New species and subspecies of Casuarina in Western Australia

By L. A. S. Johnson*

Abstract

The following taxa are described and discussed: *C. scleroclada* sp. nov., *C. campestris* Diels subsp. *tessellata* (C. A. Gardn.) comb. et stat. nov., *C. campestris* subsp. *eriochlamys* subsp. nov., *C. campestris* subsp. *grossa* subsp. nov. and *C. cristata* Miq. subsp. *pauper* (F. Muell. ex Miq.) comb. et stat. nov.

Introduction

The following descriptions of new taxa, together with the reduction of a supposed species to subspecific rank, are published so that the names will be available for use in the forthcoming treatment of Casuarinaceae in " The Flora of Western Australia ". It is intended to deal with the general taxonomy of the family elsewhere.

For morphological reasons certain terms are employed here and elsewhere in my *Casuarina* studies, for which those more traditionally used in *Casuarina* are indicated in parenthesis: leaf lamina (" tooth ", " scale-leaf "), article (" internode "), phyllichnium (" ridge "), infructescence (" cone ").

Casuarina scleroclada L. Johnson, sp. nov.

[Greek: skleros = hard, klados = branch]

Frutex dioicus 1–3 m altus, saepe trunco singulo, ramis saepe arcuatis, ramulis pendentibus. *Rami persistentes* novelli ramulis deciduis aliquanto similes sed internodiis brevioribus distincti, vetustiores mox lignosi cortice plus minusve sulcato. *Ramuli decidui* multiarticulati, penduli sed duri: verticilli plerumque (9–)10–11–foliati; *laminae foliorum* (" dentes ") primo circiter 1·0–1·5 mm longae, demum (fissione vaginarum) usque ad 2·0 mm longae, elongato-triangulares, erectae, brunneae nigrescentesque, marginibus praesertim basin versus plus minusve lanuginoso-ciliatis; *articuli* (" internodia ") (1–) 2–4(–5) cm longi, plerumque 0·7–0·9 mm crassi, in sicco cinerascentes; *phyllichnia* subconvexa (in sicco), haud carinata, pilis sulcorum superficie manifestis sed non protrudentibus. *Inflorescentiae masculae* in ramis persistentibus sessiles (saepe cum ramulis vegetativis in verticillis isdem), 0·3–0·1 (vel plus) cm longae; verticilli bractearum crebri, ad 1·2 mm longi (laminis inclusis); laminae bractearum illis foliorum similes sed breviores, circiter 0·5 mm longae; bracteolae persistentes, stipitatae, elongato-cymbiformes, acutae, apicibus ad anthesin plus minusve expositis, marginibus versus apicem minute ciliolatis; tepalum 1 (abaxiale deficiens), adaxiale oblanceolatum, vix cucullatum, antheram partim includens; filamentum 1·5 mm attingens; anthera rubens, apiculata, circiter 0·7 mm longa. *Inflorescentiae foemineae* in ramis persistentibus sessiles, ovoideae, 6–8 mm longae, bracteis tomentosis. *Infructescentiae* (" strobili ") sessiles, subglobosae vel crasse ellipsoideae, apice truncato, 1·5–3·0 cm longae, 1·5–2·5 cm diametro, 18–22–stichae, verticillis fertilibus plerumque 8–12; bracteae tenues apice triangulari tomentoso minute apiculato exposito; *bracteolae* (" valvae ") maturitate lignosae, apice crasso convexoque, obtuso, plus minusve glabrato et sine protuberatione separata. *Nux* tota 5–8 mm longa corpore maturo atro vix nitenti, ala expansa quam corpore saepe aliquanto longiore, translucenti basi styli excepta, ad apicem suboblique rotundata apiculataque. Chromosomata somatica 50–52.

Holotypus (♀): c. 40 km SSE. of Caiguna (c. 3·2 km in from sea), W.A., 2–3 m, very arching and drooping, no ♂ seen, on limestone plain with mallee and scrub, 1.ix.1967, *L. A. S. Johnson* 2155, NSW 132432, isotypo in PERTH ponendo.

Dioecious shrub 1-3 m, often with a single trunk, the branches often arching and the branchlets drooping. Young *permanent branches* rather similar to the deciduous branchlets but distinguishable by their shorter articles (" internodes "), the older ones soon becoming woody with more or less furrowed,

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hard, grey bark. *Deciduous* (" foliage ") branchlets many-jointed, pendulous but hard: whorls usually (9–)10-11-leaved (" -toothed "); *leaf laminae* (" teeth ") at first c. 1·0-1·5 mm long but finally apparently up to 2·0 mm long (by splitting of the sheaths), elongate-triangular, erect (appressed to succeeding article), brown and becoming blackish, margins more or less woolly-ciliate especially towards the base; *articles* (" internodes ") (1-)2-4(-5) cm long, usually 0·7-0·9 mm thick, becoming ashy-grey when dry; *phyllichnia* (" ridges ") slightly convex (when dry) but not keeled, the hairs of the furrows visible on the surface but not protruding. *Male inflorescences* sessile on the permanent branches (often with vegetative branchlets in the same whorl), 0·3-1·0 (or more) cm long; whorls of bracts crowded, to 1·2 mm long (including the laminae); laminae of the bracts (" teeth "), similar to those of the leaves but shorter, about 0·5 mm long; bracteoles persistent, stipitate, elongate-cymbiform, acute, their apices more or less exposed at anthesis, the edges minutely ciliolate towards the apex; tepal 1 (the abaxial one lacking), adaxial, oblanceolate, scarcely hooded, partly enwrapping the anther; filament attaining 1·5 mm; anther reddish, apiculate, c. 0·7 mm long. *Female inflorescences* sessile on the permanent branches, ovoid, 6-8 mm long, with tomentose bracts. *Infructescences* (" cones ") sessile, subglobose or thickly ellipsoid, truncate at the apex, 1·5-3·0 cm long, 1·5-2·5 cm in diameter, 18-22-stichous (*i.e.* with alternate 9-11-membered whorls), fertile whorls usually 8-12; bracts thin with the tomentose minutely apiculate apex exposed at the cone surface; bracteoles (" valves ") woody at maturity, the apex thick and convex, obtuse and without a separate dorsal protuberance. *Nut* 5-8 mm long overall, the body black and scarcely shining when ripe, the wing expanded and usually somewhat longer than the body, translucent (but brownish) apart from the style-base, subobliquely rounded and apiculate at the apex. Chromosome No. $2n = 50$-52.

Distribution: Western Australia, from the Borden district to the western part of the Great Australian Bight.

Specimens examined: Western Australia: 312 miles (499 km) on the Lake King-Ravensthorpe road, *E. M. Bennett* 3120, 16.i.1970 (♂ and ♀, apparently separate plants) (PERTH, NSW); 17 miles (27 km) E. of Ravensthorpe on Esperance road, *B. G. Briggs* 442, 443, 444a, 11.ix.1966 (NSW); Mt Ragged, near SW. base, *A. S. George* 2110, 7.xii.1960 (PERTH); Salmon Gums *C. A. Gardner*, v.1924 (PERTH); Great Bight, *Carey* (MEL); 6 miles S. of Toompup, *Newbey* 1249 (PERTH); and the Holotype. Further collections from the Caiguna area by R. F. Parsons seen, but details not recorded (AD).

This sharply defined species is probably nearest to *C. acutivalvis* F. Muell., from which it differs in the arching habit of growth (more pronounced in female plants, A. S. George pers. comm.), short sessile male inflorescences, the smaller and always sessile infructescences with obtuse bracteoles, the coarser branchlets and other vegetative parts, as well as in numerous fine details. It differs clearly also from other species of this group, such as *C. campestris* Diels and *C. dielsiana* C. A. Gardn. in habit, male inflorescences, infructescences, and branchlets.

C. scleroclada has been little collected but is common enough in places, for instance in the type locality towards the Bight coast from Caiguna. It was first recognized by the author some twenty years ago from the Gardner and the rather fragmentary Carey collections but for many years it was impossible to gain any field knowledge of it or to obtain suitable material for chromosome number determination.

Unlike the diploid *C. acutivalvis*, *C. campestris*, and *C. helmsii* Ewart & Gordon, all of which have $2n = 24$ (Barlow 1959), and *C. dielsiana* ($2n = 28$), *C. scleroclada* (at least from the type locality) is at the tetraploid level with $2n = 50$-52.

Casuarina campestris Diels in Bot. Jahrb. 35:126 (1905)

This widespread species is fairly uniform over much of its range but in the Mt. Singleton and Kalgoorlie districts, as well as towards the southern coast, populations occur which appear to be best retained within *C. campestris* but differ sufficiently to warrant subspecific rank. *C. dielsiana* C. A. Gardn. also greatly resembles *C. campestris* in vegetative features but differs in the infructescences, the peculiar short, more or less globose male inflorescences, and in chromosome number (Barlow 1959).

Thus *C. campestris* can be regarded as comprising four subspecies which show some morphological intergradation and some geographic overlap. For some purposes, and with intermediate material, it may be convenient to refer simply to *C. campestris*, but the following key indicates the more characteristic features of the four races. Specimens without infructescences may be difficult to determine unless they are associated with fruiting material from the same population.

Key to Subspecies

1. Surface of fruiting bracteoles divided into 4 " protuberances " (Infructescences pedunculate, glabrescent, bracteoles protruding, phyllichnia markedly convex when dry, leaf-whorls mostly 9-merous) 1. subsp. **tessellata**

1*. Surface of fruiting bracteoles not divided.

2. Infructescences mostly sessile or subsessile (fruiting peduncles mostly 0–4 mm), mostly 1·3–4·0 x 1·2–1·6 cm, glabrescent when ripe. Bracteoles protruding, phyllichnia markedly convex when dry (leaf-whorls 7–9-merous) **2.** subsp. **campestris**

2*. Infructescences on peduncles of 4–15 mm, *either* greyish-pubescent to tomentose when ripe *or* mostly 1·8–2·8 cm in diameter. Bracteoles flush or protruding. Phyllichnia only slightly convex when dry

3. Infructescences mostly 2·0–3·5 x 1·3–1·6 cm, with fruiting bracteoles ± flush with general surface and tawny to greyish pubescent or tomentose. Articles 5–12 mm long, 0·8–0·9 mm diam. (when dry), leaf-whorls 8–9-merous **3.** subsp. **eriochlamys**

3*. Infructescences mostly 2·0–5·2 x 1·8–2·8 cm, with fruiting bracteoles markedly protruding, tawny pubescent at first but glabrescent when fully ripe. Articles 8–15 mm long, 0·9–1·1 mm diam. (when dry), leaf-whorls 8–11-merous **4.** subsp. **grossa**

1. subsp. **campestris**

Lectotypus: Watheroo, *L. Diels* 2038, 31.xii.1900 (B). This is one of four syntypes and is a specimen with mature infructescences which are characteristically sessile, slender, and glabrescent. The Casuarinaceae in the Berlin Herbarium fortunately survived the 1939-1945 war.

This is the very wide-ranging and familiar form of *C. campestris* found throughout the wheat belt of Western Australia on sandplains and laterite. Occasional individuals may be found with over-sized infructescences, and there are forms near the southern coast which may approach subsp. *grossa* in this respect, though the infructescences are usually sessile or subsessile. Intergrading to subsp. *eriochlamys* appears to occur in the Coolgardie district. There is geographic overlap with subsp. *grossa* in the Norseman-Esperance area (see below).

2. subsp. **tessellata** (C. A. Gardn.) L. Johnson, comb. et. stat. nov.

C. tessellata C. A. Gardn. in J. Roy. Soc. W. Austral. 22:119 (1936). *Holotypus:* Summit of Mt. Singleton, *C. A. Gardner* 2217, 9.vii.1931. " erect, 10-15 ft. high, red loamy soil ", ♀ with cones (PERTH, isotype in K).

I have seen a number of collections, but all are from the type locality and they include no male material. A possibility remains that male inflorescences or chromosome number may support its retention as a species, but on the known characters it appears to differ no more from *C. campestris* subsp. *campestris*

than do the other subspecies here recognized. Subsp. *tessellata* is distinguished by the combination of characters listed in the Key. The peduncles range from 7 to 15 mm in length and the infructescences are similar in shape and size (but not bracteoles) to those of subsp. *campestris*, which subsp. *tessellata* also resembles in branchlet dimension and surface.

3. subsp. **eriochlamys** L. Johnson, subsp. nov.
[Greek: erion = wool, chlamys = mantle]

Articuli ramulorum 5–12 mm longi, 0·8–0·9 mm crassi, phyllichniis subconvexis, verticillis plerumque 8–9 foliatis. *Inflorescentiae masculae* eis subsp. *campestris* similes. *Infructescentiae* (" strobili ") in pedunculis 7–13 mm longis,maturae circiter 2·0–3·0 cm longae, 1·2–1·6 cm diametro; bractearum facies externa ea subspecierum alterarum crassior; bracteolae (" valvae ") haud protrudentes, ad maturitatem pubescentes vel cano-tomentosae.
Holotypus: NSW 61832, Comet Vale, *J. T. Jutson* 255, viii.1917, ♀ with inflorescences and infructescences.

Branchlet *articles* 5-12 mm long, 0·8-0·9 mm thick, phyllichnia (" ridges ") somewhat convex but not prominently so, whorls with 8-9 leaves (" teeth "). *Male inflorescences* like those of subsp. *campestris*. *Infructescences* (" cones ") on peduncles of 7-13 mm, when mature 2·0-3·0 cm long, 1·3-1·6 cm in diameter; the outer face of the bracts thicker than in the other subspecies; bracteoles (" valves ") not protruding (flush with the general cone surface), tawny to greyish or whitish pubescent or tomentose at maturity.

This subspecies is represented by a number of collections from Comet Vale (of which Royce 4444 and Gardner 7969 in PERTH are good examples). Some specimens of subsp. *campestris* from the Coolgardie district show some approach to subsp. *eriochlamys* in having a denser and more persistent indumentum on the infructescences and less convex phyllichnia than is usual in the type subspecies. Again, subsp. *grossa* shares certain characters (pedunculate infructescences, non-prominent phyllichnia) with subsp. *eriochlamys* and in the northern part of its range may approach the latter subspecies.

4. subsp. **grossa** L. Johnson, subsp. nov.
[Latin: grossus = coarse, thick]

Articuli ramulorum 8–15 mm longi, 0·9–1·1 mm crassi, phyllichniis planis vel subconvexis, verticillis 8–11-foliatis. *Inflorescentiae masculae* eis subsp *campestris* similes sed aliquanto crassiores. *Infructescentiae* (" strobili ") in pedunculis 4–15 mm longis, maturae 2·0–5·2 cm longae, 1·8–2·8 cm diametro; bracteolae (" valvae ") valde protrudentes, primum fulvo-pubescentes sed ad maturitatem glabrescentes.
Holotypus: NSW 58480, 5½ miles (9 km) N. of Norseman, *L. A. S. Johnson* W177, 18.xii.1960, " bushy shrubs to 2–2·5 m around granite tors with *Eucalyptus websterana*. Uniform population. Dioecious here. *C. helmsii* nearby ". Isotype in PERTH.

Branchlet *articles* 8-15 mm long, 0·9-1·1 mm thick, phyllichnia (" ridges ") flat or somewhat convex but not prominently so, whorls with 8-11 leaves (" teeth "). *Male inflorescences* like those of subsp. *campestris* but somewhat thicker. *Infructescences* (" cones ") on peduncles of 4-15 mm, when mature 2·0-5·2 cm long, 1·8-2·8 cm in diameter; bracteoles (" valves ") strongly protruding, at first tawny-pubescent but glabrescent at maturity.

This subspecies grows characteristically around granite tors in the Norseman district, a habitat rather different from those of subsp. *campestris*. There are a number of collections from this area and habitat but there are also forms with large infructescences and coarse branchlets in various other south-eastern localities which seem to connect subsp. *grossa* with subsp. *campestris*.

More extensive collecting and exploration may make it clearer whether these four races are in fact best treated as subspecies.

Casuarina cristata Miq., Rev. Crit. Cas. 70, t.10 (1848).

This widespread species will be dealt with elsewhere but it is convenient at this stage to establish formally the two subspecies into which it may be subdivided.

1. subsp. **cristata**

This comprises the populations in Queensland (except for a small area of subsp. *pauper* in the far south-west, isolated from other Queensland occurrences of the species) and in New South Wales east of a line from west of Moree to Lake Cargelligo and Barmedman. In this area, where it is known as " Belah ", it occurs on heavy grey or black soils with calcium carbonate in the lower horizons. The type locality is at " Fields Plains ", now the Condobolin district. For some 50 km or so to the west of this line there are occasional occurences of forms intermediate between subsp. *cristata* and subsp. *pauper*.

2. subsp. **pauper** (F. Muell. ex Miq.) L. Johnson, comb. et stat. nov.
C. pauper F. Muell. ex Miq. in Ned. Kruidk. Arch. 4:98 (1859).

This subspecies, the " Black Oak " of South Australia, extends from western New South Wales (west of the transitional zone to subsp. *cristata*) through north-western Victoria and South Australia (the type locality is in Eyre Peninsula) to southern inland districts of Western Australia, where it appears sometimes to hybridize with *C. obesa* Miq.

C. cristata subsp. *pauper* also occurs on soils with a calcareous subsoil but these usually have a lighter-textured and more reddish or brownish surface horizon than those on which subsp. *cristata* occurs. It differs from subsp. *cristata* in the usually thicker and more waxy-surfaced branchlets and the shorter fruiting bracteoles of the infructescences, which are also often more persistently tawny-pubescent. The trees are usually smaller and of poorer form.

C. obesa is more closely related to the eastern Australian *C. glauca* Sieber ex Spreng. and, like that species, occurs on more or less saline soils. It is common in Western Australia but in South Australia and New South Wales it is known to persist in only two localities, whilst in Victoria it is represented only by one old unlocalized collection.

I am grateful to the past and present officers in charge of the herbaria from which specimens have been examined and to Dr R. F. Parsons for the opportunity of examining his collections. My colleague Dr Barbara Briggs has kindly made available the result of her investigation of the chromosome number of *C. scleroclada*. Mrs Eleanor Bennett has been most helpful in the provision of material and information.

Reference

BARLOW, B. A. (1959)—Chromosome numbers in the Casuarinaceae. Austral. J. Bot. 7:230–237.