to include those collections more closely resembling plants of *K. preissiana* and *K. jucunda* × *K. preissiana*,

the latter being distinguished mainly by its broad rounded bracts. Consequently, specimens of *K. affinis* × *K. preissiana* are often found to show little resemblance to one another, and a continuous range of characters is only found when a sufficiently large range of material is examined. Such a range is, however, usually not encountered in the field where only a few hybrid plants are found at any locality. While this might be confusing, the range of material examined for this revision did not allow the separation of extreme forms.

Blackall (1980) distinguished *K. preissiana* on the basis of its glabrous calyx lobes combined with rather linear leaves, characters which agree with this hybrid, while the leaves of the very similar *K. jucunda* × *K. preissiana* tend to be broader and elliptic. Although the lectotype of *K. preissiana* is now without flowers, there is no such indication in the protologue, and as the leaves are densely covered with spreading hairs on both surfaces there is no doubt about the application of the name.

Selection of specimens examined (ca 40 seen)

WESTERN AUSTRALIA: *C. Andrews s.n.*, E Stirling Range, -.x.1903 (PERTH); *A.M. Ashby 527*, Borden, 30.ix.1963 (AD); *J.S. Beard 3649*, 12 km E Gairdner River, 18.x.1964 (PERTH); *E.M. Canning CBG 38576*, 1.4 mls SSW Jerramungup, 1.xi.1968 (CANB, PERTH); *R.J. Cranfield 4533*, 9 km SSE Pingelly, 21.x.1984 (PERTH); *A.R. Fairall 2328*, Jerramungup, 9.x.1967 (KPBG, PERTH); *W. Fitzgerald NSW 124067*, E Stirling Range, -.x.1903 (NSW); *C.A. Gardner 9460*, Bendering, 18.x.1949 (PERTH); *C.J. Keighery 1399*, Mt Chudalup, 29.x.1972 (KPBG); *V.F. McDougall 50*, Nyabing, -.x.1956 (PERTH); *K. Newbey 507*, Needelup, 30.xi.1962 (PERTH); *A.E. Orchard 1628*, 32 km NNE of coast of Stokes Inlet, 18.x.1968 (AD, CANB, PERTH); *R.D. Royce 9174*, northern boundery of Fitzgerald River National Park, 21.x.1970 (PERTH); *A. Strid 20991*, 16 km S Jerramungup, 24.x.1982 (G, K); *J. Taylor 1707 & P. Ollerenshaw*, 13 km from Raventhorpe to Hopetoun, 11.ix.1983 (PERTH); *H.R. Toelken 6482*, 23 km W Gairdner Station, 7.x.1979 (AD, PERTH); *6501*, 18 km S Ravensthorpe, 6.x.1979 (AD, PERTH); *7134*, 4km S Qualup H. S., 29.x.1981 (AD, PERTH); *7158*, 19.5 km N Telegraph Road on Hammersley Road, 31.x.1981 (AD, PERTH); *7164*, 27 km W Ravensthorpe on road to Jerramungup, 31.x.1981 (AD, PERTH); *P.G. Wilson 7804*, ca 22 km N Shoal Cape, 25.ix.1968 (PERTH); *E. Wittwer 885*, Wickepin, 22.x.1972 (CANB, PERTH); *2087*, N Chililup, 15.x.1977 (KPBG, PERTH); *J. W. Wrigley CBG 36378*, 72 mls Albany to Jerramungup, 26.x.1968 (CANB, NSW); *D. Young 328*, 45.6 mls W Raventhorpe, 12.x.1967 (KPBG, PERTH).

20. **K. cincinnata** Toelken, *sp. nov.*

A *K. affine* tomento cincinnato in ramis, bracteis longioribus foliis clavatis; a *K. eriocalyx* tomento cincinnato in ramis, ovariis plerumque pentalocularibus quoque 8–10 ovulis differt.

Type: Western Australia. 3 mls SE Ravensthorpe, *J.W. Wrigley CBG 29930* (holo.: PERTH; iso.: CANB).

Shrubs 0.6–1 (–1.5) m tall, with few erect stems and many short lateral branches; young branches with flanges shortly decurrent, pubescent rarely tomentose with more or less coiled or twisted hairs; early bark fibrous-mosaic, scarcely fluted, peeling in long narrow strips. *Leaves*: *petiole* 0.5–0.9 mm long, appressed; *lamina* linear-oblanceolate, rarely linear or linear-elliptic, (2.8–) 3.5–6.4 (–7.3) × 0.7–0.8 (–0.95) mm, bluntly acute, becoming rounded, rarely acute, gradually constricted into the petiole, concave to flat above, usually strongly convex below (but not ridged), erect or rarely spreading at right angles, sparsely covered with coiled hairs on both surfaces. *Inflorescence* a loose botryum with 1–3 (–5) flowers terminal on mainly short shoots, often clustered towards the apex of branches, with vegetative growth continuing from the terminal bud or from lateral buds below the fruiting inflorescence; *perules* few to more than 4, ovate- rarely lanceolate-acuminate, central vein continued into the beak, rarely with 3 veins from the base, with marginal cilia, covered with forward-directed hairs; *bracts* ovate to sometimes elliptic-acuminate, 3–4.5 × 0.6–0.9 mm, similar to perules; *bracteoles* in pairs, linear-lanceolate, 2–3.2 × 0.3–0.6 mm, but often unequally long, acute or bluntly acute, with single vein, with marginal cilia and forward-directed hairs outside. *Hypanthium* 2.8–3.5 mm long when flowering (free tube 1.6–2 mm long), usually villose with forward-directed hairs. *Calyx lobes* ovate to ovate-oblong, 0.9–1.2 mm long, bluntly acute to rounded, with margins slightly incurved, usually not ridged above main vein, pubescent to tomentose, rarely becoming glabrous. *Corolla lobes*

orbicular-spathulate, 2.4–3.2 mm long, pink to deep magenta. *Stamens* 26–34, in more than one whorl, usually scarcely longer than corolla lobes; filaments 2.6–3.4 mm long; anther with small terminal gland. *Ovary* with (3–) 5 locules, surmounted by broad style base somewhat sunk into the upper surface; placenta elliptic to narrowly elliptic, a somewhat fleshy disc with ascending attachment connected to the centre, lobes bulging and connate at the base, each one with 1 or 2 rows of spreading ovules; ovules 8–10 per locule, subequal, spreading, lower ones pendulous and slightly longer; style broadened towards the base, 4–4.5 mm long; stigma discoid. *Fruit* an urn-shaped capsule usually without vertical ridges and spreading calyx lobes. *Flowers*: September, October. Fig. 21.

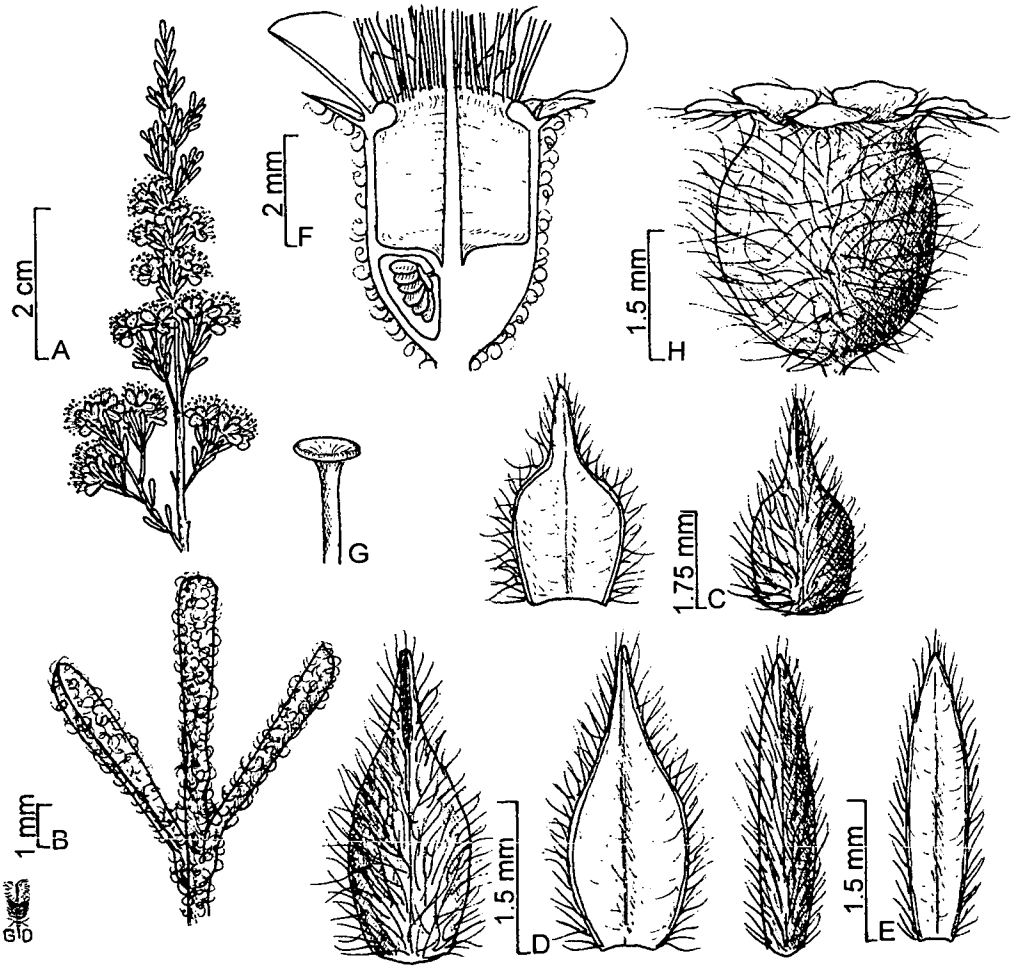


Fig. 21. ***K. cincinnata*** Toelken. A, flowering branch; B, branchlet; C, perule; D, bract; E, bracteole; F, half flower; G, stigma; H, fruit. (A–G, *C.A. Gardner & W.E. Blackall s.n.*, -.xi.1925; H, *A.S. George 1642.*)

Distribution and ecology

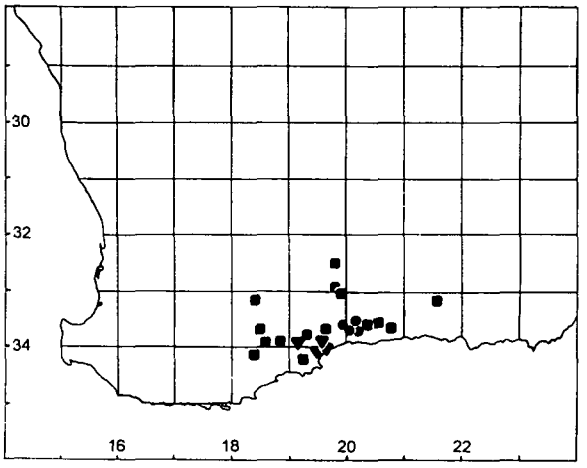
Recorded from 'laterite' and gravelly loam in the mountain ranges near Ravensthorpe. Map 8.

Conservation status

Although only occasionally recorded and from a restricted area it seems to be locally common.

Diagnostic features

Although this species has the typical habit of subsect. *Floridae* it produces predominantly terminal vegetative growth after flowering. Superficially, *K. cincinnata* appears to be a hairy form of *K. affinis* but it is also distinguished from the latter by its larger bracts and bracteoles, which are more than half the length of the hypanthium, and its club-shaped leaves. The hairy flowers and leaves are reminiscent of *K. eriocalyx* which is, however, distinguished by its fewer stamens and an ovary with 2 locules each with 1(2) ovules. *K. cincinnata* could also be confused with hybrids of *K. affinis* and *K. preissiana*, but is distinguished by its coiled hairs and broader perules and bracts.



Map 8. *K. jucunda* ■; *K. cincinnata* ●; *K. eriocalyx* ▼.

Variation

The tomentum on branches and flowers soon wears off so that it is often reduced or on some parts, particularly the calyx lobes, absent or stubby. The hairs on the inflorescence were only on rare occasions found to be coiled and are usually slightly twisted and spreading. At times even the leaves subtending the inflorescence produce hairs which are not coiled (*C.A. Gardner 12156*).

Etymology: The epithet '*cincinnata*' (has curled hairs, Lat.) refers to one of the distinguishing characters from similar *K. affinis*.

Specimens examined

WESTERN AUSTRALIA: *E.M. Bennett 2499*, Mt Short, 30.viii.1968 (PERTH); *E.M. Bennett s.n.*, Ravensthorpe Range, -.ix.1980 (KPBG); *C.A. Gardner 1895*, Desmond Range, 24.ix.1925 (PERTH); *12156*, Ravensthorpe Range, 1.x.1959 (PERTH); *C.A. Gardner & W.E. Blackall, s.n.*, Desmond Range, -.x.1925 (PERTH); *A.S. George 300*, Ravensthorpe Range, 12.ix.1958 (PERTH); *1642*, E side of Mt Desmond, 14.x.1960 (PERTH); *5724*, Mt Short, 30.viii.1963 (PERTH); *P.G. Wilson 7974*, ca 8 km N Ravensthorpe, 27.viii.1968 (PRETH); *J.W. Wrigley CBG 29930*, 3 mls SE Ravensthorpe, 29.x.1968 (CANB, PERTH).

Putative hybrids

20(i) ***K. cincinnata* × *K. jucunda***

The leaves of the two specimens cited below are reminiscent to *K. jucunda* in that they are elliptic, shorter (2.1–3.2 mm long) and early glabrescent, and in addition also the bracts are very broad and glabrescent. However, young branches and leaves are covered with coiled hairs and the bracts are acuminate as in *K. cincinnata*.

Specimens examined

WESTERN AUSTRALIA: *E. Wittwer 381*, 2 mls S of road from Ravensthorpe to Hammersley River, 26.viii.1965 (KPBG, PERTH).

21. **K. eriocalyx** F. Muell., Fragm. 2: 28 (1860); Benth., Fl. Austr. 3: 112 (1867); F. Muell., Syst. Census Austr. Pl. edn 1: 5 (1882); edn 2: 93 (1884); Blackall & Grieve, West. Austr. Wildflow. edn 1, 1: 294 (1954); Beard, West Austr. Pl. edn 1: 77 (1965); Blackall & Grieve, West. Austr. Wildflow. edn 2, 3A: 990 (1980); J. Green, Census Vasc. Pl. West. Austr. edn 2: 128 (1985).

Type: Western Australia, Middle Mt Barren, *G. Maxwell 157* (*holo.*: MEL 92535).

Shrubs 0.5–0.8 (–1) mm tall, with spreading stems sparsely covered with usually short lateral branches each terminating in a cluster of leaves and often an inflorescence; young branches with flanges scarcely developed, covered with long forward-directed and more or less appressed hairs, soon glabrescent; early bark fibrous-mosaic, scarcely fluted, peeling in broad strips. *Leaves*: *petiole* 0.6–1.1 mm long, appressed only at the base; *lamina* linear-oblanceolate (± club-shaped) rarely linear or elliptic, (2–) 2.5–4.5 (–7) × 0.4–0.6 mm, abruptly rounded at apex, very gradually tapering into petiole, flat to slightly convex above, strongly convex below especially near apex (not keeled), stiff-ascending or rarely spreading, glabrous or with appressed forward-directed cilia when very young. *Inflorescence* a botryum with (1–) 3–5 (–7) erect flowers, terminal mainly on short shoots, with vegetative growth continuing mainly from terminal bud or rarely from one to several lateral buds below fruiting inflorescence; *perules* usually few, broadly obovate, cuspidate, with 5–7 veins from the base, with long silky hairs more or less spreading; *bracts* broadly obovate-spathulate, 2.8–3 × 1.8–2.1 mm, cuspidate to acuminate, with 1–3 veins, with long silky hairs more or less spreading; *bracteoles* in pairs, oblanceolate to linear-oblanceolate, 2–2.5 × 0.7–1 mm, acute to acuminate, with single vein, covered with long silky hairs more or less spreading. *Hypanthium* 2.4–3.2 mm long when flowering (free tube ca 1 mm long), densely covered with long, silky, more or less spreading hairs. *Calyx lobes* lanceolate to oblong-lanceolate, 0.8–1.2 (–1.3) mm long, bluntly acute or rounded, margins often incurved and with marginal cilia, densely covered with long spreading hairs. *Corolla lobes* orbicular-spathulate, 1.6–2 mm long, usually with a short broad claw, pink. *Stamens* 11–15, usually in more than 1 whorl, often with gaps in front of corolla lobes; filaments 1.6–2.1 mm long; anthers with small terminal gland. *Ovary* with 2 locules, surmounted by a broad style base which is not sunk into the raised surface of upper surface; placenta broadly elliptic with conical base continued into narrow attachment, lobes almost indistinguishable, forming a ring around a depression with 1 (2) ovules; ovules 1 (2) per locule, equal, pendulous; style slightly broadened towards the base, 2.6–3.2 mm long; stigma small, scarcely discoid. *Fruit* urn-shaped with erect to spreading calyx lobes. *Flowers*: September, October. Fig. 22.

Distribution and ecology

Recorded from "spongolitic loam", "sandy clay over laterite", "in sand" and "among quartzite rocks" in mainly the Fitzgerald River National Park, where it is adequately conserved. Map 8.

Conservation status: 2KCa (Briggs & Leigh 1988).

Notes

A very distinct species distinguished from similar species by its sparsely branched habit, club-shaped leaves, which are aggregated at the tips of branches, few stamens, and 2-locular ovary with 1 (2) ovules in each locule. The lateral branches (short shoot) often have several years of growth and the annual growth is often less than 1 cm.

Specimens examined

WESTERN AUSTRALIA: *C.A. Gardner 9225*, Fitzgerald River, 23.ix.1948 (PERTH); *A.S. George 10958*, W of lower Fitzgerald River, 8.ix.1971 (PERTH); *G. Maxwell 157*, Middle Mt Barren Ranges, s.d. (MEL); *K. Newbey 2762*, near Twertup Creek, between Ongerup & Ravensthorpe, 19.x.1968 (PERTH); *K. Newbey 2879*, 8 mls W Point Charles, 20.ix.1969 (PERTH); *K. Newbey 3444*, 15 mls SW Mt Drummond, 2.x.1971 (PERTH).

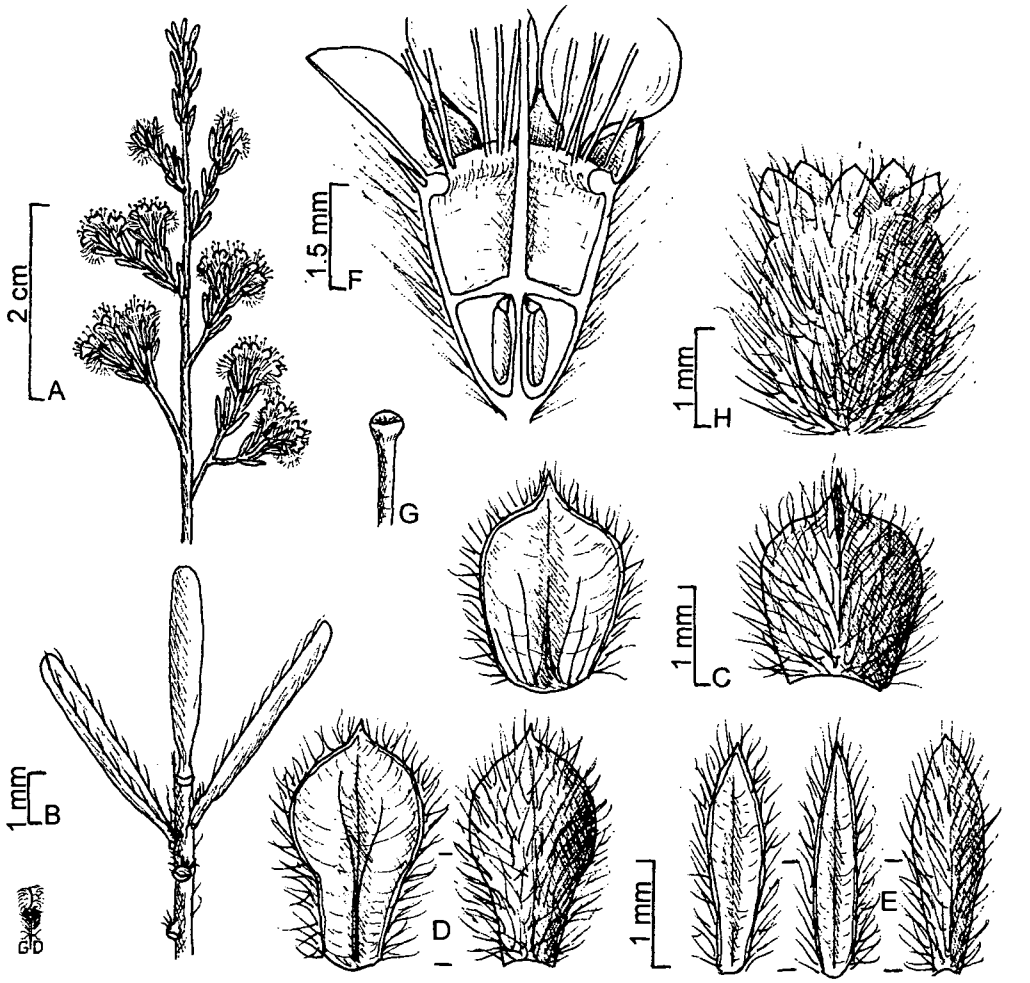


Fig. 22. ***K. eriocalyx*** F.Muel. A, flowering branch; B, branchlet; C, perule; D, bract; E, bracteoles; F, half flower showing 1 or 2 pendulous ovules; G, stigma; H, fruit. (A–G, *K. Newbey 2879*; H, *K. Newbey 2762*.)

Species excluded or insufficiently known

Metrosideros sororia Endl., Enum. Pl. Huegel 49 (1837); Walp., Repert. 2: 165 (1843); Schauer in Lehm., Pl. Preiss. 1: 134 (1844); Benth., Fl. Austr. 2: 114, 154 (1867).

Type: Western Australia, Swan River, *K.A.A. Hügel s.n.* (W, n.v.)

Bentham (1867) suggested that judging by "the characters given" this species should be placed into his broad concept of *K. recurva*, while Schauer (1844) considered it to agree with his *Melaleuca endlicheriana*, which is now generally included in *M. seriata*. As unfortunately no type could be traced in W, it must be assumed the specimen has been placed in another genus and is very likely not a *Kunzea* species. The description in the same publication of the style as simple in contrast to the capitate one in *Metrosideros propinqua* (now *K. ericifolia* susbsp. *ericifolia*) also indicates that *Metrosideros sororia* is not a species of *Kunzea*.

Tetraspora verrucosa Turcz., Bull. Cl. Phys.-Math. Acad. Imp. Sci. Saint-Pétersbourg 10: 405 (1852); F. Muell., Fragm. 8: 185 (1874); Domin, Mém. Soc. Sci. Bohême (1921) 22, 2: 87 (1923).

Type: Western Australia, *J. Drummond 5, 127* (KW - PERTH, photo).

T. verrucosa was placed by Domin (1923) into the synonymy of *K. recurva*, but, like *T. glomerata* (*J. Drummond 5, 117* —*Baeckea pentandra* according to F. Muell., Fragm. 8: 183), the specimens show on the photographs long flower stalks (?pedicels) unlike any *Kunzea* species.

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