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TAXONOMIC NOTES ON *HAKEA* SCHRADER (PROTEACEAE), MAINLY RELATING TO SOUTH AUSTRALIA

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Abstract

Sect. *Grevilleoides* Benth. is in need of revision, the current species often being poorly distinguished. *H. ivoryi* Bailey is shown to be confined to Queensland, *H. eyreana* (S. Moore) D. McGillivray to the Simpson Desert and east of it, and *H. divaricata* L. Johnson, reinstated for South Australia, occurs in central arid Australia, possibly extending to central Queensland; *H. suberea* S. Moore and *H. cunninghamii* R. Br. are likely to be synonymous, the latter name having priority. Among *H. leucoptera* R. Br. and its allies the branching and indumentum of the rachis are important diagnostically; *H. leucoptera* is variable in floral indumentum throughout South Australia, sometimes has a drooping habit east of the Flinders Ranges, and encompasses South Australian material previously assigned to *H. kippistiana* Meissner; *H. tephrosperma* R. Br. is newly recorded for South Australia and its variability in south-east Australia and distinction from *H. leucoptera* is clarified; *H. vittata* var. *glabriflora* J. Black ex J.H. Willis, described from the Mt Lofty Ranges, is reduced to synonymy under *H. sericea* Schrader, which is likely to be naturalised there; a Victorian record of this variety was based on a specimen of *H. lissosperma* R. Br.

Introduction

The following notes explain modifications to the taxonomy of *Hakea* adopted in the forthcoming edition of the "Flora of South Australia" (Barker, in press) and a precursor list of species in the State (Barker 1984).

Visits to the National Herbarium of Victoria (MEL), the Australian National Herbarium (CANB), the British Museum (Natural History) (BM) and the Royal Botanic Gardens, Kew (K), study of specimens of *H. ivoryi* F.M. Bailey from the Queensland Herbarium (BRI), field observations in north-west South Australia and Northern Territory in 1978 and in north-east South Australia and south-west and central Queensland in 1984 have assisted in confirmation or clarification of some aspects.

Two main groups of *Hakea* are dealt with. In the corkwoods (Sect. *Grevilleoides* Benth.) some advances have been made towards the clarification of the taxonomy of South Australian species which have traditionally been placed in two groups defined by the preponderance of simple or compound leaves. In *H. leucoptera* and its allies, to which the common name needlewood is often applied, diagnostic traits separating the South Australian species are clarified and the misapplication of some names is corrected.

As a result of this study it is clear that these two natural groups of species, in particular Sect. *Grevilleoides*, would benefit from Australia-wide revision.

1. *Hakea* Sect. *Grevilleoides* Benth., *Fl. Austral.* 5 (1870) 490 (*Corkwoods*).

While the division of the corkwoods into a group with long simple leaves and another with short compound leaves has proved useful for some workers, not only in keys in floras (Bailey 1901; Black 1924, 1948), but also in the more detailed work of Blake (1963), the distinction between the two groups is by no means clear-cut. Blake (1963) himself mentions the tendency for the simple-leaved species to have sporadic compound leaves, this phenomenon occurring most commonly in *H. suberea* (see b. below). *H. ivoryi* has leaves which can be simple or compound, although by their shortness this species can be conveniently and, it seems, naturally grouped with the other taxa with short compound leaves. Only a future revision will show whether this division is truly natural.

In 1963, Blake reviewed the taxonomy of the simple-leaved corkwoods (*H. lorea* (R. Br.) R. Br. and its allies) on the basis of material from a limited number of herbaria. His notes on the morphology of the group have implications for the taxonomy of the compound-leaved species and as a result have been considered in the context of the corkwoods of South Australia and neighbouring regions as a whole. The sporadic glandular hairs which Blake recorded in *H. chordophylla* FvM. as new for the Proteaceae also occur occasionally in inflorescences of all the central Australian corkwoods. Occasional glabrous inflorescences occur in the three central-Australian compound-leaved taxa, but this character has neither other correlated morphological traits nor distinct geographical range, such that the character seems likely to occur within populations with eglandular-pubescent inflorescences. In the main, leaf scar characters, gland size and shape, pollen-presenter morphology, fruit shape and position of the seed in the valve show wide variability within the central Australian taxa and are rarely diagnostic, although Blake (l.c.) used these traits diagnostically in his group of taxa and in this region the compound-leaved species have a smaller fruit than the single predominantly simple-leaved species.

a. The compound-leaved corkwoods (the *H. eyreana*-*H. ivoryi* complex).

Apart from *H. ednieana* Tate, which has distinctive floral characters, there has been much confusion as to the taxonomy and geography of the other corkwoods in this complex in South Australia. In 1924 Black recognised only *H. intermedia* Ewart & Davies but commented upon the need for study of the corkwood group. He later (Black 1948) distinguished a second species *H. ivoryi* F.M. Bailey (1901) which had been described from south-west Queensland. *H. intermedia* was subsequently replaced by *H. divaricata* L. Johnson (1962) because *H. intermedia* was an illegitimate later homonym. *H. divaricata* in turn was replaced by *H. eyreana* (S. Moore) McGillivray (1975), based on priority of publication.

Black (1948) gave his two species quite different ranges in South Australia, *H. ivoryi* of south-west Queensland and north-western New South Wales occurring in the Musgrave Ranges in the north-west of the State, and the other species "*H. intermedia*" of central Australia, western New South Wales and Queensland occurring in the north-east of the State north of Coopers Creek and along the Diamantina River. His diagnostic characters were poor, only greatly overlapping leaf lengths being used in the key. However, from his descriptions, characters of leaf segment length and orientation seemed potentially more reliable. Confusion in herbarium specimen identification and publication resulted, as for example in Boomsma (1972, 1981).

Mr C.D. Boomsma (pers. comm. 1982) has since questioned the application of the name *H. ivoryi* to South Australian populations on the basis of its very different foliage as figured in the protologue (Bailey 1901).

Having studied a wide range of material from South Australia and Northern Territory, with additional specimens from New South Wales and Queensland, I come to the conclusion that there are several taxa worthy of distinction within the compound-leaved corkwoods of the central and eastern arid regions of Australia, each with separate or divergent geographical ranges.

Overall, these compound-leaved corkwood species are poorly distinguishable. Unless further diagnostic characters can be discerned, a future revision may show them to be better treated as subspecies of a widespread polymorphic species. This would emphasise the somewhat greater distinctiveness of *H. ednieana*.

Key to the compound-leaved corkwoods in central and eastern arid Australia

- 1a. Perianth with tube in mature bud 2.5 mm long, straight, the limb slightly oblique, pistil 8.5-11 mm long, style ± straight, pollen-presenter ± erect. [*Branchlets and leaves white-pubescent, (? finally) glabrescent. Leaves 2-7 cm long, petiole 0.6-4 cm long, final segments 1-14, spreading, 0.15-3.6 cm x 0.7-1.8 mm, mucro 1-3 mm long*] *H. ednieana*
- 1b. Perianth with tube in mature bud 5.5-10 (-12) mm long, recurved towards apex such that limb downturned, pistil 18.5-28 (-30) mm long, style initially recurved, finally straight, pollen-presenter oblique to almost lateral.
 - 2a. Branchlets densely tomentose and leaves densely pubescent over many nodes, finally both glabrescent. Rachis usually densely tomentose, rarely glabrous.
 - 3a. Lateral width of fruit 1.7-2 cm. Leaves (when divided) 13-30 cm long, [*petiole 4-18 cm long, final segments 2-5, narrowly spreading, 1.5-17 cm x 1.3-2.5 mm, mucro 1.5-7 mm (fragile !)*] *H. suberea*
 - 3b. Lateral width of fruit c. 1-1.2 cm. Leaves 1.5-10 (-12) cm long.
 - 4a. Branchlets stout, raised-tomentose, rarely subglabrous. Leaves always compound, the petiole 0.8-2.5 (-4.5) cm long, final segments 4-15, 0.9-1.5 mm diameter. Gland (2-) 2.7-3.2 mm long. Shrub or small tree to 2-4 (-6) m high *H. eyreana*
 - 4b. Branchlets slender, appressed-pubescent, sometimes with scattered hairs with raised arms. Leaves usually to sometimes simple on most plants of a population, on some plants entirely compound; when compound, the petiole (1-) 1.5-4 (-7) cm long, final segments 1-4 (-7), (0.5-) 0.6-1.2 (-1.4) mm diameter. Gland (0.6-) 1.3-2.5 (-3) mm long. Shrub or usually tree 2-12 m high *H. ivoryi*
 - 2b. Branchlets pubescent at first few nodes, elsewhere usually glabrous, sometimes sparsely, rarely densely pubescent; leaves glabrous or sparsely pubescent, glabrescent. Rachis often pubescent, usually sparsely, sometimes densely so, sometimes glabrous. [*Leaf mucro 0.5-3.5 (-5) mm long*].
 - 5a. Leaves (7-) 9-16 (-20) cm long, petiole 2.5-9 cm long, final segments (1-) 3-13 (-16), i.e. often as few as 3, (0.3) 2-9 (-12) cm long *H. divaricata*: race "Southern"
 - 5b. Leaves (4-) 5-9.5 (-10) cm long, petiole (1.5-) 2-4 (-5) cm long, final segments (3-) 5-18 (-22), i.e. rarely 3, (0.05-) 0.2-6 (-6.5) cm long *H. divaricata*: race "Northern"

H. ednieana Tate, Trans. R. Soc. S. Austral. 7 (1885) 70.

Type citation: "... stony slopes of the Aroona Range, bordering the Basin of Lake Torrens on the east. *R. Tate*." *Possible syntype*: *Anon.* 382, s.dat., MEL 642951 (fruits only; in Mueller's hand: "*Hakea Ednieana* Tate, Sent by Prof. R. Tate!").

Confined in South Australia to the northern Flinders Ranges, this species is distinctive both morphologically and, at least in South Australia, geographically. I am uncertain of its reported occurrence in far north-western New South Wales (Cunningham et al. 1981; Jacobs & Pickard 1981) as I have seen no specimens from there with fully-opened flowers, which are necessary to distinguish it from other compound-leaved species in the region. The photograph in Cunningham et al. (1981) is not of *H. ednieana* but of *H. eyreana*, recognised by its oblique pollen-presenter, stout branchlets and many-segmented leaves.

Selected specimens examined

(Number of specimens seen are given when not all specimens are cited).

SOUTH AUSTRALIA. LAKE EYRE BASIN: *Hornsby* 49, 11.iv.1981, Moolawatana Station (AD sterile). FLINDERS RANGES (42 specimens): *Anon. (Herb. Tate) s.n.*, s.dat., Aroona Range (AD 98325160; material with flowers, no fruits, possibly a topotype but not a syntype); *Bakker s.n.*, 7.vii.1973, Brachina Gorge, Oraparinna (AD 97336004); *Eichler* 19635, 26.x.1967, Balcanoona near Nudlamutana Well along track leading W into mountain (AD); *Kuchel* 2973, 18.x.1971, Arkaroola Sanctuary, c. 25 km E of headquarters (AD); *Mollemans* 1124, 6.x.1981, creek leading up to Freeling Heights Plateau, 4.5 km NW of Paralana Hot Springs (AD; this specimen has sparser

than normal indumentum on rachis and flowers and more or less erect, twisted hairs, characters not evident in the several other specimens from the Paralana Springs area); *Mollemans 1132*, 6.x.1981, same locality (AD). EASTERN (3 specimens): *Rogers s.n.*, 21.x.1967, 10 miles E of Martins Well (AD 97006202 ex NT 25897).

H. ivoryi Bailey, Qld Fl. (1901) 1346, t. 59.

Syntypes: *J.F. Bailey s.n.*, xii.1896, Bingara, (BRI 11492); *Ivory s.n.*, i.1901, Charlotte Plains, (BRI 11491).

H. ivoryi is a taxon confined to south-western Queensland and north-western New South Wales. Its leaves are much shorter than the misleading "usually under 6 in. long" stated in the protologue (Bailey 1901) implies. Cunningham et al. (1981), also give a leaf length of 5-18 cm; they possibly confused *H. ivoryi* with a simple, long-leaved corkwood.

H. ivoryi differs from other corkwoods with relatively short, compound leaves in its high frequency of simple leaves. These leaves are very slender and flexible. In the population *Barker 4671* such leaves were predominant on most of the trees; the divided leaves on these trees tended to have very few (up to 3) segments which were similarly slender and flexible. Other plants, including the highest tree, had stiffer divided leaves with up to 7 segments. Leaves of this latter type were not seen by Bailey (1901). They have been noted, however, on "suckers" (*Smith 838* & *Everist*), but whether these developed from trees with similar or fewer segmented leaves was not indicated. In the collections seen, there was a higher proportion with simple or few-segmented leaves than with predominantly several-segmented leaves, indicating that the pattern of leaf division may be similar throughout the range of the species. Population samples are required to confirm this, particularly in regions such as north-western New South Wales where *H. eyreana* and *H. ivoryi* may overlap in distribution.

Specimens examined

QUEENSLAND. GREGORY SOUTH: *MacGillivray 1018*, 8.ix.1923, Bransby (BRI). WARREGO: *Althofer 37*, x.1971, 32 km from Charleville on Cunnamulla road (BRI); *J.F. Bailey* xii.1896 (syntype); *Barker 4871* & *Chinnock*, 26.ix.1984, c. 13 km by road N of Yowah Opal Field store, c. 3 km by road S of turnoff to 'Bundilla' and 'Jandell', c. 14 km by road SW of 'Alroy' (AD & duplicates); *Bell 515*, 1.xii.1971, near Charleville (BRI); *Clemens s.n.*, x.1945, near Charleville (BRI 242962); *Ebersohn E210*, 14.iv.1962, 50 miles on Cunnamulla-Barrington Road (BRI); *Ivory* i.1901 (syntype); *Smith 838* & *Everist*, 16.x.1940, c. 9 miles NW of Charleville (BRI, CANB, MEL). MARANOVA: *Roe 736*, 12.x.1947, 30 miles W of Bollon on Cunnamulla [?Cunnamulla] Road (CANB); *Roe 908*, 24.x.1946, 59 miles W of St George on Bollon Road (CANB); *Williams 73*, Boatman Road, 33 miles N of Cunnamulla Road Junction (BRI).

NEW SOUTH WALES. NORTH WESTERN PLAINS: *Moore 3579*, 15.x.1964, between Enngonia and Bourke (CANB). FAR NORTH WESTERN PLAINS: *Blaxell 601*, 5.xi.1971, 'Wirranya', W of Bourke (BRI); *Boorman s.n.*, x.1912, Waverley Downs (AD 9832535, AD 97525233 p.p. Herb. Black, BRI 24965); *Dalton s.n.*, x.1906, Wanaaring, Paroo River, (MEL 642899, AD 97525226 p.p. Herb. Black); *Moore 4715*, 8.xii.1966, 'Pelora', about 60 miles NW of Louth (CANB); *Moore 5656*, 12.xi.1969, 'Mt Mulyah' about 50 miles NW of Louth (CANB); *Moore 6555*, 7.v.1974, 'Pelora', 30 miles NW of Louth (CANB, 3 sheets).

H. eyreana (S. Moore) D. McGillivray, *Teloepa* 1 (1975) 30.

Grevillea eyreana S. Moore, J. Linn. Soc. (Bot.) 45 (1920) 210, basionym.

Holotype: *Capt. Sturt s.n.*, s. dat., [South Australia, Lake Eyre district,] Lat. 27°30' (sic!), on sand hills BM.

H. intermedia auct. non Ewart & O.B. Davies: J. Black, Fl. S. Austral. (1924) 160 p.p., non Hook.

H. divaricata auct. non L. Johnson: Boomsma, Native Trees S. Austral. (1972) 197, p.p.

H. ivoryi auct. non Bailey: Boomsma, Native Trees S. Austral. (1981) 262, p.p.

H. eyreana is restricted to the Cooper-Diamantina river basins and the margins of the Simpson Desert in north-eastern South Australia and south-eastern Northern Territory, extending into neighbouring parts of New South Wales and Queensland. It is distinguished from other compound-leaved corkwoods by its woolly-tomentose branchlets and its shortly petiolate leaves which tend to be more greatly divided into shorter segments than in any other species. Some material (e.g. *Barker 4625*), both at a flowering and a fruiting stage, may have subglabrous branchlets, but this is rare and in some cases the older parts of the branchlets show remnants of the persistent raised tomentum typical of the species. This lack of hairs may therefore be a rare phenotypic phenomenon.

Selected specimens examined

SOUTH AUSTRALIA. LAKE EYRE BASIN (25 specimens seen): *Anon. (S. Aust. Pastoral Board) s.n.*, 5.vi.1957, Cordillo Downs (AD 97630015); *Badman 325*, 13.vii.1981, Kooncherra Sandhill, 1 km NW of Birdsville Track (AD, CANB, NSW; erect ?glandular hairs in inflorescence); *Barker 4621-4624 & Chinnock*, 14.ix.1984, c. 11½ km by road ENE of Patchawarra Creek crossing and bore, c. 68 km by road N of Innamincka store, on road to 'Cordillo Downs' (AD & duplicates); *Barker 4625*, 15.ix.1984, Montkeleary ("Montecleary") Creek crossing by 'Cordillo Downs'-Innamincka road, c. 4 km by road SSE of southern turnoff to 'Arrabury' (AD & duplicates); *Donner 5346*, 28.viii.1975, c. 30 km E of Cordillo Downs, c. 4 km W of Arrabury Homestead (AD); *Jackson 2744*, 13.viii.1975, Clifton Hills Station, c. 40 km SSE of Koonchera Waterhole (AD; inflorescence glabrous); *Williams 8123*, 23.v.1976, Innamincka township (AD).

NORTHERN TERRITORY. CENTRAL AUSTRALIA SOUTH: *Crocker (Simpson Desert Expedition) 1*, 29.v.1939, plain, W of Andado Station (AD); *Crocker (Simpson Desert Expedition) 2*, 12.vi.1939, between sandridges, camp 7 (AD); *Crocker (Simpson Desert Expedition) 3*, 18.vi.1939, Camp 10 (AD).

QUEENSLAND. GREGORY SOUTH: *Barker 4636*, 15.ix.1984, c. 75 km by road ENE of Betoota, c. 21 km by road ENE of 'Arrabury' turnoff, on Birdsville Developmental Road to Windorah (AD & duplicates; inflorescence with glandular hairs).

H. divaricata L. Johnson, Contrib. N.S.W. Natn. Herb. 3 (1962) 93.

H. intermedia Ewart & O.B. Davies, Fl. N. Terr. (1917) 86, basionym, non Hook.

Syntypes: *G.F.Hill 108*, 21.iii.1911, 37 miles E of Hermansburg (MEL, AD); *G.F. Hill 111*, 21.iii.1911, near Jay Gorge, Jay River (MEL); *G.F.Hill 287a*, 60 miles N.E. C[amp] 2, [Lander River, NE of Stuarts Bluff Range] (MEL, AD).

H. ivoryi Bailey var. *glabrescens* J. Black, Trans. R. Soc. S. Austral. 61 (1937) 242.

Syntypes: *Cleland s.n.*, 4.ix.1930, MacDonald Downs Station, Fraser River (AD 97230203, AD 96046069 p.p.); *White s.n.*, 19.viii.1913, Crown Point, Finke River (AD 96046069 p.p., AD 97525234 p.p.).

H. ivoryi auct. non Bailey: J. Black, Fl. S. Austral. (1948) 264

H. eyreana auct. non (S. Moore) D. McGillivray: Boomsma, Native Trees S. Austral. (1981) 261, p.p.

With *H. ivoryi* restricted to the eastern arid regions, the name *H. divaricata* L. Johnson must now be reinstated to the central Australian species to which *H. ivoryi* has been often misapplied. It should be noted that some herbaria, e.g. NT, have continued to use *H. divaricata* for this species. It is distinguished by its glabrous or rapidly glabrescent red-brown branchlets.

H. divaricata seems divisible into two races tending to occur respectively in the northern and southern parts of its overall range. From the Musgrave, Mann and Tomkinson Ranges of north-west South Australia to the MacDonnell Ranges, Northern Territory, is a race with leaves with ultimate leaf segments tending to be fewer and longer than in other consistently compound-leaved corkwood species. From the MacDonnell Ranges northwards and on the western margin of the Simpson Desert is a shorter-leaved race with shorter more narrow ultimate segments, in these characters approaching *H. eyreana*. A population *Barker 4708* from central Queensland, south of Winton, has close affinities with this race, but alternatively

it may come from an intergrade with *H. chordophylla*, a species with predominantly simple, long leaves which occurs in the same region. Study of populations and a wider range of collections is required for the pattern of variation in the various diagnostic traits to be accurately recorded and to determine if a formal taxonomic breakdown of the variation is warranted.

The southern race of *H. divaricata* approaches compound-leaved forms of *H. suberea* which occurs sympatrically, but specimens of the latter can readily be distinguished by their persistently woolly-pubescent branchlets, longer leaves and broader fruits in lateral view. For further discussion see under *H. suberea*.

Selected specimens examined

H. divaricata L. Johnson race "Northern"

NORTHERN TERRITORY. CENTRAL AUSTRALIA NORTH (13 specimens, none with glabrous inflorescence): *Chippendale 2052*, 17.v.1956, Napperby Creek, NW Stockroute (AD); *Hill 287a* (syntypes of *H. intermedia* Ewart & O.B. Davies); *Nelson 1567*, 26.ix.1967, 3 miles S of Eurobra Gap, Jinka Station (AD). CENTRAL AUSTRALIA SOUTH (10 specimens, 3 with glabrous inflorescences): *Country Womens Assoc. per Ashby 59*, 1.x.1957, Alice Springs area (AD; inflorescences glabrous); *Hill 108* (syntype of *H. intermedia* Ewart & O.B. Davies); *Lazarides 5765*, 21.viii.1956, 31 miles NNW of Alice Springs township (AD; photos of habit, bark); *Nelson 975*, 12.iii.1964, Tropic of Capricorn, 13 miles S of Kintore Range (AD).

Specimen with affinities to *H. divaricata* L. Johnson race "Northern"

QUEENSLAND. GREGORY NORTH: *Barker 4708*, 19.ix.1984, near Wirribi (2) Bore, c. 5 km by road SSW of 'Colston' turnoff, c. 45km direct SSW of Winton, on 'Opalton' road (AD & duplicates).

H. divaricata L. Johnson race "Southern"

SOUTH AUSTRALIA. NORTH WEST (23 specimens, none with glabrous inflorescences): *Barker 3334*, 7.ix.1978, c. 2 km by road NNE of Pipalyatjara-Putaputa road along road to Waltjitjata; Tomkinson Ranges (AD); *Boomsma 15*, 28.ix.1974, Wardulka Valley, Everard Ranges (AD); *Weber 190*, 30.x.1966, Musgrave Ranges, Mt Harriet Road, c. 25 km S of Musgrave Park Station (AD).

WESTERN AUSTRALIA. WARBURTON (3 specimens, none with glabrous inflorescence): *Kuchel 200*, 2.viii.1962, Warrabri Gorge, SW side of Rawlinson Range, c. 15km NW of Giles (AD). GREAT VICTORIA DESERT: *Tietkins s.n.*, 1889, Lindsay Hills (AD 97733688).

NORTHERN TERRITORY. CENTRAL AUSTRALIA NORTH: *Cleland 4*.ix.1930 (syntypes of *H. ivoryi* var. *glabrescens* J. Black; inflorescences glabrous). CENTRAL AUSTRALIA SOUTH (9 specimens, 2 with glabrous inflorescences): *Correy s.n.*, vi.1964, Ayers Rock (AD 96532148); *Lothian 386*, vii-viii.1954, MacDonnell Ranges, Province's Gap (AD); *White 19*.viii.1913 (syntype of *H. ivoryi* var. *glabrescens* J. Black; inflorescence glabrous).

H. divaricata L. Johnson (race indeterminable).

(6 specimens from the Central Australia North and South regions of Northern Territory, including *Hill 111*, syntype of *H. intermedia* Ewart & O.B. Davies).

H. suberea S. Moore: compound-leaved form

(See under following section).

b. The simple-leaved corkwoods (*H. suberea* S. Moore and its allies).

In the past only one species has been recognised for South Australia's far north-western regions in this group of species. It was formerly known as *H. lorea* (R. Br.) R. Br. (e.g. Black 1924, 1948), but Blake (1963) showed that this species was confined to north-eastern and eastern Queensland and substituted the currently used name *H. suberea* S. Moore for the species in South Australia.

The present study has concentrated on the taxonomy and nomenclature of this species. Detailed examination of material from the central arid regions of Australia, shows there to be the one relatively homogeneous species.

H. suberea S. Moore, J. Linn. Soc. (London) 34 (1899) 223.

Type citation: "Specimens of the same tree were obtained by Mr. Helms of the Elder Expedition in the Cavanagh and Barrow Ranges . . . Seen from the Black Gin soak, between Goongarrie and Mt Margaret, northwards to . . . high granite rocks fourteen miles north of Lake Darlot . . . My specimen — unfortunately only a single one and not very good — agrees perfectly with that of the Elder Expedition in the Kew Herbarium." *Iso syntypes*: *Helms s.n.*, 4.viii.1891, near Camp 33 near Barrow Ranges (MEL 643557); *Helms s.n.*, 17.viii.1891, near Barrow Range, MEL 643560, ?AD 96236037 p.p. (Camp 33). *Possible iso syntypes*: *Helms s.n.*, 29.v.1891, near Everard Ranges (MEL 643561); *Helms s.n.*, 30.v.1891, near Everard Ranges, K, AD 96236037 p.p., ?AD 96236036 p.p. None of the syntypes referred to in the protologue could be traced at K or BM.

?*H. cunninghamii* R. Br., Suppl. Primum Prod. Fl. Nov. Holl. Prot. nov. (1830) 26.

Syntypes: *A. Cunningham 108*, 16.ii.1818, Capt. King's 1st voyage, north-west coast of Australia, Exmouth Gulf, Bay of Rest, lat. 22° 17' S, long. 114° 20' E (BM, 2 sheets; K).

H. lorea auct. non (R. Br.) R. Br.: FvM. & Tate, Trans. R. Soc. S. Austral. 16 (1896) 362; J. Black, Fl. S. Austral. (1924) 160; J. Black, Fl. S. Aust. (1948) 264.

In the central arid regions of Australia this species has long stout leaves and branchlets and inflorescences covered by a woolly tomentum composed of T-shaped hairs with upturned arms. It is closely associated with the mountain systems and inselbergs in the region.

Leaves divided into a few long segments occur sporadically on a substantial proportion of specimens from central Australia, although wholly simple-leaved specimens are more common. Blake (1963) commented that compound leaves occurred more frequently in *H. suberea* than in other species of the *H. lorea* group. Past identifications of material in AD and NT, notably by the late J. Maconochie, a *Hakea* specialist, indicated indecision as to whether these were variants of *H. suberea* or hybrids with *H. divaricata*, although Maconochie appears from more recent determinations to have decided that the former was the case. There is little doubt that this is indeed so, for the three main characters separating *H. suberea* from sympatric populations of the southern race of *H. divaricata* hold true. The northern race of *H. divaricata* is even more distinct from *H. suberea*.

In western Western Australia, from Laverton north-west to the Pilbara region, there is, in a relatively sparse sample of specimens, evidence of a trend from the leaves and indumentum of the central arid-zone populations in the south to more slender leaves and an appressed silky indumentum, owing to the shorter straight arms of the T-shaped hairs, in the north. All specimens examined from the region are listed below with these characters.

The slender leaves and silky appressed pubescence evident in material from north-west Western Australia were attributed by Blake (l.c.) to *H. fraseri* R. Br. of eastern Australia and, at least as to the latter character, *H. cunninghamii* R.Br., which he cited as restricted to northern Australia. Material in AD which Blake saw from the Pilbara and neighbouring regions with these characteristics, he assigned to *H. suberea*. Surprisingly he missed the anomaly that the type locality of *H. cunninghamii*, being in Exmouth Gulf, was in the same region, far away from the northern Australian localities to which he restricted the species.

Apart from the degree of appression of the indumentum, Blake's (l.c.) characters distinguishing *H. cunninghamii* from *H. suberea* break down in the material seen. All fruit-bearing specimens seen of plants with the *H. cunninghamii* indumentum type have the seed cavity displaced to one side and the fruit sometimes curved at the apex, characters attributed by Blake to *H. suberea*. Furthermore, the torus seems equally oblique in the two species. The

character of channelling of the leaf towards the apex does not characterise *H. suberea* in central or western Australia. There is a tendency for narrower leaves in western Western Australian material, but the character does not correlate with the indumentum variation. Thus, the great variability in characters described by Blake (l.c.) in the simple-leaved corkwoods applies just as much to fruit shape and seed cavity position in this complex.

When the specimens from the central and western arid regions of Australia are brought together they form a relatively homogeneous group. Through his confusion about the range of *H. cunninghamii*, Blake himself circumscribed *H. suberea* in this way. It seems likely that following examination of all types and a study of all Western Australian material the species will have to be renamed *H. cunninghamii*, for reasons of priority. Whether the species is conspecific with the northern Australian populations to which Blake assigned the name *H. cunninghamii* will require examinations of more than the few specimens seen for this study.

Specimens examined

H. cunninghamii R. Br.

WESTERN AUSTRALIA. PILBARA (5 seen): *Boomsma 16*, 2.vii.1976, Dampier (AD); *Boomsma 624*, 6.viii.1980, 2 km SW of Paraburdoo (AD); *Jackson 2912*, 18.viii.1977, Hamersley Range National Park, Fig Tree Soak, c. 10 km by road SW into Yampire Gorge from Wittenoorn-Roy Hill road (AD). CARNARVON: *Ashby 3889*, 18.vii.1971, c. 80 km E of North West Coast Highway, on Gascoyne Junction Road (AD); *A. Cunningham 108* (syntypes of *H. cunninghamii*). ASHBURTON: *Speck 78*, 15.vii.1958, 10 miles S of Berringarra (AD).

NORTHERN TERRITORY. VICTORIA RIVER: *R.M. Barker 202*, 20.iv.1983, No. 12 Government Bore, 2 km off Buchanan Highway (AD, NSW); *Shaw 852*, 3.vi.1967, c. 3 km E of the Victoria River Crossing (AD).

H. suberea S.Moore: simple-leaved specimens

SOUTH AUSTRALIA. NORTH WEST (37 specimens): *Helms 29.v.1891*, 30.v.1891 (? isosyntypes of *H. suberea*); *Whibley 6631*, 31.viii.1978, Mt Lindsay inselberg; northern side near the base (AD); *Wilson 2571*, 10.viii.1962, foot of Mt Woodroffe (AD). LAKE EYRE BASIN (6 specimens): *Badman 246*, 5.vi.1980, Carpamoongana Waterhole, Hamilton Station (AD); *Helms 20.v.1891* (?isosyntype of *H. suberea*).

WESTERN AUSTRALIA. PILBARA/ASHBURTON: *Burbidge 6039*, 8.v.1958, Roy Hill-Mundiwindi (60 miles S of Roy Hill) (AD; slender leaves but raised pubescence). AUSTIN: *Speck 607*, 4.ix.1957, 13 miles NW of Meekatharra, (AD; slender leaves but raised pubescence). GREAT VICTORIA DESERT: *Crisp 5849*, *Taylor & Jackson*, 15.ix.1979, c. 30 km W of Plumridge Lakes, 3 km N of Salt Creek airstrip (AD; stout leaves, raised pubescence); *Toelken 6058*, 9.ix.1979, 23 km ENE of Laverton (AD; slender leaves but raised pubescence). SOUTH WEST INTERZONE: *Young s.n.*, Ularing (MEL 643851). WARBURTON (7 specimens, all stout leaved and with raised pubescence): *Chinnock 613*, 29.viii.1973, 22.5 km E of Warburton Mission (AD); *Helms 4.viii.1891*, 17.viii.1891, (isosyntypes of *H. suberea*); *Kuchel 285*, 4.viii.1962, c. 65 km NW of Giles (AD).

NORTHERN TERRITORY. CENTRAL AUSTRALIA NORTH: *Maconochie 383*, 13.vii.1967, 36 miles W of Harts Range Police Station (AD). CENTRAL AUSTRALIA SOUTH (18 specimens): *Donner 4301*, 20.viii.1973, Mount Cavenagh, c. 17 km SW of Kulgera Homestead (AD); *Lazarides 5195*, 7.v.1955, Strangway Mountains, 4.5 miles NE of Yambah Station (AD; habit photo); *Nelson 1514*, 5.vii.1967, 20 miles NW of Alice Springs, N side of Macdonnell Ranges (AD).

H. suberea S.Moore: specimens with one or more compound leaves.

SOUTH AUSTRALIA. NORTH WEST: *Cleland s.n.*, 13.viii.1933, Eriwanjawanja, Musgrave Ranges (AD 96807289); *Cleland s.n.*, 17.vi.1958, Cave Hill, Western Musgrave Ranges (AD 966080696); *Turvey s.n.*, 23.iv.1966, Ernabella (AD 97628083).

WESTERN AUSTRALIA. WARBURTON: *Cleland s.n.*, 22.vi.1960, Giles Creek, S of Rawlinson Range (AD 968071043).

NORTHERN TERRITORY. CENTRAL AUSTRALIA NORTH: *Ising s.n.*, 21.vi.1933, 50 miles NE of Alice Springs (AD 97647358); *Maconochie 386*, 13.vii.1967, 62 miles W of Harts Range Police Station (AD). CENTRAL AUSTRALIA SOUTH (17 seen): *Henshall 2906*, 26.iii.1980, Petermann Ranges Reserve, Chirnside Creek (AD); *Lothian 82*, 1954, Standley Chasm (AD); *Munir 5139*, 23.viii.1973, in gorges of Mt Olga (AD); *Nelson 1558*, 21.ix.1967, Harry Creek, 33 miles N of Alice Springs (AD).

2. *H. leucoptera* R.Br. and its allies (*Needlewoods*).

Sect. *Hakea* Ser. *Pubiflorae* Benth., Fl. Austral. 5 (1870) 491, p.p. (at least as to *H. kippistiana* and *H. vittata*).

Sect. *Hakea* Ser. *Glabriflorae* Benth., Fl. Austral. 5 (1870) 492, p.p. (at least as to *H. leucoptera* and *H. cycloptera*).

While a formal taxonomic subdivision of Sect. *Hakea* which adequately reflects the relationships of its many species has yet to be proposed, there is a group of species closely allied to *H. leucoptera* characterised by simple rigid terete leaves, umbellate inflorescences of small flowers with oblique discoid pollen-presenters, and fruits with a porrect beak and style-end, which are sometimes flanked by two prominent apical horns. The representatives of this group, recognised to date as occurring in South Australia (Black 1948; Eichler 1965) have been *H. leucoptera* R.Br., *H. kippistiana* Meissner, *H. cycloptera* R.Br., *H. vittata* R.Br. and *H. vittata* var. *glabriflora* J.Black.

The ability to distinguish to needlewoods recognised here has been enhanced by characters of the inflorescence previously little used in this group. The rachis of each species has its own characteristic patten of branching and indumentum, *H. leucoptera* having a simple, relatively long rachis with a woolly white pubescence, *H. tephrosperma* a simple short rachis with an appressed brown pubescence, *H. sericea* a short simple rachis with a white raised pubescence, *H. vittata* a rachis with 1-3 short branches with an evenly appressed brown pubescence, and *H. cycloptera* with similar short rachis branches, up to 5 together, but often borne on remnants of rachises from prior year(s) and with a white sericeous pubescence often mixed with brown hairs. Flower number in the inflorescence, and pedicel and tepal indumentum are also of importance.

Key to the South Australian needlewoods

- 1a. Tepals glabrous outside. [*Rachis white-pubescent*].
 - 2a. Pedicels sparsely white, ± appressed puberulent. Leaves grooved below near base. [*Rachis simple or obscurely compound, 0.3-0.8 (-2.5) mm long*] *H. sericea*
 - 2b. Pedicels glabrous. Leaves not grooved.
 - 3a. Rachis white woolly puberulent, simple, sometimes with 1 or 2 basal buds rarely developed into branches, 6-14 mm long. Flowers 18-45; perianth tube 3-4.5 mm long. Fruit 1.7-3.2 cm long; seed wing cream to brown-white, decurrent on one side only. Shrub to tree 1-8 m high *H. leucoptera* (p.p.)
 - 3b. Rachis white-sericeous, sometimes with brown hairs, simple or shortly branched, 0.5-3 mm long, sometimes up to 5 together on branches of prior year(s) and 1-10 mm long. Flowers 1-14; perianth tube 4-6.5 mm long. Fruit 2.5-4 cm long; seed wing brown to brown-black, decurrent on both sides (narrower on one side). Shrub 0.3-1.3 m high *H. cycloptera*
- 1b. Tepals hairy outside.
 - 4a. Rachis white woolly pubescent, simple or with 1 or 2 basal buds sometimes developed into branches, 6-14 mm long. Flowers 18-45; perianth with raised white pubescence at least on limb, tube 3-4.5 mm long *H. leucoptera* (p.p.)
 - 4b. Rachis densely ± appressed brown pubescent, simple or compound and knob-like with up to 4 branches, 0.5-3 mm long. Flowers 1-22; perianth with appressed white and/or brown hairs at least on limb, tube 4-6.5 mm long.
 - 5a. Rachis simple. Flowers 6-22. Fruit smooth or verrucate, dehiscing fully down both sides. Leaves often hooked at apex, sometimes straight. Shrub to small tree, without witches-broom galls *H. tephrosperma*
 - 5b. Rachis compound, of up to 4 branches, but a very short knob. Flowers 1-8 (-14). Fruit smooth or with broadly folded surface, dehiscing partly down one side, fully down the other. Leaves straight. Small shrub with witches-broom galls *H. vittata*

H. leucoptera R. Br., Trans. Linn. Soc. London 10 (1810) 180.

Type citation: "In Nova Hollandiae ora australi; Flinders' Land: ad margines sylvarum prope radices montium" [i.e. at base of Mt Brown] *Syntypes*: *R. Brown s.n.* [*Iter Australiense 3376*], 1802, Inlet XII, South Coast (BM, 2 sheets; K; MEL 64322).

?*H. kippistiana* Meissner, Hookers' J. Bot. Kew Gard. Misc. 7 (1855) 115.

Probable holotype: *Drummond Ser. 5, suppl. no. 14*, s. dat., Swan R[iver] (K, "Presd. by W.W. Saunders Esq. F.L.S.") *Isotypes*: BM ("1848"), K, MEL 642215, MEL 642216, MEL 642217.

Black (1948) distinguished *H. leucoptera* and his *H. kippistiana* on the absence or presence of indumentum on the outer surface of the perianth and pedicel; earlier (Black 1924), he had distinguished the two at a varietal level. In the material seen flowers may be completely glabrous or have a sparse to dense, appressed silky pubescence. Both character states are distributed widely in South Australia and Northern Territory, so that it seems probable that the character may vary within populations, as is evident from *Badman 219*, which represents a sample from a population near Lake Eyre (the only other population sample available with flowering specimens, *Ulyatt 109-111* from near Alice Springs, has consistently glabrous flowers). It is noteworthy that, from both the material seen in AD and MEL and published descriptions (Willis 1973; Cunningham et al. 1981; Beadle 1982), *H. leucoptera* in the eastern States has glabrous flowers; it is possible however that some hairy-flowered specimens not seen from New South Wales could have been placed under *H. tephrosperma* (q.v.), with which material of *H. leucoptera* from New South Wales and Victoria has sometimes been confused.

H. leucoptera is also variable in habit, existing most commonly as a tall well-shaped shrub with many ascending main stems (e.g. *Pfeiffer 2*, *Barker 3515*, *Lazarides 6007*), but also, at least in the eastern margins of the Flinders Ranges, as a mis-shapen crooked tree with twisted and irregularly directed branches (e.g. *Pfeiffer 3*, *9*). Its fruits also vary from having a quite prominent pair of horns on either side of the apex to the more normal state in which they are reduced to obscurity.

I have concluded, therefore, that apart from in the Renmark area (see under *H. tephrosperma* below) this complex in South Australia is a single variable species to which the name *H. leucoptera*, being the earlier published name, must be applied. This conclusion was adopted by George (1981) following correspondence. Study of type material of the *H. leucoptera* from the southern Flinders Ranges and *H. kippistiana* from Western Australia shows the two probably to be conspecific. A range of material, including fully opened flowers, from the type locality of the latter is needed to confirm this. While the rachis of the *H. kippistiana* types is appressed-puberulent, the pedicels, and base and limb of the perianth in bud are sparingly pubescent as in some South Australian material.

Even if the two types prove to belong to different species, *H. leucoptera* is the correct name for the South Australian species.

Selected and cited specimens

(*Glabrous* and *hairy* refer to the pedicel and perianth; habit characters are also referred to in the Eastern region of South Australia).

SOUTH AUSTRALIA. NORTH WEST (15 specimens): *Anon. (S.Aust. Pastoral Board) s.n.*, 2.x.1955, The Currie Creek (AD; *glabrous*); *Weber 250*, 4.xi.1966, Wantapilla Bore, E end of Everard Ranges (AD; *hairy*). LAKE EYRE BASIN (55 specimens): *Badman 219*, 12.xi.1979, Lake Eyre South, 18 km E of Curdimurka (AD, 2 sheets; MEL, HO, LSU, SIU; *glabrous, sparsely hairy*); *Badman 223*, 24.x.1979, 28 km S of Oolgowa Water Hole, Macumba Station on W edge of Simpson Desert (AD, H, HO, GZU; *hairy*); *Lothian 1469*, 9.viii.1963, Simpson Desert, c. 12 km E of base camp which is c. 61 km E of Dalhousie Springs AD; *glabrous*). NULLARBOR:

B.C. Crisp 96, 28.v.1974, Lake Tallacootra (AD; fruiting). GAIRDNER-TORRENS BASIN (24 specimens): *Anon. (S. Aust. Pastoral Board) s.n.*, 23.x.1958, Wilgena (AD 97636211; *glabrous*); *Lay* 155, 20.xi.1970, c. 5 km W of Mullina Well, Wilgena Station (AD; *hairy*). FLINDERS RANGES (46 specimens): *Telfer* 107, 5.xi.1968, Hawker, Windy Hill (AD; *glabrous*); *Whibley* 2196, 26.x.1967, c. 6 km W of Balcanoona-Wertaloona turnoff, on road to Copley (AD & 3 dupl.; *hairy*). EASTERN (24 specimens): *Pfeiffer* 2, 2.i.1964, c. 6-8 km SW of Paratoo Homestead (AD; *glabrous*; habit like "a mulga"); *Pfeiffer* 3, 2.i.1967, same location (AD, 2 sheets; *glabrous*; "small trees 8-10 ft high decidedly droopy appearance...*H. leucoptera* without weeping appearance grows not far from coppice of this specimen"; habit photo); *Pfeiffer* 9, 20.xii.1967, on "Methuen" c. 16 km SW of Paratoo homestead (AD; *glabrous*; "small tree 8-10 ft high decidedly droopy appearance"). EYRE PENINSULA (23 specimens): *R. Brown* 1802 (syntype of *H. leucoptera*; fruits only); *Eardley s.n.*, 30.x.1942, Yudnapinna Station (AD 97617536 ex ADW; *glabrous*). NORTHERN LOFTY (8 specimens): *Copley* 2920, 30.xi.1969, c. ½km S of Telowie School (AD; *sparsely hairy*); *Higginson per Beaglehole* 7359, c. 1950, Port Germein (AD; *glabrous*); *Spooner* 5280, 24.vii.1977, South Hummocks Range (AD; fruits only); *Boehm* 413, 9.xi.1963, c. 4 km W of Bower (AD; *hairy*). MURRAY (34 specimens): *McAlister* 134, 25.xi.1980, Danggali Conservation Park, 4 km E of Terawi turnoff (AD; *glabrous*). YORKE PENINSULA (2 specimens): *Smith* 2384, 2.i.1976, near Maitland (AD; *sparsely hairy*).

WESTERN AUSTRALIA. WITHOUT SPECIFIC LOCALITY: *Drummond* 14; (types of *H. kippistiana* Meissner; *sparsely hairy*).

NORTHERN TERRITORY. CENTRAL AUSTRALIA NORTH (2 specimens): *Lazarides* 6007, 16.ix.1956, 37 miles SE of Yuendumu Native Settlement (AD, MEL; *hairy*; habit photo). CENTRAL AUSTRALIA SOUTH (23 specimens): *Barker* 3515 & *Ulyatt*, 14.ix.1978, c. 1 km by road NNW of crossing of 16 Mile Creek by Stuart Highway, c. 28 km NNW of Alice Springs (AD, IBSC, KRAM, G; fruits); *Ulyatt* 109-111, 8.xii.1978, same locality (AD; *glabrous*; material from different trees).

QUEENSLAND. GREGORY SOUTH: *Gardiner s.n.*, 16.viii.1962, c. 95 km S of Nappa Merrie Homestead (AD; fruits).

NEW SOUTH WALES. NORTH FAR WESTERN PLAINS (6 specimens): *Campbell* 1261 & *Pickard*, xi.1970, 3.2 km N of Turleys gate, S.A.-N.S.W. border (AD; *hairy*); *E. Ashby s.n.*, s.dat., Broken Hill (AD 966041248; *glabrous*). SOUTH FAR WESTERN PLAINS: *Corrick* 7401, 1.ix.1981, Gol Gol Forest, between Sturt Highway and Murray River (AD, MEL; fruits only).

VICTORIA. NORTHERN PLAINS (9 specimens): *Henshall* 8/66/4, 17.xii.1966, 3 miles N of Red Cliffs (MEL; *glabrous*); *St John s.n.*, xii.1907, Nhill (MEL s.n.; *glabrous*). MALLEE (8 specimens): *Chandler per Beaglehole* 7774, 7.xii.1949, Carwarp (MEL; *glabrous*); *Cummings* 172, *Crisp & Barnsley*, 9.x.1977, SW of Mildura, S shore of Rocket Lake (MEL; *sparsely hairy*); *Luly* 216 (ANU 30178), xi.1980, shoreline away from Rocket Lake (MEL; *sparsely hairy*).

H. tephrosperma R. Br., Suppl. Primum Prod. Fl. Nov. Holl. Prot. Nov. (1830) 26.

Type citation: "Ora orient., mont. Port Jackson, 1817. *D. Cunningham*." Possible holotype: BM.

H. vittata auct. non R. Br.: J.H. Willis, Hdbk Pl. Vict. 2 (1973) 50, p.p. (excluding S.Aust. occurrences and var. *glabriflora*).

H. tephrosperma R. Br. is newly recorded for South Australia, where it occurs in the Murray Valley region near the State's eastern border, with a single occurrence further west near Blanchetown. It resembles *H. leucoptera* in general appearance and fruit such that South Australian material has been previously misidentified as that species, but it differs in the often hooked apices of the leaves, the appressed rusty indumentum on the shorter rachis, and the flowers fewer in the inflorescence and with a shorter perianth tube. Of these characters, only the difference in rachis indumentum is constant. The presence of an apical pair of horns on the fruits and the reflexion of the leaf apices are not always evident in *H. tephrosperma* and also occur in *H. leucoptera*, although much less frequently. Variation in seed colour in each species, like the floral characters, also overlaps.

The rachis indumentum is often apparent in non-flowering material of each species and use of this character has shown that much material of *H. tephrosperma* has been misidentified in the past, not only as *H. vittata* (see below), but also as *H. leucoptera*. In particular *H. tephrosperma* is the source of confusion between *H. vittata* and *H. leucoptera* in north-western Victoria (Galbraith 1950; Willis 1973, as var. *vittata*). A tree habit and

uncinate leaves were attributed to Victorian *H. vittata*, characters descriptive of *H. tephrosperma* but not present in typical *H. vittata*, a small shrub with straight leaves confined to southern South Australia. Previous misapplication of *H. vittata* to *H. tephrosperma* in New South Wales (e.g. Dixon 1906; Anderson 1947, rectified in Jacobs & Pickard 1981, Cunningham et al. 1981) had been brought to light by L.A.S. Johnson some years ago (D.J. McGillivray, pers.comm. 1984). Recently, *H. tephrosperma* been recorded for Victoria in Beaglehole (1979, 1980), Costermans (1981) and Jacobs & Pickard (1981) as a result of McGillivray's communications.

Specimens examined

H. tephrosperma R. Br.

(Representative outside South Australia).

SOUTH AUSTRALIA. MURRAY: *Cleland s.n.*, 12.x.1963, Renmark (AD 96410061); *Conrick 610*, s.dat., Dangali Conservation Park on Canopus-Morgan Vale Road (AD); *Foreman 40*, 25.iii.1978, Canopus Station (AD); *Kraehenbuehl 3383*, 4.ix.1974, Blanchetown-Waikerie road, 19 km NE of Blanchetown (AD); *Mack s.n.*, 21.ix.1969, East Sandy Dam, Morganvale Station (AD 96940152); *Sommen s.n.*, 30.ix.1973, between Canopus and Morganvale (AD 96318008, sic).

NEW SOUTH WALES. CENTRAL WESTERN SLOPES (2 specimens): *Ising 2142*, 5.iv.1924, Logan Gate (AD). NORTH WESTERN PLAINS (2 specimens): *Cleland s.n.*, ix.1911, Cobar (AD 97732582). SOUTH WESTERN PLAINS: *Brazenor E4*, 1941, Moulamein (MEL); *Cleland s.n.*, 5.x.1912, Mirro[o] near Yanco (AD 97732583); *Hall s.n.*, 27.x.1969, CSIRO Field Station, 15 miles N of Deniliquin on Conargo Road (AD, MEL ex FRI 18511); *Willis s.n.*, 28.ix.1969, Cocopara Range, Mailman's Gap (MEL 503325); *Willis s.n.*, 30.ix.1969, Pulletop Nature Reserve, ca. 40 km NW of Griffith (MEL 503513). NORTH FAR WESTERN PLAINS: *Moore 6762*, 29.ix.1974, 62 km NW of Louth on road to Wanaaring via "Mt Mulyah" (AD); *Morris 612*, 30.vi.1921, near White Cliffs (AD).

VICTORIA. NORTHERN PLAINS (13 specimens): *Beaglehole 56169*, 4.v.1977, Lake Powell, ca. 16 km SE of Robinvale P.O. (MEL); *Falla 1*, early xi.1959, near Donald (MEL); *Falla 5*, s.dat., near Robinvale (MEL); *Muir 6130*, 2.x.1978, Goulburn Valley, 8 km WSW of Nathalia, beside Barmah-Shepparton road (MEL); *Watts 223*, iv.1917, Wycheproof (MEL). MALLEE (6 specimens): *Aston 110*, 1.xi.1958, Kulkyn State Forest, W of Lake Hattah (MEL); *Beaglehole 29330 & Finck*, 13.x.1968, N side of Wyperfeld National Park (MEL); *Begg s.n.*, 10.x.1963, c. 10 miles S of Swan Hill, along road between Croschen and Tresco West (MEL); *Muir 1132*, 13.viii.1980, beside Walpeup Lake, Timberoo Forest, in the Ouyen district (MEL).

H. vittata R. Br.

(Representative specimens)

SOUTH AUSTRALIA. EYRE PENINSULA: *Brown s.n. (Iter Austral 3372)*, 1802, Bay X [near Port Lincoln] (BM, sheets; K, 2 sheets; MEL 643225, MEL 643224; syntypes of *H. vittata* R.Br.); *Eichler 19505*, 13.x.1967, c. 45 km SE of Streaky Bay along Flinders Highway, c. 3½ km SE of the turnoff to Sceale Bay (AD). SOUTHERN LOFTY: *Eichler 14537*, 19.xi.1957, Cape Jervis (AD). KANGAROO ISLAND: *Cleland s.n.*, 18.xi.1924, Rocky River (AD 96807962). SOUTH EASTERN: *C.R. Alcock 3012*, 5.xi.1969, Big Heath National Park, north-west (Brown Stringy Bark) corner (AD); *Sharrad 359*, 3.xi.1959, c. 6 km W of Malinong, which is c. 45 km SE of Murray Bridge (AD); *West 2352*, 8.x.1977, 20 km NE of 'Emu Springs', on Box Flat-Coombe track, 5.3 km SE of Box Flat which is 34 km SSW of Lameroo (AD).

LOCALITY UNCERTAIN: *Anon. (Herb. Mueller) s.n.*, s.dat., Murray-scrub (MEL 642101, cited in Willis 1957).

H. sericea Schrader in Schrader & Wendl., Sert. Hannov. (1797 or ?1798) 27.

Type citation: None given apart from diagnosis, but possibly from Botany Bay. *Holotype*: ?GOET (n.v.)

H. vittata R. Br. var. *glabriflora* J. Black ex J.H. Willis, Victorian Nat. 73 (1957) 150.—*H. vittata* R.Br. var. *glabriflora* J. Black, Fl. S. Austral. (1948) 265, nom invalid. *Holotype*: *J.B.Cleland s.n.*, viii.1944, near Stirling E. school (AD 95643529, Herb. Black). *Isotype*: AD 96807226.

Since the late 1930s an unnamed taxon of needlewood was known to the botanists E.H. Ising, J.B. Cleland and J.M. Black from the Mt Lofty Ranges near Stirling East. Black (1948) distinguished it as a separate variety *glabriflora* of *H. vittata*, differing from the typical

variety in floral indumentum and larger fruit. Willis (1957; also 1973) validated the name by supplying the mandatory Latin description and citing a collection in the Black Herbarium (AD) as holotype; in so doing he also ascribed a specimen from western Victoria to the taxon.

L. Haegi (pers. comm. 1973) recognised that the specimens of *H. vittata* var. *glabriflora* in the Black Herbarium, including the holotype, belonged to the common south-east Australian species *H. sericea* Schrader, although he did not annotate specimens at the time.

The origin of *H. sericea* in the Mt Lofty Ranges is debatable. There is the possibility that populations surrounding Stirling East are natural occurrences, showing the not uncommon relictual pattern of disjunction between the Mt Lofty-Flinders range system of South Australia and the mountains and forest regions of the eastern States discussed by various authors (e.g. Parsons 1973; Specht 1972). However, in view of the relatively late discovery of *H. sericea* in the Mt Lofty Ranges in an area populated almost 100 years before, its restriction to such areas of early settlement, its use in cultivation in the State as early as 1925 (*Dutton AD 97850393*), and its noxious weedy properties in New Zealand (Sykes 1982) and South Africa (Morris 1982; Kluge & Richardson 1983) as well as its naturalisation in Portugal (Ball 1964), it seems more likely that all populations have originated through introduction.

The collection *MEL 643057*, which according to its label was collected by C. French jr. from the Wimmera region of Victoria and was attributed to *H. vittata* var. *glabrifolia* by Willis (1957, 1973), is in fact an eastern Victorian species, *H. lissosperma* R.Br. It emanated from the herbarium of C. Walter, whose collections are notorious for their erroneous localities (McGillivray 1973; Mrs M. Corrick & Mr R.V. Smith, pers. comm. 1983).

Specimens examined

H. sericea Schrader

SOUTH AUSTRALIA. SOUTHERN LOFTY (arranged chronologically): *Ising s.n.*, 13.iii.1937, Mt Lofty near Stirling East Public School, opposite Mr Daw's (AD 966081087; "?Garden escape. Mr Daw has known of this species growing there for 10 to 15 years...He says it also grows on hillside on East of Miss Snow's. Saw 15-20 plants"); *Ising s.n.*, 18.vi.1938, prior locality (AD 97701240); *Cleland s.n.*, 6.iv.1944, Colony (12 counted) in scrub at Stirling East, Mt Lofty (AD 96807224, "Not ornamental so unlikely to be a garden escape"; AD 96807225 "near school" (AD 9752529, Herb. Black); *Cleland* viii.1944, near Stirling East school, "about 12 plants" (holotype of *H. vittata* var. *glabriflora* J.Black ex J.H.Willis); *Wade s.n.*, 26.ix.1944, Stirling East (AD 97650206); *Wade per Cleland s.n.*, 12.viii.1947, Stirling (AD 966130091); *Ising s.n.*, 20.i.1953, Stirling East (AD 96617007; "From same locality, only place known where var. [*H. vittata* var. *glabriflora*] occurs"); *Ising s.n.*, 7.xi.1953, Stirling East (AD 96617006); *Ross s.n.*, viii.1956, Piccadilly Valley (AD 95927091; "On side of road, growing wild"); *Ising s.n.*, 30.iii.1957, Stirling East (AD 96625031; "From the type locality of the variety and the only locality known—and only a few plants now growing"); *Ising s.n.*, 7.viii.1957, Stirling East (AD 96149275; "Type locality"); *Eichler 13906*, 17.viii.1957, Stirling East, near the school (AD; "in natural scrub"); *Lange s.n.*, 12.vii.1961, a few miles N of Stirling, down slope from road junction signposted "Woodhouse Golf Links" (AD 96727001; "Tall shrub c. 3 m, in dense understorey near drainage line under *Eucalyptus rubida* E. *viminalis*"; *Whibley 821*, 23.vii.1961, Stirling East, on property of D.J.E. Whibley (AD); *Ising s.n.*, 13.iv.1965, Stirling East (AD 96848245); *Whibley 3893*, 2.viii.1973, Property of D.J.E. Whibley at Stirling East (AD; "Not an escape from adjacent planting; occurring in roadside remnant of *Eucalyptus obliqua* sclerophyll forest. A few shrubs 4 m high" pers. comm. 1983); *Barker 1894*, 29.v.1977, Watiparinga National Trust Reserve, Belair (AD; "Cultivated (partly), partly escaped. Area once cleared, replanted in 1957 with Australian trees and shrubs. Shrubs to c. 1m, common in area, probably at least some spreading from originally planted one with possible assistance of fires"). CULTIVATED: *Dutton s.n.*, ix.1925, Anlaby (Northern Lofty region) (AD 97850393; Also a series of collections from Wittunga Botanic Garden dating from 1968.

NEW SOUTH WALES (representative only). CENTRAL COAST: *Ising s.n.*, 17.vi.1961, Beecroft, an outer north-western suburb of Sydney (AD 96220026); *Ising s.n.*, 13.ix.1969, North Turrumurra, suburb of Sydney (AD 97023022). SOUTH WESTERN SLOPES: *Evans 2640*, 7.x.1967, Mt Jerrabomberra, 2 miles SW of Queanbeyan (AD).

VICTORIA. WESTERN HIGHLANDS (representative only): *Beaulehole 30817*, 22.vi.1969, Grampians, Black Range, extreme N end, E side of Picnic Rocks (AD); *Haegi 643*, 18.iv.1975, Victoria Range, Grampians, Halls Gap

to Mt Zero Road, c. 26 km SE of Mt Zero (AD); *Haegi 1453*, 25.ix.1977, Grampians, c. 0.5 km NW of Gotton Gorge turnoff on Halls Gap-Mt Zero road (AD).

NEW ZEALAND. NORTH ISLAND: *Goulding 888*, 6.viii.1977, Waitemata County, East Coast Bays Road, S of Lonely Track Road (AD); *Halliday 85*, 19.vii.1974, Auckland University Reserve, Swanson, at end of Tram Valley Road, near Swanson Stream (AD).

H. lissosperma R. Br.

(Representative only).

VICTORIA. EASTERN HIGHLANDS: [?Soues] *per St John*, 19.xii.1907, Buffalo Mountains (MEL 536988); *Willis s.n.*, 6.xii.1970, Logging road ca. 6 km NNE of Snowy Plains air-strip, Wonnongatta-Macalister River Divide (MEL 502508, AD 97612365).

TASMANIA. EAST COAST: *Orchard 5271*, 20.i.1981, One O'Clock Hill, above Murderers Marsh, Mt Dromedary (AD). MT FIELD: *Cleland s.n.*, 24.x.1939, road to Lake Fenton (AD 97308414). MT WELLINGTON: *Ising s.n.*, 14.i.1928, The Springs (AD 97648212).

SPECIMEN WITH DISCORDANT LABEL: *C. French jr. s.n.*, x.1898, Mallee, Victoria, "probably near Pine Plains Station" (in hand of J.H. Willis, MEL 643057).

H. vittata R.Br.

(See under *H. tephrosperma*).

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References

- Anderson, R.H. (1947). "The Trees of New South Wales," 2nd edn. (Govt Printer: Sydney).
- Bailey, F.M. (1901). *Hakea*, Schrad. In "The Queensland Flora," pp. 1344-1351, pl. LIX. (Queensland Govt: Brisbane).
- Ball, P.W. (1964). *Hakea* Schrader. In T.G. Tutin et al. (Eds). "Flora Europaea", Vol. 1, p. 69. (Cambridge Univ. Press).
- Barker, W.R. (1984). Proteaceae. In J.P. Jessop (Ed.). "A List of the Vascular Plants of South Australia", 2nd edn, pp. 74-75. (Adelaide Botanic Gardens & State Herbarium and Environmental Survey Br., Dept of Environment & Planning).
- Barker, W.R. (In press). Proteaceae. In J.P. Jessop & H.R. Toelken (Eds). "Flora of South Australia", Vol. I. (Govt Printer: Adelaide).
- Beadle, N.C.W. (1982). "Students Flora of North Eastern New South Wales", Part II. (Dept. Bot., Univ. New England: Armidale).
- Beauglehole, A.C. (1979). "The Distribution and Conservation of Native Plants in the Victorian Mallee". (Western Victorian Field Nat. Clubs Assoc.: Portland).
- Beauglehole, A.C. (1980). "Victorian Vascular Plant Checklists 13-Study Area and 24-Grid Distribution". (Western Victorian Field Nat. Clubs Assoc.: Portland).
- Black, J.M. (1924). *Hakea*, Schrad. In "Flora of South Australia", pp. 159-161. (Govt Printer: Adelaide).
- Black, J.M. (1948). *Hakea*, Schrad. In "Flora of South Australia" 2nd edn, pp. 264-267. (Govt Printer: Adelaide).
- Blake, S.T. (1963). New or noteworthy plants chiefly from Queensland, II. *Proc. R. Soc. Qld* 73, 61-77, pl. VI-VII.
- Boomsma, C.D. (1972). Native trees of South Australia. *Woods & Forests Dept., S. Austral. Bull.* 19.
- Boomsma, C.D. (1981). Native trees of South Australia. *Woods & Forests Dept., S. Austral. Bull.* 19, 2nd edn.
- Brown, R. (1830). "Supplementum Primum Prodromi Florae Novae Hollandiae: exhibens Proteaceas novas ..." (London).
- Costermans, L.F. (1981). "Native Trees and Shrubs of South-eastern Australia". (Rigby: Adelaide).
- Cunningham, G.M., Mulham, W.E., Milthorpe, P.L. & Leigh, J.H. (1981). Proteaceae. In "Plants of Western New South Wales", pp. 211-218. (N.S.Wales Govt Printing Office).
- Dixon, W.A. (1906). "The Plants of New South Wales". (Angus & Robertson: Sydney).
- Eichler, H.J. (1964). "Bibliographic Catalogue of Vascular Plants of South Australia". (Manuscript held at AD, the Proteaceae Section probably compiled prior to 1962).
- Eichler, H.J. (1965). "Supplement to J.M. Black's Flora of South Australia". (Govt Printer: Adelaide).
- Galbraith, J. (1950). *Hakea vittata*, "Black" and "White". *Vict. Naturalist* 66, 179.

- George, A.S. (1981). Proteaceae. In J.P. Jessop et al. (Eds). "Flora of Central Australia", pp. 18-24. (Reed: Sydney).
- Jacobs, S.W.L. & Pickard, J. (1981). "Plants of New South Wales". (Govt Printer: New South Wales).
- Johnson, L.A.S. (1962). Taxonomic notes on Australian plants. *Contrib. N.S. Wales Nat. Herb.* 3, 93-102.
- Kluge, R.L. & Richardson, D.M. (1983). Progress in the fight against *Hakea*. *Veld & Flora* 69, 136-138.
- McGillivray, D.J. (1973). Michel Gandoger's names of Australian plants. *Contrib. N. S. Wales Nat. Herb.* 4, 319-365.
- McGillivray, D.J. (1975). Australian Proteaceae: new taxa and notes. *Telopea* 1, 19-32, pl. I-V.
- Morris, M.J. (1982). Biological control of *Hakea* by fungus. *Veld & Flora* 68, 51-52.
- Parsons, R.F. (1973). Disjunctions in the distribution of *Eucalyptus* species between western Victoria and the Mount Lofty Ranges-Flinders Ranges area, South Australia. *Proc. R. Soc. Vict.* 86, 29-34.
- Specht, R.L. (1972). "The Vegetation of South Australia". (Govt Printer: Adelaide).
- Sykes, W.R. (1982). Checklist of dicotyledons naturalised in New Zealand 12. Haloragales, Myrtales, Proteales, Theales, Violales (excluding Violaceae). *N. Zeal. J. Bot.* 20, 73-80.
- Willis J.H. (1957). Vascular flora of Victoria and South Australia. (Sundry new species, varieties, combinations, records and synonymies). *Vict. Naturalist* 73, 149-160.
- Willis, J.H. (1973). "A Handbook to Plants in Victoria, Vol. II. Dicotyledons". (Melbourne Univ. Press: Carlton).

