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NOTES ON *ZYGOPHYLLUM* (ZYGOPHYLLACEAE) IN AUSTRALIA INCLUDING THE DESCRIPTIONS OF FIVE NEW SPECIES AND ONE NEW SUBSPECIES, REVISED KEYS AND TYPIFICATIONS

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Abstract

Two new species, *Z. eichleri* R.M. Barker and *Z. rowelliae* R.M. Barker, are described from within the 5-merous group of *Zygophyllum* species, together with a revised key to this group. *Z. halophilum* R.M. Barker, *Z. reticulatum* H. Eichler ex R.M. Barker and *Z. aurantiacum* ssp. *simplicifolium* H. Eichler ex R.M. Barker are described from the group of species with 4-winged fruits and a revised key is also provided to this group. *Z. marliesiae* R.M. Barker, closely related to *Z. prismatothecum*, is distinguished for the first time. Typifications and notes on other Australian species are also presented.

Introduction

An earlier paper (Barker 1996) documented some of the manuscript names of Hj. Eichler within the Zygophyllaceae of Australia. Many of these names were already in use since there were collections which had been annotated with them and Eichler had chosen and segregated types. The following paper continues to document new taxa within *Zygophyllum*.

Z. reticulatum and *Z. aurantiacum* ssp. *simplicifolium* were named and at least partially segregated by Eichler but in a less obvious way to those species published in the earlier paper. As will be seen from this treatment there still remain problems with the taxonomy of *Z. reticulatum*.

A mixture of *Z. eichleri* and *Z. rowelliae* was segregated within the CANB collections as the "Interior-North Western form of Z. iodocarpum", but this would appear to have involved both Eichler and his ABRS-funded assistant Alison Rowell. There were also occasional specimens which had been annotated earlier by Eichler as "aff. tesquorum" or "aff. iodocarpum" but these had not been segregated in any systematic way from the rest of the collections.

As was indicated in the earlier paper, the strength of the Eichler manuscripts did not lie in the provision of descriptions, but in the area of synonymy and a gathering of information on type material. While the author has seen type material that resides in Australia, the same cannot be said for material held in overseas herbaria. In these cases, however, there is invariably a photograph of these types within the manuscripts enabling discussion and choice of lectotypes, many of which are documented here.

The 5-merous species of *Zygophyllum*

The group of *Zygophyllum* species in which the parts are pentamerous had not been worked on to any great extent by Eichler and so when this project started the taxa still needed to be clarified. There is still some field work required to establish whether *Z. tesquorum* J.M. Black and *Z. retivalve* Domin, both documented here, are truly distinct. Similarly *Z. lobulatum* (F.Muell. ex Benth.)H. Eichler is almost certainly not deserving of species status, but it has been maintained here because its relationship with *Z. hybridum*

Tate and *Z. kochii* Tate is in need of clarification. Only limited material of all of these taxa is available.

Some of the leaf characters used to separate species in the past are known to be unreliable since they can be found on the one plant. The lobe on the outer edge of the leaflet towards the base, characteristic of *Z. lobulatum*, seems to occur mostly in older leaves. Consequently many of the leaves on one plant may be lacking the distinguishing character. The three-lobed leaflet apex, characteristic of *Z. kochii,* is also to be found in some specimens identified as *Z. lobulatum* (e.g. *R.M. Barker 1216*).

Two new species are recognised here for the first time. One, *Z. rowelliae*, is most closely related to *Z. iodocarpum* F.Muell., resembling that species in almost all characters, but possessing larger floral parts. The other, *Z. eichleri*, is most closely related to *Z. tesquorum*. A mixture of both of these new species had been segregated by Eichler and Rowell within the CANB collections as the "Interior-North Western form" of *Z. iodocarpum.*

Key to 5-merous *Zygophyllum* species

1 Capsule truncate at apex, with appendages on upper corner of each angle. Petals 10–15 mm long ..... ***Z. apiculatum***

1: Capsule rounded at apex, lacking appendages. Petals less than 10 mm long

2 Leaflets lobed at base on outer side

3 Fruits 5–6 mm long, 1–2 seeds per cell; fruiting pedicel 10–12 mm long [Perth to Karratha] ..... ***Z. lobulatum*** *p.p.*

3: Fruits 8.3–11.5 mm long, 2–5 seeds per cell; fruiting pedicels 12–18 mm long [Lake Eyre region] ..... ***Z. hybridum***

2: Leaflets not lobed at base

4 Leaflets 3-lobed at apex

5 Corolla 5.5–7 mm long; fruit 8–13 mm long, somewhat angled at apex; seeds 2–4 per cell [inland WA from Pilbara to SA] ..... ***Z. kochii***

5: Corolla 4 mm long; fruit 5–6 mm long, rounded at apex; seeds 1–2 per cell [Perth to Karratha] ..... ***Z. lobulatum*** *p.p.*

4: Leaflets entire or emarginate at apex

6 Floral [fruiting] pedicel more than 5 mm long.

7 Flowers white; fruits thin, not glaucous [central Australia] ..... ***Z. tesquorum***

7: Flowers yellow; fruits thick-walled, glaucous [Kalbarri to Karratha area of W.A.] ..... ***Z. retivalve***

6 Floral [fruiting] pedicel less than 5 mm long.

8 Flowers and fruits single at each axil; fruits 6.5–8 mm long, 7.5–9.5 mm wide; style 0.5–0.6 mm long; leaflet apex rounded [inland WA, and central Australia] ..... ***Z. eichleri***

8: Flowers and fruits paired at each axil; fruits 4–6 mm long, 5–7 mm wide; style shorter or longer than 0.5–0.6 mm; leaflet apex rounded or emarginate

9 Leaflet apex emarginate; corolla 2.7–3.7 mm long; style 0.2–0.3 mm long; stigma 5-lobed [common, widespread Nullarbor to New South Wales and into central Australia] ..... ***Z. iodocarpum***

9: Leaflet apex entire or emarginate; corolla 4–4.7 mm long; style 1–1.5 mm long; stigma entire [central Australia] ..... ***Z. rowelliae***

Zygophyllum tesquorum J.M. Black, *Flora of South Australia* 2: 334 (Jun. 1924).

Type citation: Lake Torrens; Far North. - Central Australia.

Lectotype here designated: Anon. [Tate on Horn Expedition] s.n., s.dat. [17.vi.1894], Deering Creek [South Australia] (AD97918157 p.p. - herb. Black, LHS specimen); *isolectotype*: AD96246172 - herb. Tate; *syntypes: Anon. [Tate on Horn Expedition] s.n.*, s.dat. [19.vi.1894], Mulga scrub SW of Mereena [Mereenie Bluff, Northern Territory]

(AD97918157 p.p. – herb. Black, RHS specimen, attributed to S.A.White; AD96246171 – herb. Tate).

Distribution & ecology

Confined to central Australian area with small incursions into S.A. (Deering Hills) and W.A. (Rawlinson Range), and possibly in the Norseman and Queen Victoria Spring areas of W.A. (see Note). Found in disturbed areas, often in calcareous soils with *Acacia kempeana, Triodia longiceps* and *Atalaya hemiglauca.* Flowering July - September.

Typification

There are two specimens in the Black Herbarium, both of which have been used to draw up the protologue. The larger branch represents the Horn Expedition collection from Deering Creek, while the smaller branch is a collection attributed by Black to S.A.White from "SW of Mereena". If White was the collector then it cannot be a Horn Expedition collection since White was not involved with that expedition. On a paper attached to the specimens Black refers to "FLS White" as the "collector of the Mereena specimen", and it is assumed that this is the source of the attribution of the collection to S.A.White.

There is further reference on this paper to the fact that there are "2 specimens in Tate Herb. in folder labelled Horn Exp." implying that both specimens should be attributed to that expedition. When these specimens were located it became quite clear that the two collections in the Black herbarium represent fragments taken from the original collections in the Tate herbarium. These collections both have locality details written by Tate and both would appear to be his own collections made on the Horn Expedition although there is not now any evidence except the locality and Black's comments to substantiate this. A pencilled annotation on the label of the Mereena collection may well be the source of the confusion with respect to the collector. The annotation is actually "Fls white", a distinguishing character for this species. Both of the Tate herbarium specimens have been annotated by Black as *Z. tesquorum*.

There is little difference between the two collections on the sheet in Black's herbarium (both have flowers and fruits) and so the larger fragment with correct collecting information has been designated as the lectotype.

Notes

1. A series of specimens from the Norseman area and from Queen Victoria Spring area appear to represent a disjunct occurrence of *Z. tesquorum*. Specimens are more depauperate, smaller in leaf and flower, and the pedicels closer to *Z. eichleri* in length, but the wing of the filaments, the flower colour and the shape of the stipular bract at each node (2-toothed vs entire) suggests that they are more closely related to *Z. tesquorum* than to *Z. eichleri*. This distribution represents a disjunction from both species.

WESTERN AUSTRALIA: *D.J. Pearson 1728,* 37 km WNW Queen Victoria Spring, Queen Victoria Spring Nature Reserve (PERTH); *G.J.Keighery & J.J. Alford 1059,* 41 km N of Trans Australia railway line on W boundary fence of Kananda Stn (PERTH); *T.E.H. Aplin 1827,* Jimberlana Hill, 8 km NE of Norseman (PERTH).

2. *Z. tesquorum* is very similar in habit to *Z. kochii* and *Z. iodocarpum*. It can be distinguished from the former by its narrower and entire leaflets. The plants are also more delicate, the capsule generally smaller, the petiole subterete and the flowers appear to be white rather than yellow drying white. It can be distinguished from *Z. iodocarpum* by its larger flowers, non-globular capsule and long pedicels in flower and fruit. It may not be distinct from the Western Australian coastal species *Z. retivalve* in any character bar the flower colour although Eichler separated the two on fruit size predominantly. The earlier name, if the two prove to be conspecific, is *Z. tesquorum*.

Selected specimens examined

AUSTRALIA. NORTHERN TERRITORY: *A.C. Beauglehole 22833*, Mt Connor, S.E.side (AD,DNA,MEL); *A.C. Beauglehole 24669*, 7.viii.1967, c. 165 km SW of Alice Springs (CANB); *A.C. Beauglehole 50637*, 17.v.1976, near Chilla Wells Bore, Tanami Desert Wildlife Sanctuary (CANB); *G.W. Carr 2217 & A.C. Beauglehole 45996*, 26.vi.1974, Gosses Bluff (CANB); *G. Chippendale NT2634*, 24.viii.1956, 40.9 mls W Hermannsburg (DNA,CANB); *G. Chippendale NT6505*, 13.viii.1959, 2 mls SW Huckitta HS (CANB,DNA); *Hj. Eichler 22636, 26.viii.1978*, 44 km from Alice Springs, Glen Helen turnoff (AD,CANB,DNA,L); *Hj. Eichler 22638*, 47 km from Glen Helen turnoff, 12 km before Ellery Creek crossing (CANB,MEL); *T. Henshall 190*, 7.v.1974, Victory Downs (CANB,DNA,PAUH); *P.K. Latz 4108*, 23.viii.1976, 4 mls E Wallera Ranch (CANB); *P.K. Latz 5147*, 5.vi.1974, 40 km SE Alice Springs (CANB,MEL,NT); *P.K. Latz 6317*, 16.x.1975, 35 km S Alice Springs (CANB,DNA); *M. Lazarides 5898*, 4.ix.1956, 15.5 mls NW of Lucy creek Stn (CANB); *D.J. Nelson 1752*, 9.ix.1968, Deep Well Rd, 17 mls S Alice Springs (CANB); *D.J. Nelson 2211*, 30.v.1972, 1.7 mls E Corroboree Rock, Ross Hwy (AD,B,CANB,DNA,K,MO,NT,PAUH); *F.C. Vasek 680914-5*, 14.ix.1968, 32 mls W of Alice Springs on Hermannsburg road (CANB).

SOUTH AUSTRALIA: *J.Z. Weber 220*, 1.xi.1966, Mt Davies Rd, c. 145 km W of Musgrave Park Stn and c. 50 km W of Piltady Camp (CANB).

Zygophyllum lobulatum (Benth.)H. Eichler in R.M. Barker, *J. Adelaide Bot. Gard.* 17: 168 (1996).

Basionym: *Zygophyllum iodocarpum* var. *lobulatum* Benth., *Flora Australiensis* 1: 293 (1863).

Type citation: W. Australia. Champion Bay, Oldfield.

Lectotype here designated: Oldfield s.n., s.dat., W. Australia, Champion Bay [Thonunoko] (MEL516551); *isolectotype:* K p.p.

Distribution & ecology

Occurs on the west coast of W.A. from Swan River to Coral Bay. It has been recorded from red sand or loam, sometimes associated with limestone, within *Acacia* shrubland. Flowers July to September.

Typification

The specimen in MEL was seen by Bentham and is annotated as "Zygophyllum lobulatum ferd. Mueller" and as "Z. iodocarpum var?" by Mueller, but bears no annotations by Bentham; it consists of three flowering plants and the leaflets on most leaves are lobed basally. On the other hand, the specimen in K consists of a single flowering plant mounted with a collection from the Elder Exploring Expedition and has been annotated as "Zygophyllum iodocarpum var?" by Bentham. The annotation, var. *lobulatum* Benth., seems to have been made at a later stage, and not by Bentham; only one or two of the older leaflets have the lobed base. Despite the fact that Bentham did not attribute the varietal name "lobulatum" to Mueller, there can be little doubt that it should be because of the annotations on the MEL sheet. Although he did not name it, Mueller also mentioned this particular specimen under *Z. iodocarpum* in his Plants of the Colony of Victoria (1862) as

> "very similar to the species above described [Z. iodocarpum], of which it may only be a variety, differing in having externally a small basal lobe protruding from most of the leaflets and also one or the other terminal teeth, and in producing solitary pedicels about ½ inch long or even longer."

The MEL specimen has been chosen as lectotype for several reasons. It has been annotated with the epithet "lobulatum" clearly attributed to Mueller, it has been seen by Bentham and there is more material than on the K specimen. In addition most leaves have a lobe at the base of each of the leaflets.

Notes

There has to be some doubt as to whether this taxon is deserving of species level. It is very closely related to *Z. kochii* and *Z. retivalve* with which it overlaps in distribution; it would appear to differ only in leaf and flower sizes. The lobe at the base of the leaflet is not always present on all leaves, but is more likely to be observed on larger and older leaves (suggesting a development with age). This characteristic would suggest a relationship to *Z. hybridum* as well, but the fruits in that species are much larger and are elliptic and it is confined to the Oodnadatta region of South Australia. With further collections and field studies it might be more appropriate to treat *Z. kochii, Z. retivalve, Z. lobulatum,* and possibly *Z. hybridum,* at an infraspecific level, but for the moment the species level has been retained.

Z. lobulatum is distinct from *Z iodocarpum* by its longer pedicels, single flowers per axil and possibly by the wing appendages of the stamens and from *Z. tesquorum* by the lobed leaflets and yellow flowers.

Selected specimens examined

AUSTRALIA. WESTERN AUSTRALIA: *R.M. Barker 1028*, 23.viii.1995, Great Northern Hwy, 7.6 km N of Ningham HS turn-off, SW of Paynes Find (AD, 4 dupl.); *R.M. Barker 1216,* 7.ix.1995, NW Coastal Hwy, km S of Overlander Roadhouse (AD); *R.M. Barker 1224,* 7.ix.1995, NW Coastal Hwy, c. 9 km N of Billabong Roadhouse (AD); *Hj. Eichler 23622,* S of Coral Bay (AD, CANB, NSW, PERTH); *Hj. Eichler 23623,* 3.ix.1985, S of Coral Bay (CANB); *Hj. Eichler 23642,* 5.ix.1985, 26.9 km S of Wooramel (AD, CANB, PERTH); *Hj. Eichler 23644,* 5.ix.1985, 17 km S of Overlander Roadhouse (CANB); *Hj. Eichler 23647,* 5.ix.1985, c. 0.5 km N of No. 18 Bore, Hamelin Stn (CANB); *Hj. Eichler 23656,* 9.ix.1985, Along roadside from NW Coastal Hwy to Kalbarri, 1.5 km E of Kalbarri Information Bay (CANB); *Hj. Eichler 23656A,* 9.ix.1985, Along roadside from NW Coastal Hwy to Kalbarri, 1.5 km E of Kalbarri Information Bay (CANB); *D. & N. McFarland s.n.*, 20.viii.1978, Kalbarri N.P., c. 16.5 km SSE of Red Bluff Caravan Park on disused track, 2.5–3 km N of Vermin Fence (CANB); *S. & E. Pignatti 112*, 19.viii.1990, C. 4 km S of Overlander Roadhouse (c. 500 m E of Coastal Hwy) (CANB); *G.L. Throssell s.n,* Sept. 1953, Mendel via Mullewa (PERTH); *D. & B. Bellairs 2181,* 14 km S of Kalbarri (PERTH).

Zygophyllum kochii Tate, *Trans. Royal Soc. S. Australia* 23: 291 (1899).

Type citation: Near Mount Fitton and Trinity Well, *J. Langley.*

Lectotype here designated: J. Langley (herb. M. Koch 469), August 1899, [South Australia] Mt Lyndhurst, near Mt Fitton, also near the Trinity well. sepals 5 petals 5 (these about 2 lines long, those of [Koch] 165 & 332 are smaller!) fruit 5-angled, with narrow membranous almost wing-like angles. 4 seeds in each cell. (AD97918101, herb. Tate); *isolectotype:* AD97904148, herb. J.M. Black; *possible isolectotypes: M. Koch 469*, August 1899, Mt Lyndhurst (K–2 sheets, BM – seen as photographs in Eichler MS); *Probable syntype: M. Koch 469,* September 1899, Mt Lyndhurst. First found by the collector (AD97904149, herb. Tate).

Distribution & ecology

Inland Western Australia from the Pilbara region to northern South Australia. Found in gravelly clay soils in low lying areas in mulga. Flowering July-September.

Typification

In the protologue, Tate attributed the collection of this species to J. Langley and there is one collection in the Tate herbarium which accords with this. This specimen was clearly given to Tate by Koch since all of the collecting details are written by Koch on one of his printed labels but with his name as collector scored through and replaced by "J. Langley" . Koch himself collected the species in the following month and this collection was also given the same number, 469, as the holotype (Koch's numbers are species numbers, not

collecting numbers). The collection has been annotated as "Zygophyllum Kochii, Tate. Oct. 1899" by Koch and formed part of the Tate herbarium and so it is quite possible that it also formed part of the material available to Tate in drawing up the protologue. Because of this possibility the Langley collection has been designated as lectotype rather than holotype. It consists of 7 pieces of plant with both flowers and fruits present. The isolectotype in the Black herbarium consists of 2 fruits and mounted floral parts together with J.M. Black's drawings of them. These were removed from the lectotype sheet and used by J.M. Black to draw up his own description for the Flora of South Australia. The three sheets from K and BM, seen as photographs, bear no indication that they were collected by Langley, but they were collected in August and so they are also possible isolectotypes.

There are almost certainly further sheets in herbaria other than those already cited bearing the *Koch 469* label, but only those collected in August can be considered as isolectotypes.

Notes

Z. kochii is distinctive by its 3-lobed leaflets; its fruits can be erect or drooping on long pedicels and they are less rounded than in other taxa of this complex, being closer to oblong rather than elliptic in shape. There is sometimes the suggestion of a small apiculum (similar to that in *Z. apiculatum* fruits) at the upper outer edge of each of the angles of the fruit and the 5 "ribs" of the fruit can sometimes appear to be very narrowly winged.

Specimens examined

AUSTRALIA. WESTERN AUSTRALIA: *R.M. Barker 1054*, 25.viii.1995, km N of Mt Magnet (AD); *A.C. Beauglehole 59625 & E.G. Errey 3325*, 14.ix.1978, 6 km S of Agnew, Leonora Rd (CANB); *C.D. Boomsma 618*, 6.viii.1980, 2 km SW of Paraburdoo (AD); *R.J. Cranfield 5541*, 9.viii.1986, Beefwood Well, Yoothapina Stn (CANB); *G. Howard [D. Symon 5815]*, 4.vi.1968, N of Lake Carnegie, 64.4 km W of Carnegie HS (AD); *C. Teichert 4*, ix.1948, NE part of Kennedy Range, Gascoyne Area (MEL); *P.G. Wilson 8407*, 29.vii.1969, 82 km E of Carnarvon near Doorawarrah HS (CANB); *P.G. Wilson 11987*, 6.ix.1984, c. 80 km W of Carnegie on road to Wiluna (CANB, PERTH).

SOUTH AUSTRALIA: *R. Bates 14736*, 11.vii.1988, Mt Fitton Talc Mine (AD); *R. Bates s.n.*, 30.vii.1989, Billeroo Stn (AD98946188); *G.H. Bell 1349*, 17.ix.1987, Slopes of hill on N side of Nent Oura Research Unit, Mt Freeling Stn (AD); *J. Carrick 1812*, 15.viii.1968, c. 22.5 km ENE of Lyndhurst (AD); *B. Copley 3654*, 7.ix.1971, c. 1 km W of Shearing Shed at Wearing Ruins north of Wirrealpa (AD); *Hj. Eichler 18645*, 8.iv.1966, c. 3 km W of Mt Lyndhurst HS (AD); *T.R.N. Lothian 3509*, 14.xi.1964, c. 1.6 km W of Landmark Tank, near Terminaton Well (AD); *R. Swinbourne 155*, 7.ix.1968, near Andamooka Opal Field airstrip (AD).

Zygophyllum hybridum Tate, *Trans. Royal Soc. S. Australia* 23: 291 (1899), p.p. (excluding the Elder Expedition collection from Cootanoorina); Koch, *Trans. Royal Soc. S. Australia* 24: 81 (1900); J.M. Black, *Trans. Royal Soc. S. Australia* 41: 643 (1917); Black, *Fl. S. Austral.* 334 (1924); 2nd ed. 489 (1948); Ising, *Trans. Royal Soc. S. Australia* 81: 168 (1958); Eichler in Jessop & Toelken (eds) *Fl. S. Austral.* 2: 732 (1986).

Type citation: Mount Lyndhurst Run, Far North; "grows on loose loamy soil, hence is seen at its best only in very wet seasons" (Mr M.Koch); also Cootanoorina (Elder Exped. as *Z. glaucescens*, var.).

Lectotype here designated: *M. Koch 332*, August 1899, Mount Lyndhurst Run, Far North {South Australia] (AD s.n.); *isolectotypes*: BM, K, MEL95283, AD97904147; *syntypes: M. Koch 332*, Sept. 1898, Mount Lyndhurst (AD96851098); *M. Koch 332*, Oct. 1898, Mount Lyndhurst (MEL95284); *M. Koch 332*, July 1899, Mount Lyndhurst (AD96851103); Excluded syntype (= *Z. iodocarpum* F.Muell.): *R. Helms (Elder Exploring Expedition) s.n.*, 7 May 1891, Cootanoorina (NSW145337; *possible syntype:* NSW145338).

Distribution & ecology

Z. hybridum is confined to the Oodnadatta–Maree region of South Australia and is listed on the Rare and Threatened Australian Plant (ROTAP) list. It is recorded from clay soil of gibber plains, but only appears in very wet years. Flowering May to August.

Typification

In the protologue, Tate identified a Koch collection from Mt Lyndhurst and one from Cootanoorina (Elder Expedition as *Z. glaucescens* var.) as *Z. hybridum*. Neither collection was identified any further. There are a number of Koch collections bearing the number 332 but this is a "species number" rather than a collection number, since the collections all bear different dates.

The majority of specimens bearing this number were collected in August 1899 (BM, K, MEL95283, AD97904147 and AD s.n.) and have been annotated by Koch as "Zygophyllum hybridum Tate Oct. 1899, new species...first found by the collector". The only one of these to have possibly been annotated by Tate is the sheet AD s.n. which bears the annotation "Zygophyllum sp." by Koch, followed by the annotation "hybridum" in a different hand and a different pen. This specimen has been designated as the lectotype.

The collection from Cootanoorina from the Elder Expedition, referred to by Tate and housed in NSW, would appear to be a collection of *Z. iodocarpum* F.Muell. It bears the annotation "Z. glaucescens FvM., small-flowered var." but has no indication on it that it was seen by Tate. Three duplicates of this collection, also housed in NSW, do not bear the annotation.

Notes

A very distinctive species due to the shape of the leaves. *Z. hybridum* is most closely related to *Z. kochii* from which it differs by the entire rather than 3-lobed apex of the leaflet and by the presence of a lobe at the base of the outer side of each leaflet. Fruits have been recorded as erect in this species, as they have in *Z. kochii* and *Z. lobulatum,* but this character needs investigation in the field. Both *Z. kochii* and *Z. hybridum* have 4–5 ovules per cell while *Z. lobulatum* has only 1–2 ovules per cell. Seed of *Z. kochii* is black and shiny.

Specimens examined

AUSTRALIA. SOUTH AUSTRALIA: *F.J. Badman 6987*, 10.viii.1993, Allandale Stn, 2 km WSW of Mt Arthur (AD); *M.E. Ballingall 2254*, 13.ix.1986, Nilpinna Stn, S of Oodnadatta on W side of main track (AD); *R.J.-P. Davies 676*, 21.viii.1983, Mt Barry Pastoral Lease, on SE side of Oodnadatta-Mt Barry Rd between Camel Creek and Aloorina Creek crossings, (AD); *T.S. Henshall 3221,* Allandale Stn, 36 km SW of Oodnadatta, (CANB,NT); *E.H. Ising s.n.,* 7.ix.1931, Oodnadatta (AD966031683); *E.H. Ising 3926*, 30.vii.1952, Fish Hole, 20 miles S of Oodnadatta (AD); *S.A. White s.n.*, 17.ix.1916, Mt Hopeless (AD97904146).

Zygophyllum retivalve Domin, *Bibliotheca Botanica* 89: 281 (Oct. 1926).

Type citation: Nordwest-Australien: zwischen Ashburton und De Gray River, *E. Clement.*

Lectotype here designated: E. Clement s.n., s.dat., Between the Ashburton and De Gray rivers [Western Australia] (PR); *isolectotype*: K. Both specimens seen as photographs in Eichler MS.

Zygophyllum sp. Karratha (J.S. Beard 3508), W.A. Herbarium Census.

Zygophyllum sp. 1 (Karratha, Coral Bay, H. Eichler 23621), Briggs & Leigh, *Rare or Threatened Australian Plants* 188 (1995).

Distribution & ecology

Occurs in Kalbarri to Karratha area of W.A. Recorded from limestones rises and from flat stony clay. Flowers July-September.

Typification

The lectotype specimen consists of 4 plants with flowers and fruits. The accompanying label has been annotated by Domin as "Zygophyllum n. sp. filaments without wings/ not fruticulosum/ neither billardieri, which has truncate capsules, not Kochii (leaflets entire)", whereas the equivalent specimen in K has merely been labelled as "Zygophyllum n. sp."

Notes

For discussion of this species see Barker 1996. *Z. retivalve* does not appear to be markedly distinct from *Z. tesquorum* (q.v.).

Specimens examined

WESTERN AUSTRALIA: *R.M. Barker 1222*, 7.ix.1995, NW Coastal Hwy, c. 34 km S of Overlander Roadhouse (AD); *Hj. Eichler 23621*, S of Coral Bay (AD, CANB, HO, L, MO, PERTH, NSW); *P. Glennon 62*, Peg's Creek, Karratha (PERTH); *D.W. Goodall 1162*, 2 km W of Learmonth (PERTH); *N.S. Lander 1367, B.A. Fuhrer & P.S. Short*, E side of Kennedy Range (MEL1556210).

Zygophyllum eichleri R.M. Barker, sp. nov.

Species nova proxima *Z. tesquoro* sed differt pedicellis brevioribus et floribus flavis.

Holotype: *Hj. Eichler 23578*, 19.viii.1985, 91.4 km N of Kumarina Mine, Western Australia (AD); isotypes: CANB, MEL, NSW, PERTH.

Z. iodocarpum auct. non F. Muell., reference to specimens from NT and WA which have been referred here in the past.

Decumbent or prostrate, spreading glabrous annual *herb*, to 20 cm high, wider than high. *Leaves* petiolate; leaflets succulent, obovate, sometimes broadly so, 5.5–15 mm long, 2.8–8.5 mm wide, continuous with petiole and not articulated at base, rounded to obtuse at the apex, sometimes with fragile acumen; petiole 5–15 mm long, narrowly winged. *Flowers* single at each node. *Pedicel* 2–3.5 mm long in flower, erect, 2–6.5 mm long in fruit. *Sepals* 5, 2–3.5 mm long. *Petals* 5, yellow, aging white, obovate to spathulate, 3.7–5.3 mm long, longer than sepals. *Stamens* 10; filaments 1.7–2.2 mm long, winged basally, wing apex widened and toothed; anthers 0.7–0.9 mm long. *Disc* 5-lobed, entire, sinuate, succulent, papillose on margin. *Ovary* 5-angled, 5-celled, glabrous; stigma minute, 5-lobed. *Capsule* pendent, transversely broadly elliptic, 6–8 mm long, 5-angled, 5-celled, rounded at apex, with 1 seed per cell; *seeds* smooth, pale to dark brown, not markedly shiny; fruiting style 0.5–0.6 mm long. Fig. 1 A–F.

Distribution & ecology

Central Australia from Alice Springs region through to Oakover River and Carnegie region of Western Australia and Musgrave and Mann Ranges of South Australia. Occurs in rocky areas, often in red sand amongst scattered mulga, or in calcareous areas with *Eucalyptus transcontinentalis*. Flowering June-September.

Note

It would appear that that the *Zygophyllum iodocarpum/tesquorum* group of species had not been studied intensively by Eichler. He had annotated the Carolin specimen (*Carolin*

5224) as "Zygophyllum sp. nov. aff. Z. iodocarpum" in 1967 and his own collection (*Eichler 23578*) is also labelled as Z. "aff iodocarpum" as are the collections *George 8764* and *Donner 4413*. *Wilson 2556* is labelled as Z. "cf. iodocarpum". However the rest of the collections were all treated as *Z. iodocarpum* F.Muell. Some specimens had been segregated, probably by Alison Rowell rather than Eichler, as the "Interior-North Western form" of *Z. iodocarpum*, but this folder consisted of a mixture of *Z. eichleri* and *Z. rowelliae* as recognised here.

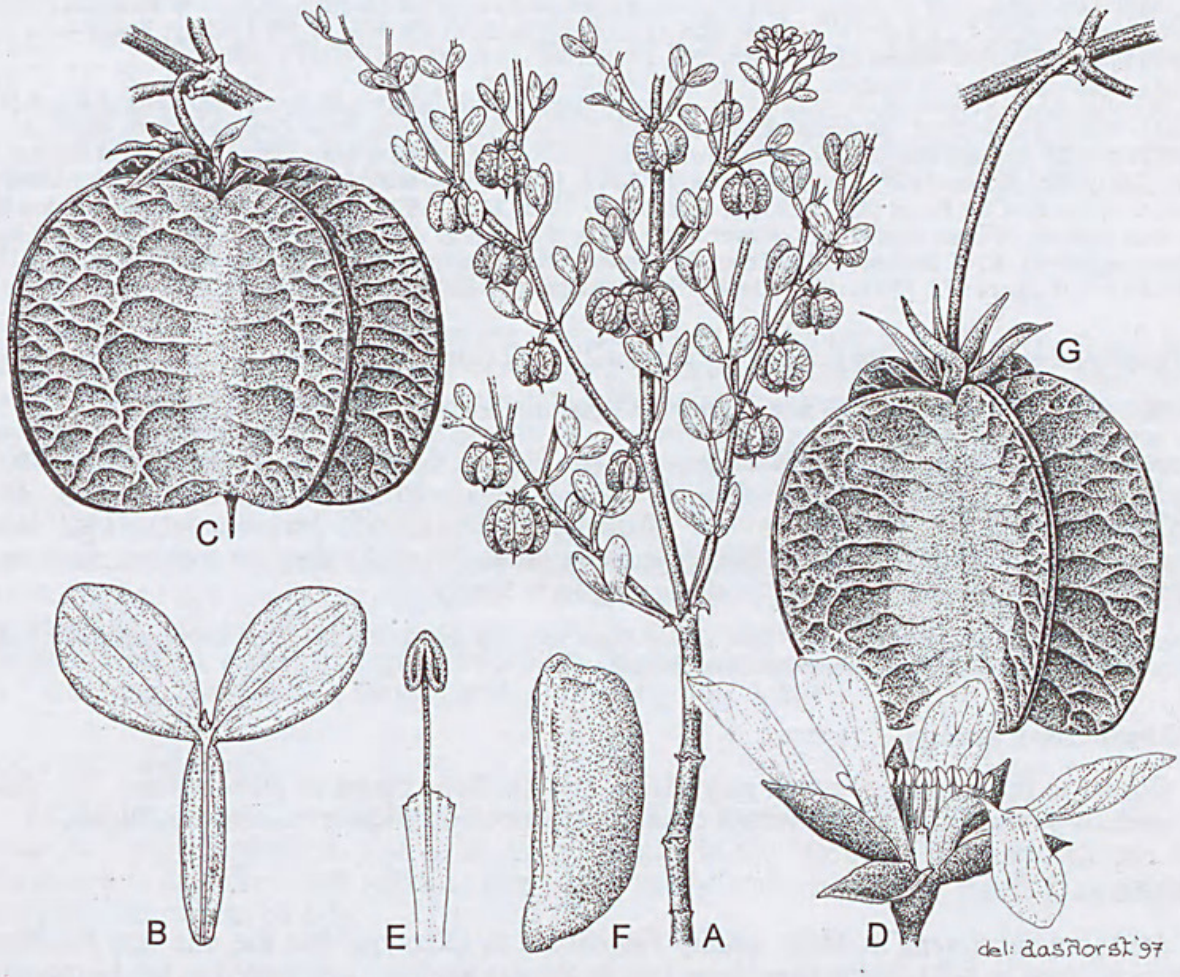

Fig. 1. ***Zygophyllum eichleri*** R.M. Barker. **A,** habit ×0·75; **B,** leaf ×3; **C,** fruit ×5; **D,** flower ×5; **E,** stamen ×14; **F,** seed ×14. (**A–F**, *M. Lazarides 5898*, CANB); ***Z. tesquorum*** J.M. Black. **G,** fruit with pedicel ×5. (**G,** *F.C. Vasek 680914-5*, CANB).

Distinguishing features and relationships

Z. eichleri is clearly distinguishable from *Z. tesquorum* by the length of the pedicel in both flower and fruit. In addition, leaves tend to be wider and the filament wing is toothed at the apex. The flower colour is apparently also different since *Z. eichleri* has yellow flowers aging white whereas records of *Z. tesquorum* are of white flowers only. The two taxa do cohabit. The shape of the fruit and the length of the pedicel in *Z. eichleri* are more like those of *Z. iodocarpum* and *Z. rowelliae*, possibly accounting for the confusion with *Z. iodocarpum* previously. Both of these species can be readily distinguished by the paired fruit at each node while they are single in *Z. eichleri*. *Z. iodocarpum* differs also by its much smaller flowers (petals 2.7–3.7 mm long), shorter styles (0.2–0.4 mm long) and the

leaflet apex often being emarginate. *Z. rowelliae* can be distinguished by its longer style (1–1.5 mm long).

Specimens examined

AUSTRALIA. NORTHERN TERRITORY: *R.C. Carolin 5224*, 17.viii.1966, c. 15 miles E of Curtin Springs (AD, SYD); *N.N. Donner 4413*, 24.viii.1973, Mt Olga, W side at Docker River Rd junction (AD); *Hj. Eichler 22636*, 44 km W of Alice Springs (turnoff to Glen Helen) (CANB, DNA); *P.K. Latz 6317*, 35 km S of Alice Springs (CANB, DNA); *M. Lazarides 5898*, 15.5 mls NW of Lucy Creek Stn (CANB, DNA).

SOUTH AUSTRALIA: *W.R. Barker 3169*, C. 6 km by vehicle ENE of Mt Moulden on track to Kuntjana (AD); *N.N. Donner 6478*, C. 1 km SW of Krewinkel Hill, which is c. 75 km NW of Mt Lindsay, beside road to Pipalyatjara (AD); *P.G. Wilson 2556*, 10.viii.1962, Foot of Mt Woodroffe (AD, CANB, AK).

WESTERN AUSTRALIA: *A.M. Ashby 3571 [Stan Gratte's party]*, 2-14.viii.1970, Carnegie Stn (AD); *R.M. Barker 1081*, 28.viii.1995, Newman-Marble Bar Rd, 2.1 km from turnoff from Great Northern Hwy (AD, PERTH); *R.M. Barker 1086*, 28.viii.1995, Newman-Marble Bar Rd, 27.2 km from turnoff from Great Northern Hwy (AD); *R.M. Barker 1120*, 30.viii.1995, Karijini NP, c. 11 km along Mt Bruce Road from Park Visitor Centre end, c. 11 km E of Mt Bruce (AD, PERTH); *W.R. Barker 2075*, 24.viii.1977, Upper Carawine Gorge, c. 1 km N of road crossing of main channel of Oakover River (AD); *A.S. George 4609*, 2.vii.1963, 9 miles E of The Gap (Rutter's Grave), E of Laverton (PERTH); *A.S. George 8764*, 18.vii.1967, Wingelinna Mining Camp (AD, PERTH); *N.H. Speck 973*, 15.vii.1958, 10 miles S of Berringarra (CANB).

Zygophyllum iodocarpum F.Muell., *Linnaea* 25: 372 (Feb. 1853).

Type citation: In pascuis collinis lapidosis subsalinis prope Cudnaka et Wulpena.

Lectotype here designated: *F.Mueller s.n.*, Oct. [18]51, Cudnaka & Akava (MEL95286); *isolectotypes: F.Mueller s.n.*, s.dat., Akava [Arkaba] (MEL110970, herb.Sonder); *Dr M[ueller] s.n.*, Oct. [18]51, Akava [Arkaba] (MEL110965, herb.Sonder). This last specimen annotated "Petala 5 oblongo-cuneata lutea ??am X ejusdem voloris. Germen viresis" as well as with the name "iodocarpum ferd. Muell".

Zygophyllum hybridum auct. non Tate: Tate, *Trans. Royal Soc. S. Australia* 23: 291 (Dec. 1899), p.p. (only with respect to the Elder Expedition collection from Cootanoorina).

Distribution & ecology

Occurs in open areas, often on clay plains, alluvial flood plains or gibber plains, but also frequently found in bare areas within chenopod shrublands. Flowering April to August.

Typification

All three specimens in MEL qualify for choice as lectotype, but the one that Mueller chose to keep in MEL rather than those sent to Sonder has been designated as the lectotype. It has Mueller's handwritten notes attached to it and these bear more relationship to the protologue than the other two collections.

Distinguishing characters

Z. iodocarpum is usually easily recognised by the paired, shortly pendent, wider than high, often purple-tinged, 5-angled fruits with a very short 5-lobed style. Fig. 2G, H.

Representative specimens examined:

AUSTRALIA. NEW SOUTH WALES: *W.R. Barker 2631*, Barrier Range, c. 1/2 km by road S of Caloola Ck crossing by main Broken Hill-Tibooburra road (AD, dupl.).

NORTHERN TERRITORY: *T.S. Henshall 581*, Andado Stn (CANB, DNA, MO, NT, PAUH).

QUEENSLAND: *R.W. Purdie 537D*, Flat plain, 18 km NE of Yaralla (BRI).

SOUTH AUSTRALIA: *F.J. Badman 1427,* Gregory Creek, 75 km W of Marree (AD, CBG, MEL); *G.H. Bell 1034,* Yalpara Conservation Pk, NE corner, near entrance gate (AD, CBG, RSA).

VICTORIA: *J.H. Willis s.n.,* Boundary Point, extreme NW corner of Victoria (MEL95289).

WESTERN AUSTRALIA: *A.S. George 11873,* c. 47 km NNW of Cocklebiddy, Nullarbor Plain (PERTH).

Zygophyllum rowelliae R.M. Barker, sp. nov.

Species nova proxima *Z. iodocarpo* sed differt floribus maioribus, stylo longioro et indivisis stigmate.

Holotype: W.R. Barker 6016, 26.viii.1989, South Australia, Arckaringa Hills; c. 9 km by road E of turnoff into Arckaringa HS, then c. 0.9 km N along track and fenceline from gate. (27° 54' S, 134° 49'E). Common. Along creekline. *Acacia aneura* open woodland over *Eremophila* and *Cassia* spp. over herbs, small bushes and grasses over siliceous gravel over red-brown sandy loam. Dark green succulent plant. Petals deepish yellow, turning white after anthesis. Anthers deepish yellow. Material off several plants. (AD99103218); *isotypes:* CANB, DNA.

Z. iodocarpum auct. non F. Muell.; many authors, including H. Eichler in *Fl. S. Austral.* 2: 733 (1986) p.p. (only with respect to collections with styles 1–1.3 mm long and entire stigmas).

Initially erect, becoming decumbent and spreading, glabrous, annual, *herb*, to 25 cm high, wider than high. *Leaves* petiolate; leaflets succulent, obliquely obovate, 6–25 mm long, 2.5–14 mm wide, appearing articulate with petiole by the constriction of the widened petiole at its apex, rounded or emarginate at the apex; petiole 3.5–12 mm long, subterete or with narrow wing. *Flowers* paired at each node. *Pedicel* 1–3 mm long in flower, erect, 3–5 mm long in fruit. *Sepals* 5, c. 3 mm long. *Petals* 5, yellow, obovate, 4–4.7 mm long, longer than sepals. *Stamens* 10; filaments 2–2.4 mm long, winged at base, wing oblong, erose at apex; anthers 0.9–1.1 mm long. *Disc* 5-lobed, sinuate; lobes joined, succulent, papillose on apex. *Ovary* not angled or 5-angled, 5-celled, glabrous; style 1–1.3 mm long; stigma subcapitate, not lobed. *Capsule* pendent, transversely broadly elliptic, 4–5 mm long, 5-angled, 5-celled, rounded at apex, with 1(-2) seeds per cell; seeds minutely verrucose, 2.5–3.5 mm long, black, shiny; fruiting style 1 mm long. Fig. 2 A–F.

Distribution & ecology

Found in an area bounded by Noccundra in S.W. Queensland, Coober Pedy in South Australia and Ooraminna, just S of Alice Springs in the Northern Territory. Occurs in breakaways and dissected regions, often in gravelly soils. Flowering April to October, probably dependent on rain.

Notes

Z. rowelliae is very closely related to *Z. iodocarpum* and it may well represent an outcrossing variant. It can be distinguished from *Z. iodocarpum* by its somewhat larger flowers and the longer style with undivided stigma, visible in both flowers and fruits. None of the specimens seen had the red-purple blush so commonly associated with the fruits and branches of *Z. iodocarpum* but this character needs to be confirmed with field study. Other characters by which it differs are the tendency to have a subterete petiole and the paired flowers often being at different stages of development.

Etymology

Named after Alison Rowell, employed on ABRS funding, to assist Hansjoerg Eichler to work on *Zygophyllum*. Many of the notes on *Zygophyllum* within the Eichler manuscripts were made by her.

Specimens examined

AUSTRALIA. NORTHERN TERRITORY: *P.K. Latz 13420,* Ooraminna Range, (DNA,MEL); *P.K. Latz 6874,* Beddome Range, New Crown Stn (CANB,NT); *J.H. Willis s.n.*, 17.vii.1966, vicinity of Heavitree Gap camping area and Mt Gillen, c. 4 miles SW of Alice Springs (MEL95288).

SOUTH AUSTRALIA: *F.J. Badman 1055,* 23.v.1984, Evelyn Creek, 3 km E of Copper Hills H.S. (AD,CBG,MEL); *W.R. Barker 5950*, 24.viii.1989, Copper Hill Stn, c. 1.5 km directly E of HS (AD); *R. Bates 18861*, 6.vii.1989, hills N of Marla town (AD); *A.C. Beauglehole 25361*, 26.vi.1968, 56 miles N of Coober Pedy (AD); *P. Copley 921*, 15.viii.1984, Coober Pedy "Breakaway" c. 32 km NW of Coober Pedy, c. 2½ km NE of Shell Patch Bore (AD); *N.N. Donner 6684*, 14.ix.1978, c. 11 km by road SSW of Hawks Nest Well and c. 18.5 km by road N of Wintinna HS (AD,CANB); *E.H. Ising s.n.*, 3.viii.1955, Evelyn Downs (AD966150221); *E.H. Ising s.n.*, 2.viii.1955, Evelyn Downs (AD966150255); *E.H. Ising 1173 & R.H. Quin,* 30.vii.1920, Coober Pedy (AD); *R.H. Kuchel 632A,*4.viii.1963, c. 70 km W of Oodnadatta (AD,CANB); *T.R.N. Lothian 4365*, 9.vii.1968, C. 3 km N of Mt Willoughby HS (AD); *A. Robinson for NPWS 2683,* 25.vi.1989, Evelyn Creek on Copper Hills Stn, 10 km E of Mt Willoughby HS on Cadney Park to Oodnadatta road (AD).

QUEENSLAND: *D.E. Boyland 3128,* 13.vii.1971, 38.4 km SSE of Noccundra (BRI,MEL).

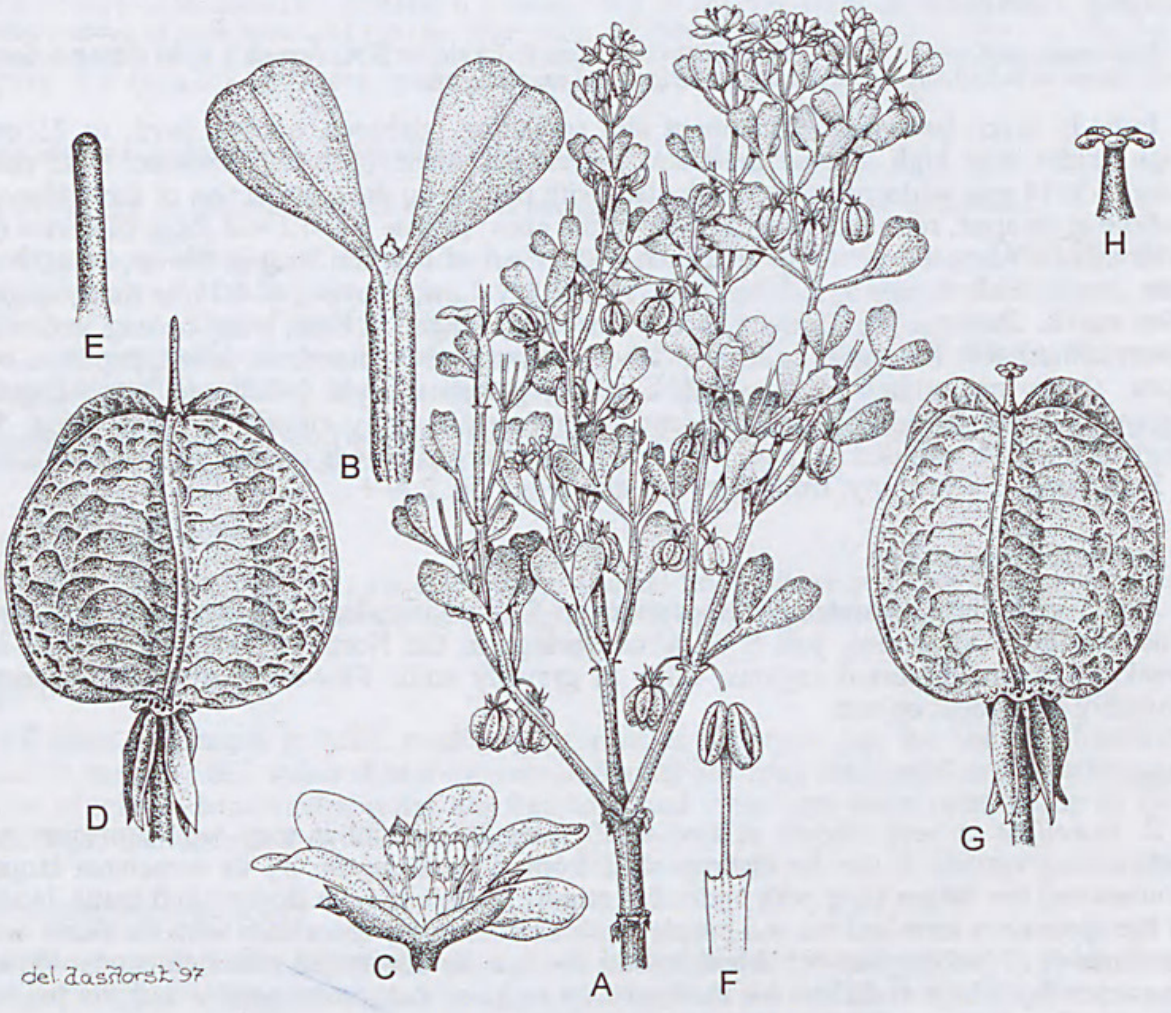

Fig. 2. ***Zygophyllum rowelliae*** R.M. Barker. **A,** habit ×0·75; **B,** leaf ×2; **C,** flower ×4; **D,** fruit ×7; **E,** style ×20; **F,** stamen ×14. (**A–F**, *W.R. Barker 5950*, AD); ***Z. iodocarpum*** F. Muell. **G,** fruit ×6; **H,** style ×20. (**G, H,** *L.D. Williams 10479*, AD).

The 4–merous species of Zygophyllum with winged fruits

The following key applies to all of those species of *Zygophyllum* in Australia with fruits with 4 vertical wings. These fruits are either dispersed entire without breaking up or

dispersed as 4 single-winged segments. Unlike other species of *Zygophyllum,* where it is the seeds which are dispersed, in this case the endocarp and exocarp do not separate and the dispersal unit is the entire 4-winged fruit or 4 single-winged, usually 1-seeded, fruitlets.

Within this group there are three new taxa. Two of these, *Z. reticulatum* and *Z. aurantiacum* ssp. *simplicifolium* were recognised by Eichler but they required further study; the last, *Z. halophilum*, was recognised subsequently by the author.

1 Petals less than 5.5 mm long, less than or just exceeding the calyx
  2 Fruits dispersed as whole, not separating into winged fruitlets
    3 Dried fruits with very close subparallel venation on wings ..... ***Z. eremaeum***
    3: Dried fruits with widely spaced reticulate venation on wings ..... ***Z. reticulatum*** p.p.
  2: Fruits breaking into 4 single-winged fruitlets for dispersal
    4 Petals usually shorter than the sepals; style 0.2–0.4 mm long; disc lobes oblong [fruits yellow-green, ?not developing reddish tinge; salt lake margins c. north of Great Eastern Hwy between Southern Cross and Coolgardie, at least as far north as Agnew and Meekatharra] ..... ***Z. tetrapterum***
    4: Petals longer than the sepals; style 0.6 mm long; disc lobes semicircular [Fruits green, developing red-purple coloration; salt lake margins, Southern Cross to Scaddan and east along Eyre Hwy, W.A., Serpentine Lakes, S.A.] ..... ***Z. halophilum***
1: Petals more than 5.5 mm long, exceeding the calyx; style usually more than 1.5 mm long
  5 Leaflets distinctly articulate with petiole [fruits with widely spaced reticulate venation on wings; coastal areas of W.A.] ..... ***Z. fruticulosum***
  5: Leaflets not articulate with petiole
    6 Fruits not separating into fruitlets, with widely spaced reticulate venation on wings when dry ..... ***Z. reticulatum*** p.p.
    6: Fruits separating into fruitlets, with closely spaced more or less parallel venation on wings when dry
      7 Leaves lacking either petiole or leaflets, subterete
        8 Leaves sessile or subsessile, apparently in whorls of 4 at each node ..... ***Z. aurantiacum*** ssp. ***verticillatum***
        8: Leaves simple, lacking leaflets or only very shortly lobed at apex, paired at each node ..... ***Z. aurantiacum*** ssp. ***simplicifolium***
      7: Leaves with distinct petioles and leaflets, flat
        9 Leaflets narrow-oblong to linear, about as long as the linear petiole ..... ***Z. aurantiacum*** ssp. ***aurantiacum***
        9: Leaflets broad, much shorter than the cuneate petiole into which they are gradually narrowed ..... ***Z. aurantiacum*** ssp. ***cuneatum***

Zygophyllum halophilum R.M. Barker, sp. nov.

Species nova *Z. tetraptero* proxima sed differt stylibus longioribus, petalis sepalis longioribus et nectario semicirculari.

Holotype: *R.M. Barker 1269*, 14.ix.1995, Western Australia, Coolgardie Esperance Hwy, 13.5 km NW of Norseman by road. Common. Edge of salt lake with samphire. Small erect or decumbent herb with reddish stems below. Leaves non-articulate, Y-shaped, fleshy. Flowers yellow, just exceeding sepals, turning white. Fruits 4-winged, green, pendent, often with reddish flush. (AD); *isotypes:* PERTH, CANB – yet to be distributed.

Z. tetrapterum auct. non Hj. Eichler ex R.M. Barker: R.M. Barker, *J.Adelaide Bot. Gard.* 17: 164 (1996) p.p. (only with respect to *Cranfield s.n.* collection from Bullfinch).

Decumbent, spreading, glabrous, perennial *shrub,* 12–20 cm high, 20–30 cm wide; often with reddish foliage. *Leaves* petiolate; leaflets succulent, oblong, 4–17mm long, 1–2.5 mm wide, continuous with petiole, obtuse-rounded at the apex; petiole 4.5–15 mm long, flattened, similar width to leaflets. *Flowers* single at each node. *Pedicel* 3–4 mm long in flower, erect, 4.5–6 mm long in fruit. *Sepals* 2.3–2.8 mm long. *Petals* yellow, 3–3.7 mm long, longer than sepals. *Stamens* 8; filaments gradually dilated to base, without appendages; anthers 0.5–0.7 mm long. *Disc* 4-lobed; lobes free, semicircular, succulent,

papillose on margin. *Ovary* 4-winged, 4-celled, glabrous, often moderately papillose; style 0.5–0.7 mm long; stigma minute, 4-lobed. *Fruit* 4-winged, pendent, cordate, elliptic with deeply emarginate apex, 7–10 mm long, often purplish in colour, breaking into four 1-celled fruitlets, rounded at apex, with 1 seed per cell; seeds 3.4–3.6 mm long, pale brown, elliptic, finely pitted; fruiting style 0.5–0.7 mm long. Fig. 3 A–D.

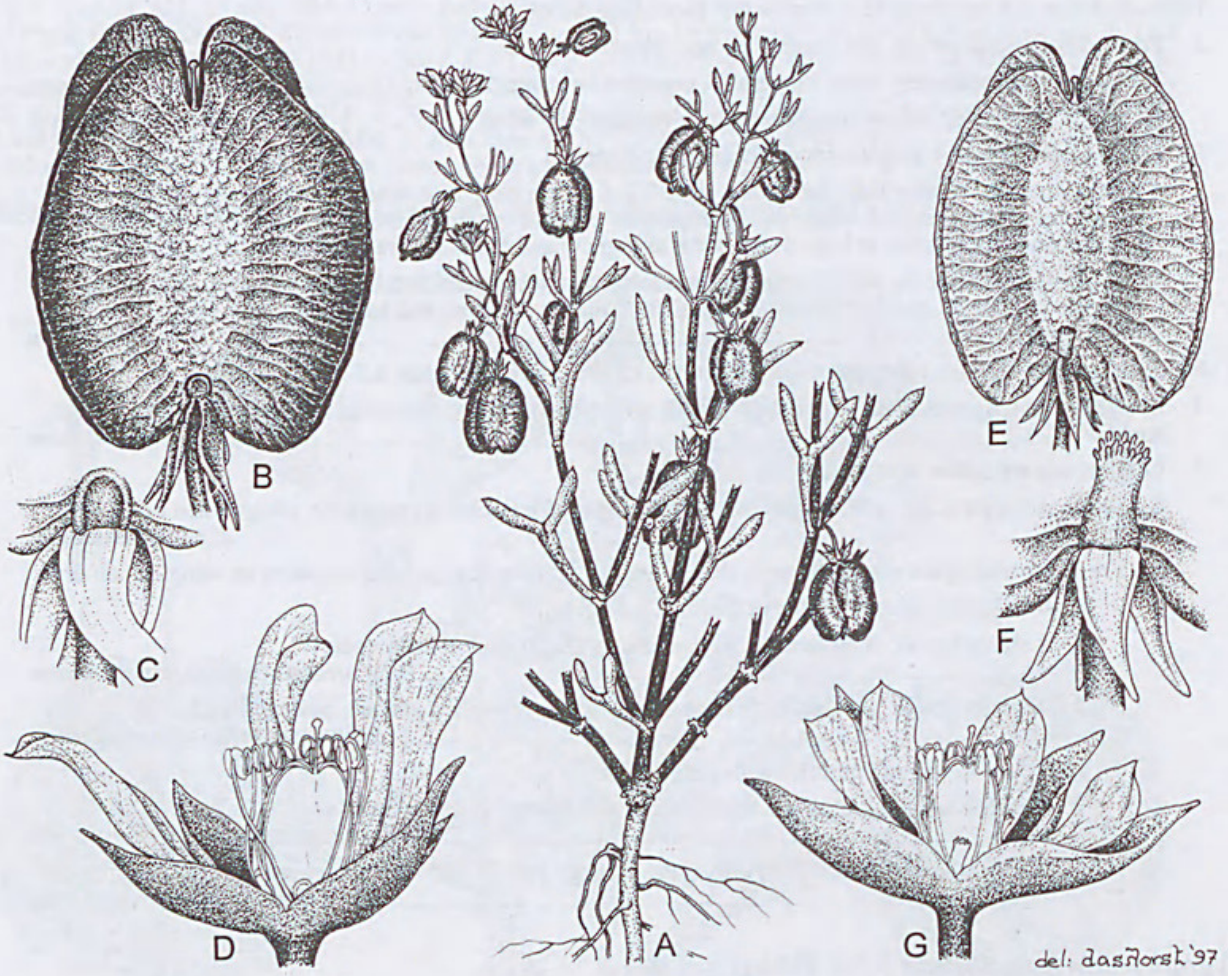

Fig. 3. ***Zygophyllum halophilum*** R.M. Barker. **A,** habit ×0.75; **B,** fruit ×6; **C,** gland ×20; **D,** opened flower ×10 showing petals longer than sepals (**A–D,** *R.M. Barker 1269*); ***Z. tetrapterum*** H. Eichler ex R.M. Barker **E,** fruit ×3.5; disc ×14; **F,** opened flower ×10; **G,** showing petals shorter than sepals (**E–G,** *R.M. Barker 1052*).

Distribution & ecology

Known by collections from the Great Eastern Highway and Coolgardie Esperance Highway between Southern Cross and Scaddan and along the Eyre Highway as far as Balladonia in Western Australia, with outlier collections from Peak Charles and also a single record from Serpentine Lakes in South Australia. It is likely however to occur in the salt lakes throughout these areas. Occurs in or on edges of salt lakes, often with samphires. Flowers August to October.

Notes

Although they are obviously very closely related, *Z. halophilum* can be distinguished from *Z. tetrapterum* H. Eichler ex R.M. Barker by a number of characters,. The semi-circular rather than oblong disc, longer style length and petals longer than the sepals all

serve to distinguish the two taxa. In addition, although further field observations are required, this species may have the capacity to become woody and perennial, and it is possible that the fruits of this species assume a reddish-purple tinge whereas those of *Z. tetrapterum* do not.

The distributions of *Z. tetrapterum* and *Z. halophilum* are distinct except for overlap in the Southern Cross area. The collection *Barker 1240*, which is a mixture of the two species in this area of overlap, indicates that petal length and disc shape differences between the two species are maintained, although the differences in length of the styles in the two taxa is not really distinct. It is also from this collection that the very marked difference in development of reddish colour in the fruit of *Z. halophilum* compared to its absence in *Z. tetrapterum* was first noted; the rest of the herbarium collections would seem to support this but field observations are required. Because of the maintenance of these differences in an area of overlap the two have been treated as species rather than at an infraspecific level.

Specimens examined

AUSTRALIA. WESTERN AUSTRALIA: *R.M. Barker 1240 p.p.*, 13.ix.1995, Great Eastern Hwy, eastern outskirts of Southern Cross (AD); *R.M. Barker 1275*, 15.ix.1995, Eyre Hwy, 36 km E of Norseman (AD); *M.A. Burgman 3680,* 14 km due south of Peak Charles, 9.54 km S of Peak Charles Road on Fields Road (PERTH); *R.J. Cranfield s.n.*, Bullfinch (PERTH); *Hj.Eichler21250bis*, 13.ix.1971, At the edge of a salt lake immediately NW of Norseman (CANB); *Hj.Eichler21288B,* 14.ix.1971, c. 84 km by road from Norseman towards Balladonia along the Eyre Hwy (AD, CANB); *Hj.Eichler22964*, 8.ix.1982, E edge of Lake Cowan, c. 1 km W of Norseman, just E of airport runway (CANB, PERTH); *Hj.Eichler22968*, 8.ix.1982, At the E end of Lake Cowan, c 3 km N of Norseman at the W side of Eyre Hwy (CANB, PERTH); *Hj.Eichler22970,* 8.ix.1982, SW of Lake Lefroy, c. 6 km N of Widgiemooltha, at the edge of the salt lake E of Eyre Hwy (CANB, MEL, PERTH); *Hj.Eichler23151*, 5.x.1982, C. 3 km N of Norseman at the W side of Eyre Hwy (CANB); *Hj.Eichler23153*, 6.x.1982, C. 5 km NNW of Norseman, near the beginning of the causeway through Lake Cowan (CANB); *P. van der Moezel 132,* 21 km NE of Scaddan (PERTH); *K. Newbey 5170,* Lake Bryde Reserve (PERTH).

SOUTH AUSTRALIA: *D.E. Symon 012575,* 25.viii.1980, Connie Sue Hwy, adjacent to Serpentine Lakes (AD, B, CANB).

Zygophyllum reticulatum H. Eichler ex R.M. Barker, sp. nov.

Species nova proxima *Z. fruticuloso* sed differt foliolis non articulatis.

Holotype: R.M. Barker 1260, 14.ix.1995, Western Australia, Boulder-Kambalda Rd, 16.8 km from Boulder P.O. (AD); *isotypes:* 4 to be distributed.

Glabrous, annual *herbs*, 25–40 cm high and 30–40 cm wide or *shrubs,* climbing or sprawling in other vegetation and up to 2 m high. *Leaves* petiolate; leaflets succulent, narrowly oblong, 4.5–12(-25) mm long, 0.9–1.5(-2) mm wide, continuous with petiole, acute at the apex; petiole 3–8(-12) mm long, flattened, similar width to leaflets. *Flowers* single at each node. *Pedicel* 2.5–3.5(-7) mm long in flower, erect, 3.5–7(-9.5) mm long in fruit. *Sepals* 4, 3–4.5 mm long, often red or purple. *Petals* 4, yellow, fading white, obovate, usually distinctly clawed, 3.3–5(-6.2) mm long, longer than sepals. *Stamens* 8; filaments 2.2–2.5(-3.7) mm long, gradually dilated to base, not winged, without appendages; anthers 0.5–0.9 mm long. *Disc* 4-lobed; lobes free, semicircular, succulent, papillose on margin. *Ovary* 4-angled, 4-celled, glabrous; stigma usually distinctly 4-lobed, rarely entire. *Fruit* 4-winged, green, sometimes with reddish edges, pendent, +/- circular to transversely elliptic, 11–15 mm long, 7.5–22mm broad, not breaking into single winged samaras, 4-celled, rounded or truncate with shallowly emarginate apex, with 0–1 seeds per cell (1(-2) per fruit); wings of dried fruits with a clear, widely spaced reticulate venation. Seeds mostly immature, c. 5 mm long, pale brown with hygroscopic hairs all over; fruiting style 0.4–2 mm long, usually red. Illustration of leaf and fruit in Barker 1996, Fig. 3. Fig. 4A–D.

Distribution & ecology

Distribution is problematic. Mainly recorded from an area east of Wiluna and from the Kalgoorlie area, with a few collections from the Nullarbor Plain and a number from the Port Augusta area in South Australia. Minimal ecological information is noted but the species is recorded from mallee and spinifex in red sand over limestone. Flowers August-October.

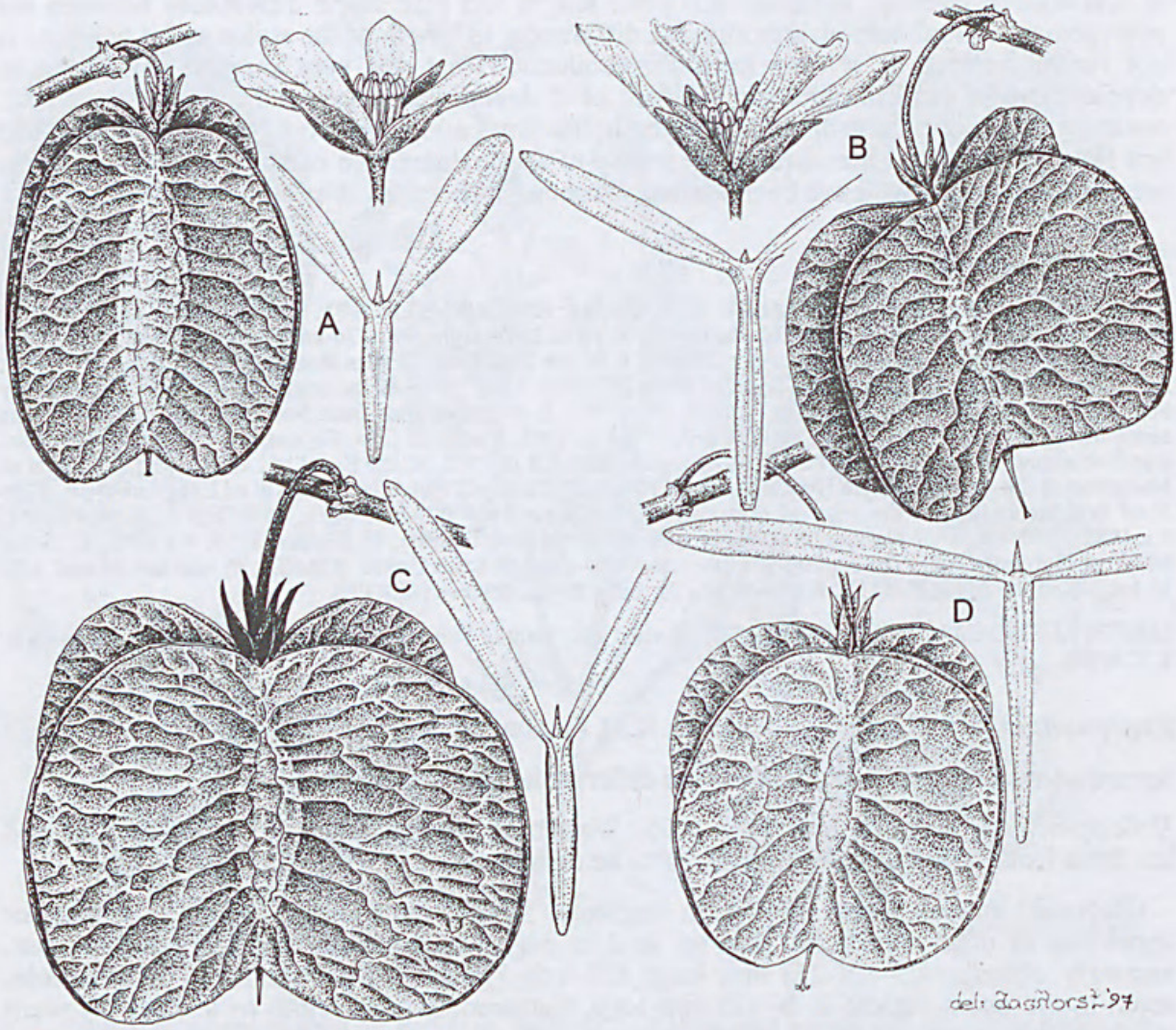

Fig. 4. Variation in ***Zygophyllum reticulatum*** H. Eichler ex R.M. Barker. **A,** fruit ×2, flower ×6 and leaf ×3.5 (**A,** *P.G. Wilson 7407*, AD, from Wiluna area); **B,** fruit ×3.5, flower ×6 and leaf ×2 (**B,** *P.G. Wilson 7207,* PERTH, from Menzies/Coolgardie area); **C,** fruit ×4 and leaf ×3.5 (**C,** *R.M. Barker 1266*, AD, from Kalgoorlie); **D,** fruit ×2.5 and leaf ×3 (**D,** *R.M. Barker 1306*, AD, from Port Augusta area).

Notes

This species was first recognised by Eichler but it was not published in the earlier paper (Barker 1996) because the taxonomy was not clear cut. It is clearly related to *Z. fruticulosum* which occurs along the coast of Western Australia, but the leaflets in *Z. reticulatum* are continuous with the petiole rather than clearly articulated as in *Z. fruticulosum*. The species is still in need of further work and extra collections and field observations may help to clarify the relationships of what are possibly a number of infraspecific taxa. All of the specimens seen were segregated into entities. Even though my

own subsequent collections have eroded these entities somewhat, they have been maintained here since they indicate the characteristics which differentiate the populations.

Specimens segregated by Eichler as this taxon bear the annotation "Zygophyllum sp. (aff. Z. fruticulosum DC.)".

Identification of *Z. reticulatum* is difficult in the field since dry fruit need to be present to see the characteristic (see Fig. 4) widely spaced, reticulate venation on the wings of the fruit. If this cannot be seen, then it is difficult to separate this species from the *Z. aurantiacum/Z. eremaeum* group which have similar fruits and leaves. My own collections from the Kalgoorlie/Norseman area (*Barker 1255, 1260, 1264, 1266*), were all segregated in the field as *Z. reticulatum* even though this reticulate venation pattern was not discernible. These specimens were all sprawling shrubs of a distinctive green with noticeably red buds and calyces, a reddish tinge on the outer wings of the fruit and the fruits topped by a small red style and stigma. However my other collection of this species from the Whyalla area (*Barker 1305*) was given a field identification of *Z. aurantiacum* and did not share the red calyces of the other collections. In this case the leaves were almost T-shaped, in line with an observation by Eichler for this species. However the character of T-shaped leaves seems to be mainly confined to collections from the Port Augusta area and is not characteristic of the whole species as delineated here.

In short, the characteristics of habit, leaf shape, calyx colour, flower size, style length, stigma division and fruit shape are all variable within this species and require further investigation.

Despite the number of fruits present on most specimens, mature seeds were rarely found, suggesting that the floral biology needs to be looked at more closely. Such observations may also lead to an explanation for the variation in a number of other characters already discussed.

Etymology

The epithet "reticulatum" was used by Eichler and refers to the diagnostic reticulate pattern of the venation in the fruit.

Specimens examined (separated into entities which have no taxonomic standing).

Spreading herbs; petals c. 3 mm long; style 0.4–0.5 mm long, fruits longer than wide; from **east of Wiluna**

AUSTRALIA. WESTERN AUSTRALIA: *A.S. George 5519*, 26.vii.1963, 14 miles E of Carnegie (PERTH); *P.G. Wilson 7407*, 28.viii.1968, c. 200 km N of Laverton (AD,PERTH); *P.G. Wilson 11965*, 6.ix.1984, 6 km E of Yelma HS (PERTH).

Scrambler or climber, fruits wider than long:

- styles 1.5–2 mm long, **Menzies/Coolgardie area**

WESTERN AUSTRALIA: *A.C. Beauglehole 13248*, 19.ix.1965, c. 80 km S of Coolgardie, near road to Norseman (AD); *T.E.H. Aplin 2310*, 17.viii.1963, 10 miles s of Leonora (PERTH); *P.G. Wilson 7207*, 19 km N of Menzies (AD, PERTH).

- styles c. 0.8–1 mm long, **Kalgoorlie area**

WESTERN AUSTRALIA: *R.M. Barker 1255*, 14.ix.1995, Kalgoorlie outskirts, Great Eastern Hwy (AD); *R.M. Barker 1266*, 14.ix.1995, Kambalda – Norseman Rd, 18.3 km SW of junction of Kambalda–Boulder and Kambalda-Norseman Rd (AD); *A.C. Beauglehole 13349*, 21.ix.1965, 9 miles N of Norseman on Coolgardie Rd (PERTH); *W.D. Campbell [Herb. Morrison]*, 22.viii.1900, Mt Hunt, Kalgoorlie (PERTH); *W.D. Campbell*, 22.viii.1900, Mt Hunt, Kalgoorlie (PERTH); *W.D. Campbell [Herb. Morrison 338]*, 22.viii.1900, Mt Hunt, Kalgoorlie (PERTH ex K); *W.D. Campbell s.n.*, 21.ix.1900, Boulder and 22.viii.1900, Mt Hunt (PERTH); *W.D. Campbell s.n., viii.*1900, Boulder (PERTH); *M.E. Phillips s.n.*, 13.ix.1962, 4 miles N of Kalgoorlie (CANB); *P.*

Wilson 2870, 9.ix.1964, 16 km s of Balladonia (AD); *P.G. Wilson 7508*, 30.viii.1968, 5 km NE of Kalgoorlie (PERTH 02413140).

Climber to 2m high or sprawler or spreading shrub, 40 × 40 cm; style 4-lobed at apex; fruits +/- circular. **From Norseman, across the Nullarbor Plain to Port Augusta.**

WESTERN AUSTRALIA: *G.J. Keighery & J.J. Alford 576*, 18.x.1986, 41 km N of Trans-line on western boundary fence of Kananda Station (Nullarbor Plain) (PERTH); *K. Newbey 6919*, 30 km ESE of Sinclair Soak, c. 75 km NE of Norseman (PERTH,2 sheets); *K. Newbey7525*, 21.ix.1980, 19 km ENE of Norseman (PERTH).

SOUTH AUSTRALIA: *R.M. Barker 1305*, 20.ix.1995, Lincoln Hwy, c. 31 km N of Whyalla (AD); *E.M. Canning s.n.*, 28.viii.1968, 6.4 km from Whyalla, towards Cowell, along Lincoln Hwy (AD97429101); *J.B. Cleland s.n.*, 19.vii.1943, Port Augusta (AD96247067, AD96247043); *R.J. & S. Chinnock 1411*, Redcliff Petrochemical area, 25 km SE of Port Augusta (AD, G, H, PH, PRE, TI, US); *R.D. Royce 5499*, 20.ix.1956, Jumnania Rocks, NE of Karowie on Transcontinental Rlwy (PERTH); *S.A. Pastoral Board s.n.*, 5.vii.1956, Euria Well and Rockhole, c. 55 km NE of Fowlers Bay (AD97914155); *D.E. Symon 485*, 12.vi.1960, From the Flinders Nursery (W. Hancock), Port Augusta (AD).

Zygophyllum aurantiacum (Lindley) F. Muell., *Linnaea* 25: 376 (Feb. 1853).

Basionym: *Roepera aurantiaca* Lindley, *Bot. Reg.* 24 (Aug. 1838) Misc. p. 57 No. 105; Lindley in Mitchell, Three Expeditions into the interior of Eastern Australia 2: 70 (Aug.-Sept.1838); *Zygophyllum fruticulosum* var. *bilobum* Benth., *Fl. Austral.* 1: 294 (1863).

Lectotype here designated: *Major Mitchell's Expedition 182[3]6*, 11 May [1836], Without specific locality [Interior of New Holland, Lachlan River, New South Wales] (CGE p.p.); *probable isolectotype*: *Mitchell's journey 142*, 11 May [1836], Without locality (MEL, possibly p.p.); *other syntype: Anon. [Mitchell per Lindley] s.n.*, s.dat., HHS [Horticultural Society, London] (CGEp.p.).

Typification

1. Type citation

   Lindley wrote in the *Botanical Register* as follows "It was found by Major Mitchell in his latest journey into the interior of New Holland, and was raised in the garden of the Horticultural Society, where it flowers in the open border in July..." while Mitchell wrote in his account of "a fine hard plain, covered very generally with small bushes of a beautiful orange-flowered spreading under-shrub, with broad thin-winged fruits". The locality was on the Lachlan River on its approach to the Murrumbidgee with the latitude for the previous day given as 34°14'37"S and longitude 144°25'E.

2. The date of publication

   There seems little doubt that Lindley's account of this species, which he cited as "Roepera aurantiaca Lindley in Major Mitchell's Australia, ined", in the *Botanical Register* preceded the publication in Mitchell's account of his journeys, as has already been pointed out in Barker & Barker (1990) and apparently accepted by Eichler in his manuscripts. The description is sufficient for formal publication of the species.

3. Specimens to be considered as types

   Obviously Mitchell's collections are type material but so also is the material grown from seeds of the Mitchell collection at the Horticultural Society in London, since this is referred to by Lindley in the protologue. This is also referred to in the second edition of Mitchell's account of his journeys (Mitchell 1839) where an additional footnote has been added under the description of *Roepera aurantiaca*. This is dated Nov. 1838 and reads "This Ro[e]pera has grown in the garden of the Horticultural Society at Chiswick, and proves a pretty new annual flower". Lindley was at this time Professor of Botany at London University but continued to hold office in the Royal Horticultural Society whose gardens were at Chiswick, and it is no doubt to him that the collection from there should be attributed. It is mounted together with Mitchell's collection on the sheet in

Cambridge, the chief repository of Lindley's herbarium. A Mitchell collection in MEL is numbered 142 and is almost certainly a duplicate of the material in the Lindley herbarium. Unfortunately the photograph of the Cambridge type in the Eichler manuscripts does not include the whole of the Mitchell label and it is unknown whether it too bears this number.

4. Selection of type

   Mitchell's collection in Lindley's herbarium in Cambridge has been chosen as the lectotype since it is the only one to have been annotated by Lindley with his characteristic "R. aurantiaca m."

Another new subspecies of *Z. aurantiacum*

Two new subspecies of *Z. aurantiacum*, ssp. *verticillatum* H. Eichler ex R.M. Barker and ssp. *cuneatum* H. Eichler ex R.M. Barker, segregated, but not published, by Hansjoerg Eichler, were described in an earlier paper (Barker 1996). Within this paper was a reference to a further taxon known as Z. "simplicifolium" which was included in the illustration (fig. 1A) of the leaf variation of the *Z. aurantiacum* complex. Z. "simplicifolium" was not formalised at that stage since it had not been treated in any of the keys, was not separated as a distinct taxon within the Eichler manuscripts, and there were few collections which had been annotated by Eichler. Nor had a type been segregated in either AD or CANB as they had for other manuscript taxa. The subspecies is formalised here.

There has been no opportunity as yet, for the author to make field studies of the subspecies of *Z. aurantiacum*, but it is known that ssp. *cuneatum* and the following subspecies are to be found in gypsiferous or limestone areas, ssp. *verticillatum* is usually to be found on rocky slopes or stony tablelands, while the more widely distributed ssp. *aurantiacum* is less discriminating in its requirements and found within sandy soils in mallee communities. Where the subspecies overlap, as with ssp. *auranticaum* and ssp. *cuneatum* in the Dulkaninna region, the leaf differences are apparently maintained (H. Vonow, pers. comm April 1997).

Zygophyllum aurantiacum* ssp. *simplicifolium H. Eichler ex R.M. Barker, ssp. nov.

[Zygophyllum simplicifolium H.Eichler MS on occasional herbarium specimens.]

Subspecies nova *Z. aurantico* ssp. *aurantico* proxima sed differt foliis simplicibus indivisis.

Holotype: Hj. Eichler 23172, 9.x.1972, South Australia, 5 km SE of Wudinna, above the shores of the salt lake on the SW side of Eyre Hwy towards Kyancutta. 35° 05'S 135° 30'E (CANB); isotypes: AD, CHR, L, MO (still to be distributed).

Z. fruticulosum DC. var. *brevilobum* J.M. Black, *Trans.Roy.Soc. S. Austral.* 54: 60 (1930).

Holotype: J.B. Cleland s.n., 30 Oct. 1929, Seventeen miles N of Tarcoola (AD97918161).

Low and spreading or upright and rounded, glabrous, perennial *shrub*, 30–100 cm high, wider than high. *Leaves* simple (petiolate only), linear, subterete, 12–40 mm long, 0.8–1.7 mm wide, rounded, truncate or emarginate at apex, sometimes with very short lobes (less than 5 mm long).

Distribution & ecology

Simpson Desert of Northern Territory and South Australia, Nullarbor to Gawler Ranges and north western Eyre Peninsula. Occurs on slopes of sand dunes at edges of salt lakes, usually in highly gypsiferous areas. Flowering July-September.

Notes

An illustration of the leaves of this subspecies is to be found in fig 1A of R.M. Barker (1996). The leaves have been described as simple in this case and in line with the terminology used in the other three subspecies, are described as consisting of petiole only. Thus the undivided part of the "leaf" is described as petiole and above the division as leaflets. Anatomically this is probably not correct, but the concept has been consistently used throughout this treatment of *Zygophyllum* for Australia.

The epithet is attributed to Eichler even though there seems to be very little material bearing this name and its origin is a little more obscure than are Eichler's epithets for other taxa. The name was certainly in use within the State Herbarium of South Australia but rather surprisingly it does not appear on AD or CANB specimens. These are more likely to be annotated as Z. "aff. aurantiacum (simple leaves)" as on *Purdie 2845* in CANB, or to have no annotation at all. The epithet may have been used on material in other herbaria.

The type of *Z. fruticulosum* var. *brevilobum* J.M. Black, falls within this taxon. It belongs with a group of specimens assigned to ssp. *simplicifolium* in which the division of the lobes apically is somewhat deeper than that usually encountered and for which the epithet "brevilobum" is particularly appropriate. Other specimens, of those listed below, which share this characteristic are *Chinnock 2722, Kraehenbuehl 3638, Whibley 707, Weber 6750, Phillips s.n.* and *Eichler 21364,* all from the Tarcoola, Penong, Gawler Range and Nullarbor region of South Australia. Thus the more deeply lobed leaves are all from the western end of the distribution of ssp. *simplicifolium.* A few of the leaves on the Whibley specimen are as deeply divided as those in ssp. *aurantiacum.*

Etymology

The epithet simplicifolium is derived from simplici-, Latin for simple or undivided and folium, Latin for leaf, and is a reference to the undivided leaves of this species.

Specimens examined:

NORTHERN TERRITORY: *G. Leach 1486,* Kilpattha Native Well, Simpson Desert (AD, DNA).

SOUTH AUSTRALIA: *S. Barker 70 & Fatchen,* 1.viii.1972, Surprise Lagoon (AD); *R.J. Chinnock 2722,* 2.x.1975, Ifould Lake (AD); *P.E. Conrick 2187,* Poeppel Corner (AD, SYD, RSA); *Hj. Eichler 21364,* 16.ix.1971, Point Sinclair, on N side of causeway towards Penong (AD); *Hj. Eichler 23161,* 8.x.1972, Point Sinclair, just after the end of the causeway of road to Penong (AD, CANB, MEL); *Hj. Eichler 23162,* 8.x.1972, Point Sinclair, just before beginning of causeway of road to Penong (AD, CANB, MEL, US, LP); *D. Kraehenbuehl 3638,* 3.ix.1972, along fringes of Ifould Lakes, c. 60 km S of Ooldea (AD); *N.F. Norris 819,* 31.viii.1982, c. 17 km NE of Kingoonya on the 29 km road connecting Kingoonya and the bitumen of the Stuart Hwy (AD); *M.E. Phillips s.n.*, 30.viii.1968, 11 miles from Streaky Bay towards Ceduna (AD, CANB, L); *R.W. Purdie 2845*, 2.viii.1982, Lower slope of sand dune adjacent to salina between Bench Markers 6863 and 6864, c. 49 "dune-km" W of Poeppel Corner, Simpson Desert (AD, CANB); *A.C. Robinson 228*, 7.x.1987, south margin of Pinjarra Lake (AD); *A.M. Rowell 125*, 29.x.1980, 4 km SE Wudinna (CANB); *A.M. Rowell 126*, 29.x.1980, 4 km SE Wudinna (AD, CANB); *A.M. Rowell 128*, 29.x.1980, minor road from Eyre Hwy near wudinna to Elliston, 2 km SW of Hwy (AD, CANB); *D.E.Symon 8205,* Gawler Ranges (AD, CANB, MO); *J.Z. Weber 6750,* 3.ix.1980, c. 30 km S of Kokatha (AD); *D.J. Whibley 707*, 19.ix.1960, Lake Yarle, c. 25 km NNW of Watson (AD); *L.D. Williams 9156*, 19.ii.1977, 28 km NNE of Streaky Bay (AD).

Zygophyllum eremaeum (Diels) Ostenf., *Det Kongelige Danske Videnskabernes Selskab Biologiske Meddeleser* 3(2): 76 (1921), Textfig. 11 b.

Basionym: Zygophyllum fruticulosum var. *eremaeum* Diels in Diels & Pritzel, *Bot. Jahrb.* 35: 315 (1904); – *Zygophyllum aurantiacum* var. *eremaeum* (Diels) H. Eichler, *Taxon* 12: 297 (1963).

Type citation: Forma per Eremaeam divulgata in distr. Austin pr. Murrinmurrin flor. et fruct. (W.J. GEORGE in hb. Berl.); in distr. Coolgardie pr. Kalgoorlie in arenosis parce fruct. m. Nov. (D. 1684).

Syntypes: W.J. George s.n., s.dat., [Western Australia], Austin district, near Murrinmurrin (B, n.v.); *L.Diels 1684*, Nov., [Western Australia], Coolgardie district, near Kalgoorlie (B, n.v.).

Notes

1. Flowers in this species (and perhaps in other species of *Zygophyllum* as the following phenomenon has been observed in other species) are in need of further study. Within the just opened calyx can be found flowers in which the style surpasses the very short corolla lobes which are themselves appressed to the ovary, as are the very short and unopened stamens. Cleistogamy was the first thought to explain these flowers, particularly as the number of fruits set in this species seems to be more than in other species, but the apparently intact stamens well below the raised style rules this out. The stamens do eventually occur at the same level as the stigma and therefore the apparently large numbers of fruit may be because this species is self-compatible.
2. A group of specimens, some of them labelled as "Zygophyllum aff. eremaeum - annual form", need closer investigation. They may be either first year plants of this species or a distinct taxon. Although very floriferous, none of them possess mature fruits and the young fruits tend to be longer than wide and the styles consistently 0.6 mm long, i.e. somewhat shorter than is usual for this species. Because of their locality, these specimens may relate to the manuscript name "Z. kalgoorliensis" within the Eichler manuscripts, but no description, discussion or specimens annotated with this name have been found.

WESTERN AUSTRALIA: *A.C. Beauglehole 60058 & E.G. Errey 3758,* 276 km by road NE of Laverton-Warburton road, Great Victoria Desert (PERTH); *A.S. George 4155,* 34 miles N of Kalgoorlie (PERTH);); *J. Dell 32,* 8.7 km ENE of Yuinmery Homestead (PERTH).

3. There are some very woody specimens, leafless in the basal parts and with reduced flowers, from Kalgoorlie and areas inland from there. These may be older specimens or a result of exposure to harsh conditions.

WESTERN AUSTRALIA: *B. Nordenstam & A. Anderberg 611,* 20 km N of Kalgoorlie (PERTH,S); *M.D. Crisp 5827, J. Taylor & R. Jackson,* c. 35 km W of Plumridge Lakes, 8.5 km WNW of Salt Lake airstrip (CBG, PERTH).

Z. marliesiae, a new species close to *Z. prismatothecum*

Zygophyllum marliesiae R.M. Barker, sp. nov.

Species nova affinis *Z. prismatotheco* sed differt fructibus rotundatibus, appendicibus brevioribus apicalibus, destitutis sulcis longitudinalis et destitutis vel papillis sparsis albis in faciebus.

Holotype: F.J. Badman 1389, 30.vii.1984, South Australia, 10 km NW of Warrina, 110 km NNW of William Creek. Common. On brown soil ridge between Edward Creek and sandhill. Spreading habit. succulent leaves. Flowers yellow. (AD); isotypes: CANB, MEL.

Zygophyllum "Lake Eyre" (K. Chorney 999), R.M. Barker MS name on AD specimens.

Spreading, glabrous, annual to 15 cm high, wider than high. *Leaves* petiolate, with 2 pairs of leaflets; leaflets succulent, elliptic, 3.5–8 mm long, 2.5–8.5 mm wide, continuous with petiole and not articulated at base, rounded at the apex; petiole flattened, 4.5–9.5 mm long, attenuate, sometimes sub-auriculate. *Pedicel* 0.8–2.5 mm long in flower, 1–2 mm long in fruit. *Sepals* 4, 2.2–3.5 mm long. *Petals* 4, yellow, 1.9–3 mm long, slightly shorter to slightly longer than sepals. *Stamens* 8; filaments winged in lower half, wing not noticeably toothed. *Disc* 4-lobed; lobes free, oblong, succulent, papillose on apex. *Ovary* 4-angled, 4-celled; style 0.2–0.3 mm long; stigma discoid, not lobed. *Capsule* erect, rounded-oblong, 7–11 mm long, 4-angled, 4-celled, sides continuous into 4 falcate, 0.5–1 mm long, appendages at apex, with (1)2–3 seeds per cell; seeds 2.5–3 mm long, smooth, shining,

ostensibly glabrous but the appressed hairs rapidly taking up water on exposure; fruiting style 0.5–1(-2) mm long. Fig. 5, G–J.

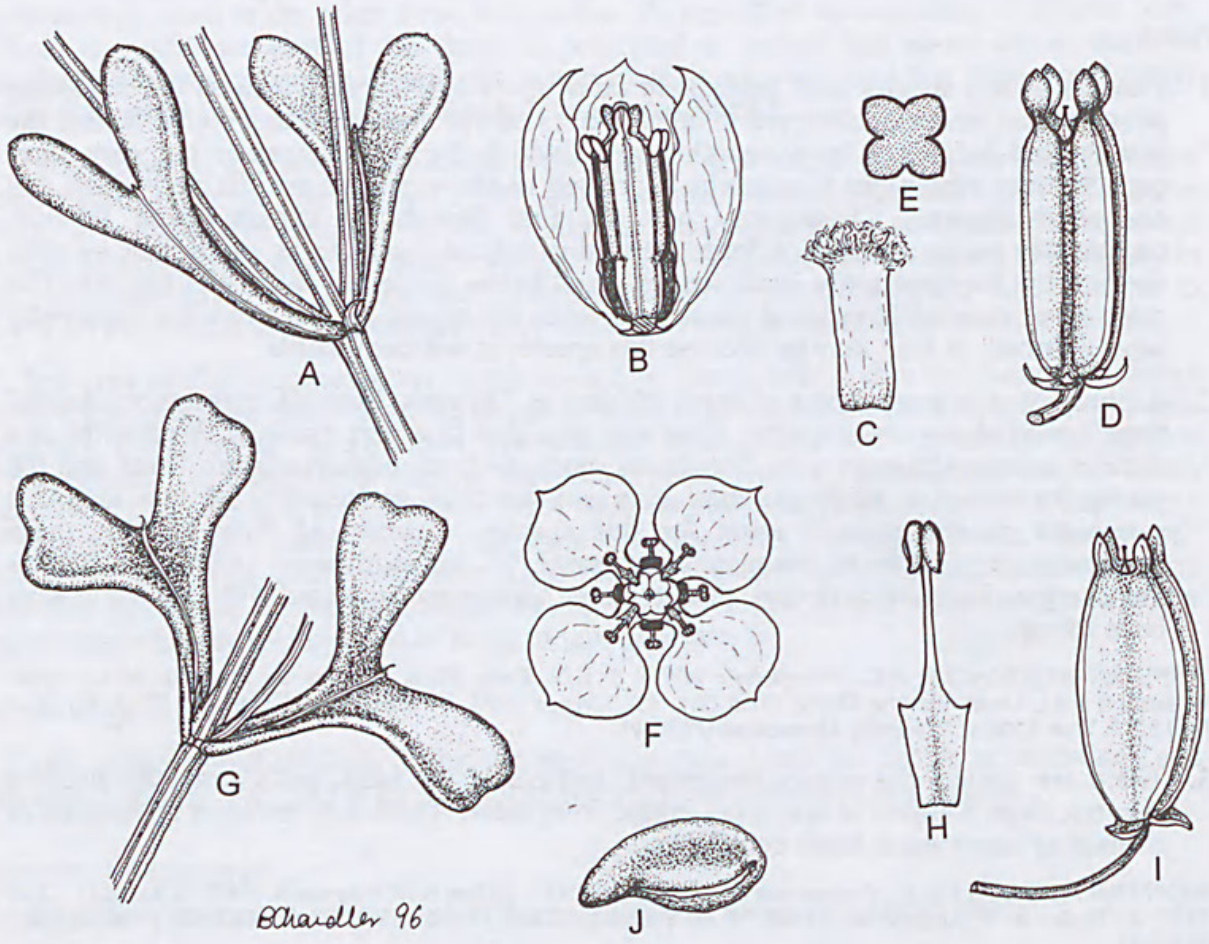

Fig. 5. Comparison of ***Zygophyllum marliesiae*** R.M. Barker and ***Zygophyllum prismatothecum***. **A–E**, ***Zygophyllum prismatothecum***: **A,** pair of leaves ×2 (*J.Z. Weber 2107);* **B,** cross-section of flower ×10 (*D.J.E. Whibley 2267*); **C,** disc or nectary ×15 (*D.J.E. Whibley 2267)*; **D,** fruit ×3 (*J.Z. Weber 2107);* **E,** cross-section of fruit. **F,** floral diagram applicable to both species; **G–J,** ***Zygophyllum marliesiae***: **G,** pair of leaves ×2; **H,** stamen ×20; **I,** fruit ×3; **J,** seed ×12 (all *K. Chorney 999).*

Distribution & ecology

Confined to the Lake Eyre region of South Australia, although it does not seem to be confined to a particular ecological niche. It has been recorded from salt pans, from samphire flood plains, from limestone formations associated with mound springs, from gypseous flats and from sand hills.

Notes

1. The white papillae on the fruit almost certainly play a role in the dispersal of *Z. prismatothecum.* Their lack or very much reduced state in *Z. marliesiae* may help to explain the very much reduced area of distribution of this species compared with that of *Z. prismatothecum.*
2. The development of the appendages on the apex of the fruit in *Z. marliesiae* and *Z. prismatothecum* does not impede pollination. In young fruits of both species, the style is

raised above the appendages (these are quite visible even in the young stages) and the stigma is at the same level as the dehiscing anthers, suggesting that self pollination is possible and likely. By maturity the style is invariably shorter than the erect appendages. The style is usually well below the level of the longer appendages in *Z. prismatothecum*, but in *Z. marliesiae* it is usually just less than them. There is variation in the style's length and thickness. The only specimen seen in which the style considerably exceeded the appendages in mature fruit as shown in unpublished illustrations of *Z. prismatothecum* by Ludwig Dutkiewicz and noted by Eichler (1986), is a single plant in a mixed collection of the two species (*Eichler 19673*). In this particular specimen the style is very slender for its whole length, twice the length (i.e. 2 mm long) of that seen in other collections of *Z. marliesiae,* and still held well above the appendages at maturity. The few flowers present on this specimen are far from perfect but they do not appear to differ markedly in character from those found in *Z. marliesiae.* The collection *Badman 1466* also has styles longer than the appendages, but this is because of the shortness of the appendages rather than the style being particularly long. Some understanding of the floral biology of this group is needed before the importance or otherwise of the style length can be assessed.

3. The seeds appear to be glabrous, but on contact with water the appressed hairs on the surface rapidly expand and absorb water. Some reports record such hairs as being mucilaginous but there was little evidence of any stickiness associated with them, i.e. the wet seed did not adhere to surfaces and did not readily attach objects to its surface.

Distinguishing features

Z. marliesiae can be distinguished from the more widely spread *Z. prismatothecum*, with which it overlaps in distribution, predominantly on fruiting characters. It differs by its longer pedicels in flower and fruit, by the elliptic rather than rectangular fruits and by the much shorter apical appendages (0.5–1 mm long cf. 2–3.5 mm long in *Z. prismatothecum*) on the fruit; these appendages are continuous with the angle of the fruit wall and not constricted at their base as in *Z. prismatothecum.* Furthermore, the fruits of *Z. marliesiae* lack a longitudinal groove at the midline of each of the faces of the fruit and the white papillae which occupy this groove in *Z. prismatothecum* are, in *Z. marliesiae*, either lacking completely or confined to a few papillae in a small apical area on each face.

Etymology

Named after Mrs Marlies Eichler. Marlies always shared in Hansjoerg's work, although her contribution is largely unsung. She has continued to very generously support Australian plant taxonomy since Hansjoerg's death.

Specimens examined

AUSTRALIA. SOUTH AUSTRALIA*: F.J. Badman 915,* 9.iv.1984, 23 km SSE of Maree (AD); *F.J. Badman 1466*, 25.viii.1984, 2 km S of Strangways Spring (AD); *R.J. Bates 19251*, 9.vii.1989, William Creek, where road crosses creek (AD); *R.J. Bates 19261*, 9.vii.1989, Flats along the Oodnadatta track, S of Oodnadatta (AD); *A.C. Beauglehole 28113,* 1.viii.1968, 21 miles N of William Creek (AD); *B. Copley 3576,* 3.ix.1971, 1 mile S of Muloorina (AD); *H. Brooks s.n.*, x.1950, shores of Lake Eyre, c. 10 miles from Coopers Creek entrance (AD 96246075); *K. Chorney 999*, 4.x.1978, Beresford Hill (AD); *Hj. Eichler 19673*, 26.x.1967, Flinders Ranges, mouth of Italowie Gorge (ADp.p.); *R.Hill 1158*, 9.ix.1963, c. 0.25 miles of Muloorina HS (AD); *R.H. Kuchel 710*, 7.viii.1963, c. 10 km N of Coward Springs (AD)*; R.H. Kuchel 1166,* 11.ix.1963, dunes, c 30 km NW of Muloorina HS (AD); *R.H. Kuchel 2880*, 3.ix.1971, Muloorina Stn HS (AD); *T.R.N. Lothian 1352,* 7.viii.1963, 15 miles N of Anna Creek (AD); *T.R.N. Lothian 4992,* 31.vii.1968, c. 15 km S of Curdimurka (AD); *D.R. Smyth 98*, 1.vii.1966, 2.5 mls W of Strangways Railway Stn, artesiam mound spring (AD); *R. Swinbourne 5156,* 7.ix.1968, Near airstrip, Andamooka Opal Fields (AD); *D.E.Symon 11117*, 1.x.1978, Strangways Springs (AD); *J.Z. Weber 8847*, 6.iii.1983, Just S of Strangways Railway siding (AD); *D.J. Whibley 3998*, 12.ix.1973, Chambers Gorge (AD); *L.D. Williams 6319,* 5.xii.1974, N end of Devils Playground, 9 km SE of Billa Kalina HS (AD).

Typifications & notes

Zygophyllum howittii F. Muell., *Fragm. Phyt. Austral.* 3: 150 (1863).

Lectotype here designated: *Dr. J. Murray [Howitt's expedition] s.n.*, [July, 1862], Sandy country near Wills Creek [Diamantina River near Salmonville, 14 miles upstream from Birdsville, Queensland] (MEL95098); *isolectotypes:* K(herb. Hooker), Kp.p., the latter seen as photographs in the Eichler manuscripts.

Typification

All three type sheets consist of small pieces of plants with mature fruits; the lectotype and the herb. Hooker sheet in K are both annotated by Mueller with the same information. Background information given in square brackets on the collector, Dr J. Murray, who joined Howitt's second expedition as surgeon and plant collector, and the locality of the type, was obtained from Willis (1962).

Zygophyllum prismatothecum F. Muell., *Linnaea* 25: 375 (1853).

Type citation: Ad clivos siccos amnis Arkaba.

Lectotype here designated: *F. Mueller s.n.*, Oct. 1851, [South Australia], Akaba, ad clivos siccos (MEL95365); *probable isolectotype*: *F. Mueller s.n.*, s.dat., S. Australia (K); *possible isolectotype*: *F. Mueller s.n.*, s.dat., N.Holl.austr. interior (MEL110964, MEL110969, both herb. Sonder).

Zygophyllum compressum J.M. Black, *Flora of South Australia* 2: 333 (Jun. 1924); J.M. Black, *Trans. & Proc. Roy. Soc. South Australia* 48: 256 (Dec.1924).

Type citation: From Port Augusta westward to near Fowler's Bay, and northward to Far North. Most of the year. - Central Australia.

Lectotype here designated: Anon.[Herb. J.M. Black] s.n., 28.ix.1920, [South Australia], Port Augusta West (AD97918162 p.p.); *isolectotypes:* AD97918163 p.p., K, MEL95437; *syntypes: S.A. White s.n.*, 11.viii.1913, [South Australia], Dalhousie Springs (AD97918163 p.p., AD97918162 p.p.); *R.Helms s.n.*, 5.v.1891, Cootanoorinna (AD97918163 p.p); *Anon.[Herb. J.M. Black] s.n.*, s.dat., [South Australia], Port Augusta (AD97918163 p.p); *Anon [Herb. J.M. Black] s.n.*, 28.vii.1909, [South Australia], Nr Port Augusta (AD97918162 p.p.).

Typification

As with many J.M. Black collections, there is not just one specimen on the type sheet, but a number of collections intermixed with Black's illustrations and notes. There are two such sheets in AD which qualify for type status. The type sheet numbered AD97918163 consists of the following collections.

1. Cootanoorinna, 5.v.1891, *R. Helms s.n.* A flower with Black's detailed drawings of it.
2. Port Augusta West, 28.ix.1920, *Anon.* [*Herb. J.M. Black*] *s.n.* A flower and seeds with Black's detailed drawings.
3. Port Augusta, s.dat., *Anon.* [*Herb. J.M. Black*] *s.n.* Ovary with Black's detailed drawings.

   Dalhousie Springs, 11.viii.1913, *S.A. White s.n.* Major specimen on sheet.

Type sheet numbered AD97918162 consists of the following collections

1. Dalhousie Springs, 11.viii.1913, *S.A White s.n.* One of three specimens on sheet, mounted with drawing and Black's notes.
2. Port Augusta West, 28.ix.1920, *Anon.[Herb. J.M. Black] s.n.* Specimen only.
3. Nr Port Augusta, 28.vii.1909, *Anon [Herb.J.M. Black] s.n.* Specimen only.

In view of the type citation it would be preferable to treat the whole of the two sheets as the holotype, but one specimen has to be chosen as lectotype. Since the collection from Port Augusta West is to be found on both sheets, and has also been sent to K and MEL, it has been chosen as the representative collection; the collection on AD97918162 has been designated as the lectotype. It consists of a small branch with fruits, as do the specimens in K and MEL.

Zygophyllum crassissimum Ising, *Trans. Royal Soc. S. Austral.* 81: 167 (1958), figs 10–14.

Holotype: *E.H. Ising. 3746*, 7.x.1954, South Australia, Evelyn Downs, about 90 miles by road south-west of Oodnadatta (AD95736042); *isotype*: AD95736043. There are a number of paratypes, all collected by Ising and from the same locality: *Ising 3654* (K); *Ising 3655* (AD); *Ising 3838* (NSW,MEL); *Ising 3938–3941* (AD).

Typification

There are two type sheets in AD, not one, as indicated in the protologue. Both consist of three robust branches, and both sheets have flowers and fruits present. It is presumed that the unmounted material as a whole was probably treated as holotype by Ising but when it came to be mounted there was too much for a single sheet. The sheet designated as the holotype corresponds with the protologue numbering and has mounted on it the original notes of Ising. The second sheet has been designated as an isotype, and has only a typewritten AD label on it.

Notes

Bright orange flowered specimens, referred to by Eichler in his manuscript as Z. "chinnockii" belong here. There seems to be no other character to separate them from the more normally yellow-flowered *Z. crassissimum*. Field observations are required to determine what causes this colour variation and whether both colours occur within a population.

Relationship of Z. glaucum and Z. crassissimum

Although closely related, *Z. glaucum* can be distinguished from *Z. crassissimum* by several features.

1. The disc is continuous, thin and shallowly sinuate compared with the discontinuous, 4-lobed, thick and deeply inverse U-shaped disc of *Z. crassissimum*. However the two conditions are not always easily distinguishable. There are often 8 sinuations in the disk of *Z. glaucum* which correspond to the insertion of the filaments.
2. Sepals are very quickly reflexed in fruit in *Z. glaucum*, while apparently (at least in dried specimens) continuing erect for some time in *Z. crassissimum.*
3. Leaflet are often more distinctly glaucous in *Z. crassissimum.*
4. Filament wings are apically toothed, acute or truncate in *Z. glaucum,* truncate in *Z. crassisimum.*

5. *Z. glaucum* is distributed across southern Australia from Coolgardie through to the Murray River area while *Z. crassissimum* occupies a more northerly distribution from the Lake Eyre region in South Australia through to Lake Mackay on the Western Australian/Northern Territory border.
6. *Z. glaucum* is a sprawling herb up to 30 cm high and not particularly woody in its habit while *Z. crassissimum* is an erect or rounded shrub, up to a metre high and wide.

Zygophyllum glaucum F. Muell., *Linnaea* 25: 376 (1853) nomen nudum; F. Muell., *Trans. Proc. Vict. Inst.* 29 (10 Sep. 1855). Non *Z. glaucum* E. Meyer ex Drège, *Zwei Pflanzengeogr.Docum* 230 (1843-44), nomen nudum; E. Meyer ex Sonder in Harvey & Sonder, *Fl.Cap.* 1: 362 (1860) = *Z. sonderi* H. Eichler, *Taxon* 12: 297 (1963).

Type citation: In the Desert along the Murray, Wimmera and Avoca; on St. Vincent's Gulf, Spencer's Gulf, and in various other places in South Australia.

Lectotype here designated: F. Mueller s.n., Nov. 1851, [South Australia], Flinders Range & Spencers Gulph (MEL95036) annotated *Z. glaucum* and *Z. glaucescens*, seen by Bentham, with a number of fruit and with an entire disc; *other syntypes*: *Anon. [F. Mueller] s.n.*, s.dat., [South Australia], Crystal Brook (MEL110966, herb.Sonder); *Anon. s.n.*, s.dat., [South Australia], St Vincents Gulf (MEL95035). Probable syntypes: *F. Mueller s.n.*, late Feb. 1847, [South Australia], Murray scrub (MEL95033) - this has subsequently been mounted separately from the material on MEL95034 with which it was originally associated; *F. Mueller 77*, 15 April 1848, [South Australia], Bethanien (MEL95034) - material is sterile and has been annotated by Mueller as *Z. glaucescens*.

Zygophyllum glaucescens F. Muell., *Plants Indigenous to the Colony of Victoria* 1: 228 (1862), nom. nov., superfluous name. Basionym: *Zygophyllum glaucum* F. Muell. (1855) non E.Meyer ex Sonder (1860).

Typification

The lectotype chosen is one of only two amongst the syntypes to have fruits present. The St Vincent's Gulf collection (MEL95035) is the other. Of these, the lectotype is by far the better material. It was initially annotated as *Z. glaucum* by Mueller but the 'glaucum' has been overwritten by 'glaucescens'. No flowers are present on any of the specimens and they were not described in the protologue; thus the syntypes cannot be placed with respect to the possible taxa discussed below. However Mueller's next description of the species in *Plants Indigenous to the Colony of Victoria,* where he changed the epithet to "glaucescens", clearly described the stamens as "scale cuneate, half as long as the filament, acutely bidentate at the apex, teethless at the sides". He also cited most of the types referred to in the protologue in the distribution statement for this species ("In the subsaline desert-plains along the Murray River, the Wimmera, and the Avoca; in South Australia on the foot of the Barossa Ranges, on St. Vincent's and Spencer's Gulf, and on Venus Bay.....") and so the typical taxon would be the eastern taxon.

Mueller first mentioned the name *Z. glaucum* in *Linnaea* in 1853, but there was no accompanying description and it was not formally published until 1855. Mueller also annotated specimens with his manuscript name 'Roepera zygophylloides'; both names appear in his hand on the syntype which he sent to Sonder.

Notes

Z. glaucum possibly consists of two taxa, separable chiefly on the morphology of the wing of the filament. The two taxa occur across southern Australia, meeting on Eyre Peninsula in South Australia, where both wing types occur, but the taxa still remain as separate entities. Plants from the eastern part of the distribution apparently have wings

which are apiculate either side of the attachment of the filament while those from the west have entire or slightly toothed wings which are either truncate at their apex or more usually, acute (i.e widened at base and then obliquely approaching filament on either side). The lectotype belongs with the eastern specimens as discussed above. These taxa have not been formalised because the author has not studied all of the available material.

Zygophyllum ovatum Ewart & J.R. White, *J. & Proc. Royal Soc. N. S. Wales* 42: 197 (1908), pl.36.

Lectotype here designated: M. Koch 1674, Sept. 1905, Watheroo rabbit fence, W.A. (MEL568254); *isolectotypes*: NSW, PERTH(specimen dated Sept. 1905 on handwritten label, see typification); *probable syntype* (not cited in protologue but annotated by authors and labelled as cotype): *M. Koch 1213*, August 1904, Cowcowing (MEL 1517068); *isolectotype or probable syntype: M. Koch 1674 [?1213]*, August 1904, Cowcowing (PERTH).

Z. iodocarpum F. Muell. var. *bilobum* Benth., *Fl.Austral.* 1: 293 (1863).

Possible holotype: J. Drummond 91, s.dat.[received 1848], [Western Australia], Swan River to the S[tirlings] (K, seen as photograph in Eichler MS); *isotype:* MEL16550.

Typification

Z. ovatum Ewart & J. White

The MEL sheet has been chosen as the lectotype since it has mounted with it a note in pencil containing much of the information found in the protologue. This note is presumably in Ewart or White's hand but neither of their handwritings has been found for comparison. There are two specimens of *Z. ovatum* in PERTH labelled as *Koch 1674*, one dated Sept. 1905 on the handwritten labels and the other, August 1904. The former is an isolectotype of *Z. ovatum*, but the latter appears more likely to be a duplicate of *Koch 1213,* collected by Koch from Cowcowing in August 1904 and represented in MEL (MEL1517068). The MEL specimen of *Koch 1213* has been labelled as "Z. ovatum n. sp. Ewart & White" (presumably by one of the authors, but not the one who wrote the pencilled note on the lectotype), and has also been labelled as a cotype of *Z. ovatum.* The specimen is certainly not mentioned in the protologue, but since it has been annotated by the authors and also bears the designation cotype, there seems little doubt that it should be considered as a syntype. The second specimen in PERTH, which is erroneously labelled either with respect to the Koch number or date and locality, is an isolectotype if the Koch number is correct or a syntype if the date and locality is correct.

Z. iodocarpum var. *bilobum* Benth.

The K material has been annotated as "Z. iodocarpum var." and possibly represents the only material to have been seen by Bentham. However Drummond collected up to 16 sets of each species for sale and so there could easily be more isotype material to be identified. A duplicate in MEL was not been seen by Bentham.

Zygophyllum crenatum F. Muell., *Linnaea* 25: 374 (1853).

Zygophyllum glaucescens var. *lobulatum* Benth., *Flora Austral.* 1: 293 (1863).

Type citation: Ad rivo Rocky river lacum Torrens versus locos depressos pusillum salsos sparsim inhabitans.

Syntypes: *F. Mueller s.n.*, Oct. 1851, [South Australia] Cudnaka [Kanyaka], in depressis [subsalsis] (MEL95448); *F. Mueller s.n.*, Oct. 1851, [South Australia], Cudnaka, Rocky creek, Crystal Brook, Akaba (MEL110968 - herb. Sonder).

Typification

A Mueller specimen, annotated by him as "Roepera crenata", was collected at Cudnaka in the Flinders Ranges in October 1851. This sheet in MEL (MEL95448) had been labelled as the holotype. Annotations on the specimen bear some relation to the protologue. However this is not the only specimen. There is a second Mueller specimen in the Sonder herbarium in MEL which has further information on its label. This may prove to be a more appropriate choice as lectotype. It has fruits and flowers present.

Zygophyllum humillimum Koch, [*Trans. Roy. Soc. S. Australia* 24(2): 82 (Dec.1900), nom. prov.]; Koch ex Tate, *Trans. Roy. Soc. S. Australia* 24(2): 207 (Dec.1900); Koch ex J.M. Black, *Fl.S.Austral.* 334 (1924).

Lectotype here designated: *M. Koch 457*, 12 June 1899, [South Australia], Mt Lyndhurst (AD97918160 - herb. Tate), ***isolectotype***: AD97918159 – herb. Black. ***Other syntypes:*** *M. Koch 457*, Aug. 1899, [South Australia], Mt Lyndhurst (AD96247051, BM, K, NSW391140).

First publication of the name

The place of publication of *Z. humillimum* has to be reconsidered. Koch included this species in a discussion on the micromorphs of *Z. ammophilum* (Koch 1900), referring to it as "*Z. ammophilum* var. or new species (?);". He further stated that he has supplied Prof. Tate with more material and "would not be surprised if he decides to raise No. 457 to specific rank... I suggest as an appropriate name *Zygophyllum humillimum*."Thus even though he provided a discussion of all of the characteristics which made this particular species distinct, the name was "proposed in anticipation of the future acceptance" of the species and as such contravenes Article 34.1 of the ICBN (Greuter et al. 1992).

This is in agreement with notes to be found in the Eichler manuscript under this species and an unsigned annotation on the isolectotype in K. Both of these sources then attribute the first official publication of the name to J.M.Black in 1924.

However within the index of the volume in which Koch published his notes and proposed the name, reference was made to "Zygophyllum *humillimum"* and beneath the explanation of the index it is stated that "specific names in italic type are described as new". Thus the official place of publication of the species can be cited as the index with reference back to the article in which Koch discussed *Z. humillimum*. As the volume was edited by Tate, the botanist to whom Koch deferred in proposing his new species, and Tate was presumably responsible for the index, the authorship of the name should be cited as Koch ex Tate. Tate would have had two opportunities to comment on this taxon, the first being when the paper was read to the Society on June 5th, 1900 and the second when he edited Koch's article for the journal, but apart from the Index there seems to be no other indication of what Tate thought about this taxon. The lectotype sheet in Tate's herbarium bears no annotation by him and has been annotated only by Koch and by J.M. Black (see below).

It is interesting to note that in a later compiled index to volumes 1–24 of *The Transactions of the Royal Society of South Australia*, the compiler, R.J.M. Clucas (1907), did not consider the reference to be "to the original or to a fairly full description" of the species, since it was not followed by an asterisk.

Typification

Koch's collections numbered 457 are from two gatherings, one made on June 12th 1899 and the other in August 1899. Of the two specimens collected in June 1899, one resides in the Tate Herbarium and the other in the Black Herbarium. The Tate herbarium sheet consists of 2 whole plants and 2 robust branches, while the specimens in the Black

herbarium are probably pieces off the collections on the Tate sheet; they have been mounted with Black's detailed analysis and drawings. Koch has annotated the Tate herbarium collection as "Zygophyllum sp." He further remarks on the label that

> "This Zygophyllum may be a new species (unless it is Z. crenatum, which I doubt for Z. crenatum has according to flora N.S.W. "2 seeds in each cell and this Z has only one seed in each cell) As the fruit resembles that of Z. am[m]ophilum I believe this Z. is a cross between Z. prismatothecum and Z. am[m]ophilum which I found near it."

Alongside this is pencilled "no" but there is no indication of who wrote this. There are further notes written by Koch on the back of the collector's label attached to the sheet. These are obviously addressed to Tate since he says that "I should be inclined to look for it in your Handbook under "I. Capsule truncate at the top", a clear reference to the treatment of Zygophyllaceae by Tate (1890) in his *Handbook of the Flora of Extratropical South Australia.* This is followed by a description of the plants. This sheet has subsequently been labelled as "humillimum M.Koch" by J.M. Black. There are no annotations on it by Tate. Despite the lack of the name in either Koch's or Tate's hand this specimen has been chosen as lectotype since it seems to best reflect the history of the naming of the species.

Of the syntype collections, the one in BM is labelled by Koch as "Zygophyllum ammophilum fv.M. var., unlike the typical form", while the specimen in K is labelled as "Zygophyllum sp., seems to be undescribed - resembling Z. am[m]ophilum". The specimen in NSW is, in contrast, labelled by Koch as "Zygophyllum sp. nov., provisionally named humillimum".

Zygophyllum billardierei DC., *Prodr.* 1: 705 (1824), as 'Billardierii'.

Type citation: in Novae-Hollandiae terrae Van-Leuwin.

?Holotype: *Labillardiere*, s.dat. [], terra van Leuwin [Western Australia] (G-DC); isotypes: ?FI, ?P.

Zygophyllum billardierei (as 'Billardieri') var. *stenophyllum* F. Mueller ex Diels & Pritzel, *Bot. Jahrb.* 35: 314 (1904) p.p. (at this stage only as to Forrest collection, Diels collection not seen, but probably not this species because of locality).

Type citation: in distr. Coolgardie orientali: Musgraves Range (32°14′ lat.,126° 24′ long.) flor. et fruct. m. Nov. leg. *J. Forrest*; pr. Gilmores haud procul a Lake Cowan in eucalyptetis lapidoso-lutosis fruct. m. Nov. (D. 5459).

Syntype: J. Forrest s.n., 1870, [Western Australia], Musgrave's Range, Lat 32°14′ Long 126° 24′[?Wurrengoodyea Hills north of the Eyre Telegraph Stn on the Great Australian Bight] (MEL56866).

Zygophyllum ammophilum auct. non F. Muell.; F. Muell., *Fragm.Phyt.Austral.* 11: 28(1878) p.p. (only as to possible syntype specimen from Port Lincoln (MEL110961, herb. Sonder).

Typification

Z. billardierei var. *stenophyllum* F. Mueller ex Diels & Pritzel

Mueller applied the name var. *stenophylla* to the very succulent, small-leaved collections of *Z. billardierei* DC. from Port Lincoln and Yorke Peninsula. He annotated one J.S. Browne specimen from Port Lincoln as var. *stenophylla* (MEL56871) and another (MEL94973), possibly a duplicate, as "Zygophyllum billardierei var." Diels & Pritzel saw a Forrest collection in MEL from Musgraves Range (near the Eyre Telegraph Station on the Great Australian Bight) which had been annotated by Mueller as "var. (ammophila) stenophylla", and adopted var. *stenophylla* for a Diels collection from Lake Cowan, near Norseman, citing it and the Forrest collection in the protologue. While there is no doubt that the Forrest collection belongs with *Z. billardierei* DC., it is unlikely that the Diels specimen will prove to be the same species, since *Z. billardierei* is confined to coastal localities and the Diels collection comes from much further inland.

Zygophyllum ammophilum F. Muell., *Linnaea* 25: 376 (1853), nomen nudum; *Fragm. Phyt. Austral.* 11: 28 (1878).

Zygophyllum billardierei (as `Billardierii'') var. *ammophilum* F. Muell., Report of Mr. Babbages Expedition into the North West interior of South Australia. *Votes Proc.Legis.Assembly 1859-60*, 7 (1859); nomen nudum.

Z. billardierei DC. var. *ammophilum* (F. Muell.)J.M. Black, *Fl.S.Austral.* 2: 333 (1924) p.p., at least to specimens with 4 stamens.

Type citation: Ad flumina Wimmera, Murray- et Lachlan-River (F. M.), Darling-River (Beckler), ad sinum Port Lincoln (Browne), ad fluvios Warrego (Bailey), Barcoo (Gregory), ad oras Great Bight (Carey), ad fontes Alice-Springs et Charlotte-Waters (Giles), ad Champion-Bay et Murchison-River (F. M.). Huc forsan plants Drummondi 91."

Lectotype: "*F. Mueller s.n.,* Lachlan River, Sept. 1878 (MEL 56877).", fide H. Eichler, *Telopea* 4(1): 16 (1990).

Typification

The epithet "ammophilum" was used as early as 1853 by Mueller in *Linnaea,* but the name was not accompanied by a description. In 1859 Mueller again used the epithet in describing *Zygophyllum billardierei* var. *ammophilum* from the Babbage Expedition and there is possibly some argument that this should be the basionym for this species. However the description consists merely of "narrow leaved variety peculiar to desert" and so is best treated as a nomen nudum as it could represent any one of a number of presently recognised species and the specimen has still to be located.

Valid publication of the name was not until 1878 and by that time Mueller had accumulated a great deal of material as can be seen from the type citation. The syntypes were found by Eichler to represent a number of different species and so he (Eichler 1990) lectotypified *Z. ammophilum*, choosing a specimen with 4 stamens which was in agreement with the protologue.

The rest of the syntypes have still to be allocated to species.

***Z. *sessilifolium* L. a short-lived South African introduction to Australia**

There are specimens attributed to a South African species, *Z. sessilifolium* L., in MEL. These were collected from Coode Island in the Port of Melbourne. They were collected in 1908, and exhibited by J.R.Tovey at the Victorian Field Naturalists Club on 8th May 1911 (note on *MEL95370*). It would appear that *Z. sessilifolium* persisted only for a few years or was eradicated. It can be distinguished from the Australian species of *Zygophyllum* by its shrubby perennial habit, white flowers with 5 petals c. 1 cm long and ?erect, ?5-lobed fruits c. 12 mm long, similar in shape to those of *Z. kochii,* to which it would appear to bear some relationship. The leaflets of these Coode Island specimens are shortly petiolate and distinctly acuminate, somewhat at odds with the Linnean type seen on microfiche (*LINN 544.5*).

Specimens examined:

VICTORIA: *J.R. Tovey & C. French Jr. s.n.*, Oct. 1908, Coode Island (MEL95368); *J.R. Tovey s.n.*, Oct. 1908, Coode Island (NSW); *J.R.Tovey s.n.*, 28 June 1911, Coode Island (MEL95369); *J.R. Tovey s.n.*, 1908, Coode Island (MEL95370); *Anon. s.n.*, 9 Nov. 1912, Coode Island (MEL1503736); *Anon. (ex herb.W.R.A. Baker) s.n.*, 9 Nov. 1912, Coode Island (MEL95402, MEL95403).

Species incertis

Zygophyllum fruticulosum var. *platypterum* Benth., *Flora Australiensis* 1: 294 (1863).

Type citation: Port Jackson, Leichhardt (Herb. F. Mueller).

Syntypes: *Leichhardt [Herb. Mueller] s.n.*, s.dat., Port Jackson (MEL s.n.); *Anon. s.n.[Herb. Mueller],* s.dat., Without locality (MEL s.n.); *Leichhardt [Herb. Mueller] s.n.*, s.dat., Port Jackson (MEL s.n.); *Anon. s.n.*, s.dat., raised from seed in Sydney (MEL s.n.).

Within the Eichler manuscripts there are photographs of the three syntypes mentioned above. There is presumably a specimen to be found at K as well although it is possible that Bentham saw the first listed syntype (there is no "B" to indicate this, but one of the labels appears to have been annotataed by him as "Z. fruticulosum var?"). It seem s clear that the species was cultivated at the Sydney Botanic Gardens since one of the specimens says "probably cultivated" and Mueller has annotated the first listed syntype as "Z. morg[s]anae affine. Forsan ex horto bot Sydneyano." The identity of the plant is unknown but it would appear to be a non-Australian species since the leaves are not divided into leaflets.

Excluded species

Zygophyllum australasicum Miq., *Pl. Preiss.* 1: 164 (1845).

Type citation: "Crescit in clivulis arenosis insulae Cornac, 8. Nov. 1839. Herb. Preiss. No. 2397".

Types: L. Preiss 2379, 8 Nov. 1839, In Nova Holland ora [occid] in clivulis arenosis insula Carnac [off Fremantle, Western Australia] (U); *L. Preiss 2379*, s.dat., New Holland, Riv. des Cygnes [Swan River, Western Australia] (P). Both seen as photographs in the Eichler collection of protologues.

Although it is difficult to make out any detail form the photographs there is little doubt from the description that the type collection is *Nitraria*. Reference to pubescence on the branches, sepals and the ovary would rule out any Australian species of *Zygophyllum* and accords with *Nitraria billardierei* as does the 5-angled ovary which continues into the style.

Acknowledgements

As in the previous paper, this one has relied to some extent on earlier work done by Hansjoerg and Marlies Eichler and Alison Rowell. I hope that the debt owed to them has been at least partly expressed in the choice of epithets for the new species.

Thanks to Paul Wilson for commenting on the first place of publication of *Zygophyllum humillimum.*

Illustrations of the new taxa are by Beth Chandler, employed under ABRS funding to prepare plates for the *Flora of Australia* treatment of Zygophyllaceae, and the AD artist, Gilbert Dashorst. Thanks to both of them and to both ABRS and the State Herbarium for making their services available.

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