

CHENOPODIACEAE

G.M. Wightman & P.S. Short

Herbs or sometimes shrubs, their stems often succulent or jointed. *Leaves* usually alternate, simple and commonly succulent, in some species opposite and reduced to small lobes at the apex of succulent, jointed internodes (articles); stipules absent. *Flowers* small, often green, unisexual or bisexual, in bracteate or bractless cymes or panicles, or solitary and axillary. *Perianth* segments (tepals) usually 1–5 in a single whorl, free or basally united, or sometimes lacking, sometimes enlarging in fruit to form tubercles, spines or wings. *Stamens* opposite and equal in number to tepals or fewer; anthers tetrasporangiate and dithecal, opening by longitudinal slits. *Gynoecium* of 2 or 3 carpels united to form a compound, unilocular, superior or rarely half-inferior ovary; ovules solitary, basal; stigmas 2 or 3. *Fruit* a nut, berry or utricle with a membranous, crustaceous or succulent pericarp. *Seeds* usually lenticular; testa membranous or crustaceous.

A cosmopolitan family of *c.* 100 genera and 1,400–1,500 species, with most diversity in semiarid regions and saline habitats. Thirty-two genera (four introduced) and *c.* 300 species occur in Australia. Cultivated species include Beetroot and Sugarbeet (both *Beta vulgaris*) and Spinach (*Spinacia oleracea*).

The above family description and notes on the number of taxa are based on Cronquist (1981), Wilson (1984) and Kühn *et al.* (1993). The latter authors recognised four subfamilies, each with one or more tribes. Following them, *Suaeda* (tribe Suaedeae) and *Salsola* (tribe Salsoleae) belong to the subfamily Salsoloideae, and *Tecticornia* in the subfamily Salicornioideae (tribe Salicornieae).

Chenopodiaceae are sometimes included in Amaranthaceae (*e.g.* Mabberley 2008) although Müller & Borsch (2005) indicated that a modified classification maintaining both Chenopodiaceae and Amaranthaceae as monophyletic families may be possible.

Taxonomic references: Wilson (1980, 1984); Cronquist (1981); Kühn *et al.* (1993); Judd *et al.* (1999); Müller & Borsch (2005); Shepherd *et al.* (2005); Shepherd & Wilson (2007); Mabberley (2008).

- | | | |
|----|---|--------------------|
| 1 | Plants appearing leafless and young branches composed of succulent segments (articles) | Tecticornia |
| 1: | Plants with narrow, terete leaves | 2 |
| 2 | Flowers with spinescent bracteoles; fruiting perianth segments with large wings | Salsola |
| 2: | Flowers with scarious, scale-like bracteoles; fruiting perianth segments without obvious appendages | Suaeda |

SALSOLA L.

Herbs or shrubs, glabrous or hairy. *Leaves* mostly alternate, sessile, entire. *Flowers* bisexual, and mostly solitary in leaf axils, each subtended by 2 leaf-like bracteoles. *Perianth* of 5, free, scarious tepals; each tepal usually developing a transverse scarious wing in fruit. *Stamens* 5. *Ovary* subglobose; stigmas 2. *Utricle* dry and included within the perianth. *Seed* orbicular; testa membranous; embryo in a conical spiral.

Predominantly Eurasian genus of *c.* 130 species.

Taxonomic references: Rilke (1999a, b); Borger *et al.* (2008); Hrusa & Gaskin (2008); Borger & Scott (2009).

S. australis R. Br.*S. tragus* L. subsp. *tragus**S. kali* auct. non. L.

Erect, succulent, probably annual *subshrubs* to *c.* 60 cm tall, glabrous. *Leaves* linear or linear-triangular, 5–50 mm long, 1–2 mm wide, decurrent, spreading or recurved, with spinescent apices. *Bracteoles* and floral leaves tending to be shorter and wider than the cauline leaves. *Tepals* *c.* 3 mm long and not or inconspicuously exceeding the bracts, membranous at anthesis. *Anthers* 0.9–1.2 mm long. *Fruiting perianth* developing horizontal, cartilaginous protuberances or wings to *c.* 1 mm wide, the central upper column formed by the tepals *c.* 1 mm long. *Flowering & fruiting*: data inadequate. **Roly-poly, Prickly Saltwort.**

Fig. 2 (*Booth 327*); Pl. 1 (unvouchered).

In the D.R. *Salsola* is only known as a coastal plant which commonly grows at the back of beaches just above high tide. Localities include Golden Sands (Cox Peninsula), Channel Point, the beach at Rapid Creek, and the north-west coast of Melville Island.

Following Rilke (1999a), all Australian material of this genus belongs to *S. tragus* L., with it naturally ranging from northern Africa and western Europe to eastern Asia, with Australia – where it occurs in all mainland States – having two adventive subspecies (subsp. *tragus* and subsp. *pontica* (Pall.) Rilke) and one endemic subspecies (subsp. *grandiflora* Rilke). All occur in the N.T., with specimens in the D.R. seemingly referable to subsp. *pontica*, a taxon characterised among other things by the absence of, or very narrow, wings on the fruiting perianth. However, in recent times it has become evident that Rilke's treatment is inadequate. Molecular, cytological and morphological work (Borger *et al.* 2008; Hrusa & Gaskin 2008; Borger & Scott 2009) has indicated that *S. tragus* *s.str.* may not even occur in Australia and that the name *S. australis* R. Br. applies to the common weedy species found throughout south-west W.A. and perhaps all of Australia. Whether this includes specimens Rilke referred to as *S. tragus* subsp. *pontica* is not clear but, somewhat tentatively, the name *S. australis* is here adopted for the species in the D.R.

SUAEDA Forssk. ex Scop.

Herbs or shrubs, glabrous or sparsely hairy. *Leaves* alternate, entire, succulent. *Flowers* unisexual or bisexual, axillary, single or in clusters, each subtended by several, small, scale-like bracteoles. *Perianth* succulent, barely to deeply 5-lobed, sometimes enlarging in fruit. *Stamens* 5, hypogenous or attached to perianth tube. *Ovary* free or partially attached to perianth, hemispherical or conical; stigmas 2 or 3. *Seed* lenticular; testa brittle or membranous; embryo in a plane spiral.

Genus of more than 100 species, with most from the northern hemisphere. Five species in Australia, two being endemic and three introduced, but only *S. arbusculoides* is in the N.T.

Taxonomic references: Wilson (1984); Wightman (2006).

S. arbusculoides L.S. Sm.

Erect, woody, often rounded *subshrub* to 50 cm high, young stems green or reddish and somewhat flexuose, glabrous. *Leaves* sessile, oblanceolate or narrowly fusiform, 10–20 mm long, 2–3 mm wide, fresh leaves in cross-section almost circular or semicircular with one flat side. *Flowers* bisexual, in axillary clusters of 1–5; subtended by 2 or 3 small, scale-like bracteoles. *Perianth* succulent, lobes 5, suborbicular, green, fleshy, 1.5–2 mm wide. *Stamens* 5; filaments *c.* 1.3 mm long; anthers ovate, *c.* 1 mm long. *Ovary* hemispherical, superior; locule 1; ovule 1; style 1 mm long, bi- or trilobed, persistent. *Fruit* semi-globose, *c.* 3.5 mm diam., pericarp membranous. *Seed* 1, circular, 2–3 mm wide; testa membranous, transparent.

Flowering & fruiting: throughout the year, but mainly Mar.–June.

Fig. 1 (*Short 5372*; *Wightman 975 & 3309*). Pl. 2 (unvouchered).

Australian endemic (W.A., N.T., Qld). A coastal species found in poorly drained tidal areas, in sands and muds, with open salt pans and mangrove shrublands being common habitats.

Associated species include *Avicennia marina*, *Batis argillicola*, *Ceriops australis*, *Sporobolus virginicus* and *Tecticornia australasica*. Superficially, the species resembles *Batis argillicola*. However, that species has opposite leaves.

The small, white flowers are insect-pollinated. The fleshy, green fruit is thought to be distributed by birds. This plant is not recorded as being used

in any way by Aboriginal people in the N.T. but in Vietnam the new, tender leaves are eaten in times of hardship.

Suaeda arbusculoides

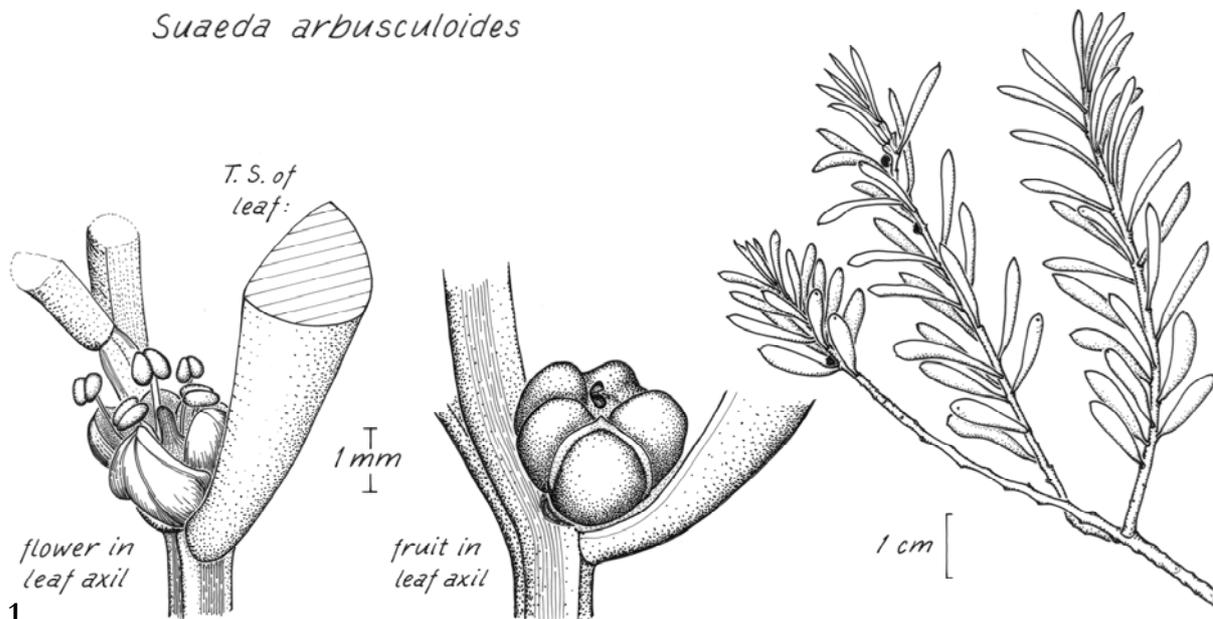


Fig. 1

TECTICORNIA Hook.f.

Annual or short-lived perennial *shrubs* or herbs; branchlets composed of succulent, globose to cylindrical segments or internodes (articles); segment apices shortly cup-shaped or bilobed and representing the reduced opposite leaves; sclereids absent from the peripheral chlorenchyma (palisade). *Inflorescence* a lateral or terminal spike-like thyrs composed of opposite pairs of (1–) 3 (7)-flowered cymules in the axil of each bract or scattered among the articles; bracts opposite, united or free, succulent. *Flowers* sessile, bisexual, female or male (one species dioecious), concealed within the bracts or exposed. *Perianth* succulent or membranous, lobes 2 lateral and with or without an abaxial lobe. *Stamen* 1. *Ovary* free or fused to stem cortex; style slender, 2- or rarely 3-lobed. *Fruiting perianth* membranous, spongy, succulent, pithy, brittle or hard. *Seed* ovoid to circular, with or without a beak; testa membranous to brittle, smooth or ornamented. **Samphires, Glassworts.**

About 33 species, with all but *T. australasica* and *T. indica* confined to Australia. Eleven species in the N.T., with three in the D.R.

Morphological and molecular studies of Australian Salicornioidea by Shepherd *et al.* (2005) indicated that several genera recognised by Wilson (1980, 1984) were untenable. Species previously included in *Halosarcia*, *Pachycornia*, *Sclerostegia* and *Tegicornia* have since been transferred to *Tecticornia* (Shepherd & Wilson 2007).

At the time of compiling this account many specimens otherwise held at DNA were on loan. The descriptions are therefore largely drawn from the accounts by P.G. Wilson.

In the D.R. both *T. australasica* and *T. indica* have been recorded as larval food plants of the lycaenid butterfly *Theclinessthes sulphitius* (Samphire Blue) (Meyer & Wilson 1995).

Taxonomic references: Wilson (1972, 1980, 1984); Wightman (2006); Shepherd & Wilson (2007).

- | | | |
|----|--|------------------------|
| 1: | Articles of branchlets commonly more than 10 mm long; perianth of 2 lateral lobes | T. australasica |
| 1 | Articles of branchlets to 10 mm long; perianth of 3 lobes, 2 lateral and 1 abaxial | 2 |

- 2 Articles to 5 mm long, never glaucous; perianth apex rounded to truncate **T. halocnemoides** subsp. **tenuis**
- 2: Articles 5–10 mm long, often glaucous; perianth dorsiventrally flattened at apex **T. indica** subsp. **julacea**

T. australasica (Moq.) Paul G. Wilson

Annual, fleshy *herb* to 40 cm high, glaucous, glabrous; lower branches procumbent, upper branches erect. *Articles* bluish-green, succulent, 7–15 mm long, apex shortly bilobed, lobes representing reduced, opposite leaves. *Spikes* terminal, occasionally lateral and sessile, narrowly ovoid to narrowly cylindrical, 10–40 mm long, 5–7 mm wide; bracts decussate, free, semi-circular. *Flowers* sessile, bisexual, 3–5 per bract. *Perianth* succulent; lobes 2, laterally appressed, acute, plano-convex, united abaxially towards base. *Stamen* 1, abaxial. *Ovary* thin-walled, superior, 2- or 3-carpellate, unilocular; ovule 1; style slender, bilobed. *Fruiting sepals* free, areolate and hyaline when dry; pericarp membranous. *Seed* ovately discoidal, *c.* 1.5 mm long; testa dark brown with several rows of grey tubercles on upper margins. *Flowering & fruiting*: throughout the year but mainly Feb.–July. **Grey Samphire.**

Fig. 2 (*Fensham 1237*); Pl. 3 (unvouchered).

Java, New Guinea, Australia (N.T., Qld). In the N.T. it occurs sporadically around the coastline but is uncommon on the west coast. It grows on coastal clay pans and is sometimes associated with mangrove areas but it is intolerant of areas with high salinity, preferring habitats where there is seasonal inundation of fresh water. Associated species include *Avicennia marina*, *Batis argillicola*, *Osbornia octodonta*, *Sporobolus virginicus*, *Suaeda arbusculoides* and *Tecticornia indica*.

Distribution of the species is presumably enhanced by the fact that infructescences of this species are capable of floating in water, with seed being released on disintegration of the mature inflorescences. Seed germination occurs from March to August.

T. halocnemoides subsp. **tenuis**

(Paul G. Wilson) K.A. Sheph. & Paul G. Wilson

Halosarcia halocnemoides subsp. *tenuis* Paul G. Wilson

Spreading or erect *shrub* to 50 cm high; branchlets green or red. *Articles* narrowly barrel-shaped, *c.* 5 mm long, *c.* 2 mm wide, dull to glossy, entire. *Spikes* almost cylindrical, mostly 10–25 mm long, rarely to 70 mm long; articles circular or compressed. *Flowers* free, exposed at apex; perianth succulent, apex truncate or rounded,

lateral lobes prominent, abaxial lobe small and within lateral lobes. *Fruiting perianth* soft or chartaceous; pericarp thin. *Fruitlets* eventually breaking away from the axis. *Seed* discoid or suborbicular, 1 mm long; tuberculate in concentric rows over embryo but otherwise granular; reddish-brown. *Flowering & fruiting*: Apr.–Aug. **Red Glasswort.**

Fig. 2 (*Fensham 1237*); Pl. 4 (unvouchered).

Australian endemic (W.A., N.T., S.A., Qld) found on tropical coasts and on the margins of salt lakes in central Australia. In the D.R. it grows at the rear of mangals or on salt pans within, and behind, mangrove communities.

Five subspecies of *T. halocnemoides* have been recognised (Wilson, P.G. 1980; Shepherd & Wilson 2007). As well as subsp. *tenuis*, the subsp. *longispicata* (Paul G. Wilson) K.A. Sheph. & Paul G. Wilson is found in the N.T. It occurs further inland and is characterised by having slender spikes mostly 20–80 mm long and seeds which are tuberculate over the embryo but otherwise smooth.

T. indica subsp. **julacea** (Paul G. Wilson)

K.A. Sheph. & Paul G. Wilson

Halosarcia indica subsp. *julacea* Paul G. Wilson

Perennial, decumbent *shrub*, branchlets commonly green but sometimes reddish. *Articles* narrowly cylindrical, 4–10 mm long, bluntly lobed, non-ciliate. *Spikes* smooth, cylindrical, 20–50 mm long, 4–5 mm diam.; bract-pairs truncate, entire. *Flowers* free from each other but partly adherent to the upper bract; perianth lobes 2, side by side, not overlapping. *Fruiting spike* with swollen articles and bulging, visible fruitlets. *Fruiting perianth* firm and pithy, breaking up when mature; pericarp apically crustaceous but membranous below, never horny. *Seeds* subcircular, *c.* 1.5 mm diam.; testa dull and faintly reticulate. *Flowering & fruiting*: May–Nov. **Green Glasswort.**

Fig. 2 (*Short 5377*); Pl. 5 (unvouchered).

Coastal, tropical Australia (W.A., N.T., Qld) on tidal mud flats. In mangrove communities it is regularly found towards the landward margin. It may grow with *T. halocnemoides* but is often a monospecific ground cover.

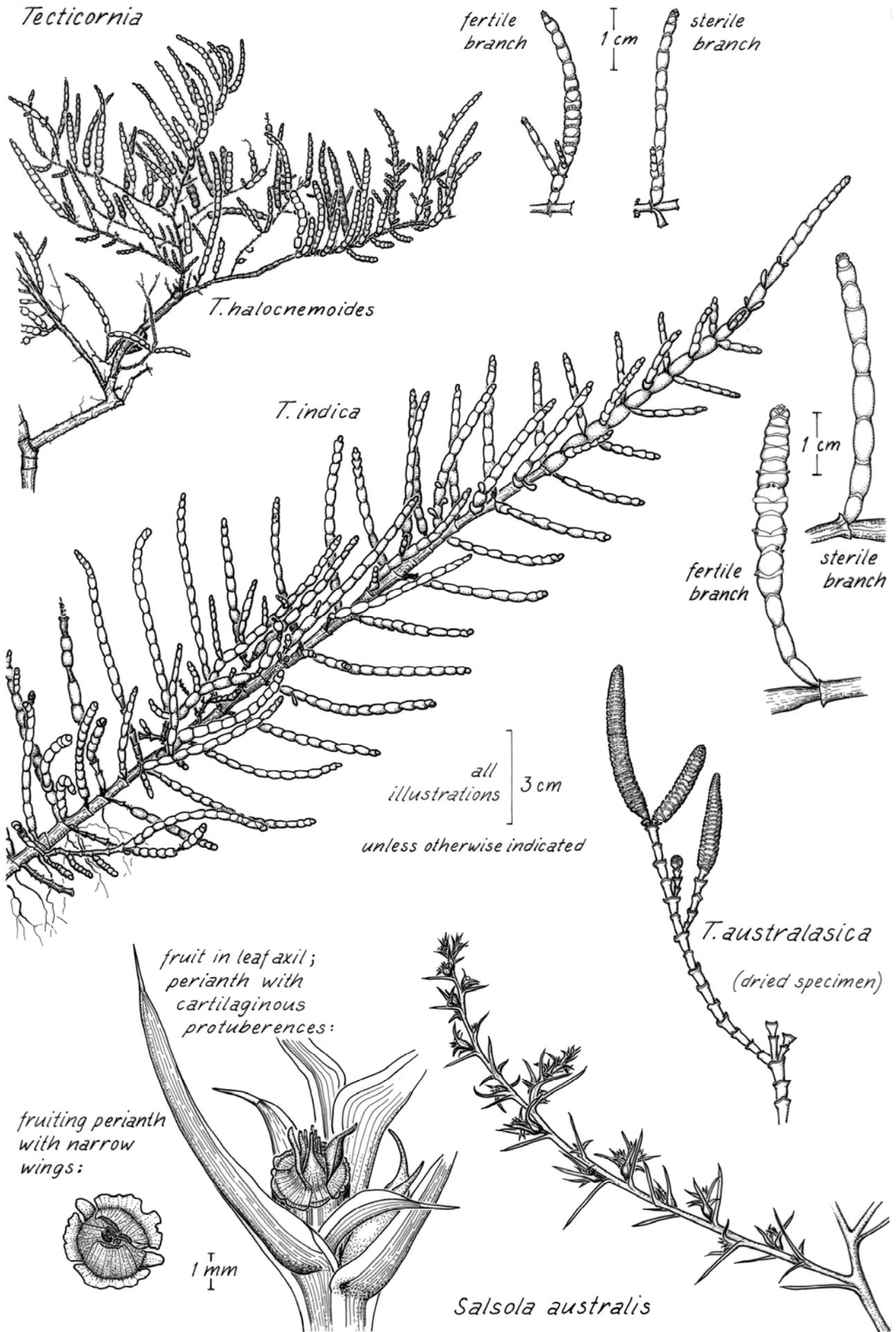


Fig. 2

As circumscribed by Wilson (1980, 1984) *T. indica* – which ranges from the tropical coasts of east Africa and east to Australia – is a highly variable species and Wilson recognised four subspecies to accommodate the more obvious entities. In addition to subsp. *julacea*, both subsp. *indica* and subsp. *leiostachya* (Benth.) K.A. Sheph. & Paul G. Wilson, are also found in the N.T. Although absent from the D.R. both do grow on tidal mud flats, although subsp. *leiostachya* is most often

found on the margins of inland salt lakes. In both of these subspecies the pericarp is horny throughout and the testa is smooth and glossy.

Aboriginal people in the southern Kimberley, W.A., eat the seeds. They are washed and then ground to make flour for damper and cakes (Wightman 2006).

Mud crabs (*Scylla serrata*) occasionally make their burrows under the decumbent stems.

REFERENCES

- Borger, C.P.D. & Scott, J.K. (2009). The biology of Australian weeds 55. *Salsola australis* R. Br. *Plant Protection Quarterly* 24: 126–137.
- Borger, C.P.D., Yan, G., Scott, J.K., Walsh, M.J. & Powles, S.B. (2008). *Salsola tragus* & *S. australis* (Chenopodiaceae) in Australia – untangling taxonomic confusion through molecular and cytological analyses. *Australian Journal of Botany* 56: 600–608.
- Cronquist, A. (1981). *An Integrated System of Classification of Flowering Plants*. (Columbia University Press: New York).
- Hrusa, G.F. & Gaskin, J.F. (2008). The *Salsola tragus* complex in California (Chenopodiaceae): characterization and status of *Salsola australis* and the autochthonous allopolyploid *Salsola ryanii* sp. nov. *Madrono* 55: 113–131.
- Judd, W.S., Campbell, C.S., Kellogg, E.A. & Stevens, P.F. (1999). *Plant Systematics. A Phylogenetic Approach*. (Sinauer Associates Inc.: Sunderland, Mass., U.S.A.).
- Kühn, U., Bittrich, V., Carolin, R., Freitag, H., Hedge, I.C., Uotila, P. & Wilson, P.G. (1993). Chenopodiaceae. In Kubitzki, K., Rohwer, J.G. & Bittrich, V. (eds), *The Families and Genera of Vascular Plants*. (Springer-Verlag: Berlin). Vol. 2, pp. 253–281.
- Mabberley, D.J. (2008). *Mabberley's Plant-Book: a Portable Dictionary of Plants, their Classification and Uses*. (Cambridge University Press: Cambridge).
- Meyer, C.E. & Wilson, D.N. (1995). A new distribution record for *Theclinesthes sulphitius* (Miskin) (Lepidoptera: Lycaenidae) in the Northern Territory and notes on the life history. *Australian Entomologist* 22: 63.
- Müller, K. & Borsch, T. (2005). Phylogenetics of Amaranthaceae based on *matK/trnK* sequence data – evidence from parsimony, likelihood, and Bayesian analyses. *Annals of the Missouri Botanical Garden* 92: 66–102.
- Rilke, S. (1999a). Revision der sektion *Salsola s.l.* der gattung *Salsola* (Chenopodiaceae). *Bibliotheca Botanica* 149.
- Rilke, S. (1999b). Species diversity and polymorphism in *Salsola* sect. *Salsola sensu lato* (Chenopodiaceae). *Systematics and Geography of Plants* 68: 305–314.
- Shepherd, K.A., Macfarlane, T.D. & Waycott, M. (2005). Phylogenetic analysis of the Australian Salicornioideae (Chenopodiaceae) based on morphology and nuclear DNA. *Australian Systematic Botany* 18: 89–115.
- Shepherd, K.A. & Wilson, P.G. (2007). Incorporation of the Australian genera *Halosarcia*, *Pachycornia*, *Sclerostegia* and *Tegicornia* into *Tecticornia* (Salicornioideae, Chenopodiaceae). *Australian Systematic Botany* 20: 319–331.
- Wightman, G.M. (2006). Mangroves of the Northern Territory, Australia: identification and traditional use. *Northern Territory Botanical Bulletin* 31: 1–168.

- Wilson, P.G. (1972). A taxonomic revision of the genus *Tecticornia* (Chenopodiaceae). *Nuytsia* 1: 277–288.
- Wilson, P.G. (1980). A revision of the Australian species of Salicornieae (Chenopodiaceae). *Nuytsia* 3: 3–154.
- Wilson, P.G. (1984). Chenopodiaceae. In George, A.S. (ed.), *Flora of Australia*. (Australian Government Publishing Service: Canberra). Vol. 4, pp. 81–316.



Pl. 1 *Salsola australis* (Photo: D.E. Biso)



Pl. 2 *Suaeda arbusculoides* (Photos: G.M. Wightman)



Pl. 3 *Tecticornia australasica*
(Photo: G.M. Wightman)



Pl. 5 *Tecticornia indica* subsp. *julacea*
(Photo: G.M. Wightman)



Pl. 4 *Tecticornia halocnemoides* subsp. *tenuis*
(Photo: G.M. Wightman)