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Aizoaceae

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AIZOACEAE Martinov

(Ice plant family; *Vygiefamilie*)

by

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Annual, biennial or perennial herbs, subshrubs or shrubs, rarely plants reduced to a single leaf-pair. **Stems** erect or prostrate and mat-forming, or underground. **Leaves** usually simple, often fleshy or scale-like, opposite or sometimes alternate, margins mostly entire; epidermis sometimes with bladder cells, often papillate to pubescent; blade flat, terete or triquetrous; true stipules absent, sometimes a stipuliform appendage present or leaves sessile or with leaf sheath. **Inflorescence** a terminal or seemingly axillary cyme, or flowers solitary; bracts present or absent. **Flowers** usually bisexual, rarely unisexual, actinomorphic, perigynous to hypogynous or epigynous, hypanthium present, with or without pedicel. Perianth consisting of sepals and petals or perigone. **Sepals** (3–)5(–8), sometimes petaloid and coloured, often with dorsal subapical appendage. **Petals** commonly absent or numerous, distinct or connate proximally, often 2–4 seriate, linear. **Stamens** 1–very numerous, free or connate at base, rarely connate with petals forming a tube; anthers bilocular, dehiscing by longitudinal slits. **Ovary** superior, inferior or semi-inferior, 1–5- or many- carpellate, syncarpous; ovules 1–many per carpel; styles 1–25 or absent, distinct or partly connate; stigmas 2–25. Nectaries absent, separate or in a ring around ovary. **Fruit** a hygrochastic loculicidal, rarely septicidal or xeromorphic capsule, with or without membranes covering the seeds, sometimes dehiscence circumscissile, or fruit a hard 1-seeded nut, or more rarely a drupe. **Seed** 1–many, usually ± ovoid, sometimes with aril, usually papillose.

References: Hartmann (2001a), Vivrette *et al.* (2003).

The family treatment here follows that of Smith *et al.* (1998) and Hartmann (2001a), and excludes the Molluginaceae while including groups sometimes considered families of their own, e.g. Sesuviaceae, Tetragoniaceae and Mesembryanthemaceae. The Aizoaceae, as treated here, consists of about 130 genera and 2 500 species (Vivrette *et al.*, 2003).

Members of the Aizoaceae are found on all continents (except Antarctica) (Vivrette *et al.*, 2003), throughout the tropics and subtropics with the centre of diversity (at species level) being in the southwestern part of Africa (Smith *et al.*, 1998; Hartmann, 2001a). Species may occur in habitats as diverse as dry subtropical deserts, wet tropical coasts, and snow-covered subtropical mountains, but the highest number of genera and species inhabit semi-arid (100–400 mm annual precipitation) winter-rainfall areas (Hartmann, 2001a). Particularly the group popularly known as mesembs ('vygies' in Afrikaans; also known as fig-marigolds, flowering stones, ice plants and midday flowers), have diversified extensively in southern Africa's winter-rainfall area, with over 1 500 species being known from, and mostly restricted to, this region (Smith *et al.*, 1998; Van Jaarsveld *et al.*, 2000).

Many members of the family are of economic importance as ornamentals and are in

cultivation worldwide resulting in a number of species occurring outside their natural distribution ranges e.g. *Carpobrotus edulis* (L.) N.E.Br., *Mesembryanthemum crystallinum* L. or *Disphyma crassifolium* (L.) L.Bolus (Vivrette *et al.*, 2003). Some species are also used to stabilise sand dunes in coastal regions (Heywood *et al.*, 2007), while others are important in the southern African medicinal plant trade (Smith & Crouch, 1999).

Only one species from a single genus is naturalised in southern Africa.

***Tetragonia* L.**

Annual or perennial herbs or subshrubs, with shiny, translucent bladder cells, resulting in a white appearance of the leaves, glabrous, pilose, or papillate. Stems erect, ascending or prostrate, semi-woody at base. **Leaves** alternate, often opposite basally; petiole short to long; blade flat, ovate to almost linear, margins entire to slightly sinuate or shallowly lobed; epidermis with variously-shaped papillae, often of two types with one elongate and hairy; stipules absent. **Inflorescences** axillary clusters of flowers or flowers solitary, sessile or peduncled; bracts usually absent. **Flowers** bisexual or unisexual, inconspicuous, 0.5–1 cm in diameter, sessile or pedicellate. **Perianth** campanulate, adnate to ovary; lobes (3–)4(–7), green or yellow adaxially, basally united into a short tube. **Petals** and petaloid staminodia absent. **Stamens** 1–20, usually twice the number of the perianth lobes, perigynous. **Pistil** 3–10-carpellate. **Ovary** inferior, (1–)3–10-loculed; ovule 1 per locule, pendulous; styles 3–10; stigmas 3–10. **Fruit** a woody, indehiscent nut with persistent perianth, ridged, winged or tuberculate, usually with 4 rows of ornaments, often apically as horns, brown to black. **Seeds** 1–10, sub-reniform or pyriform, light brown, arils absent.

References: Adamson (1955), Taylor (1994), Hartmann (2001b), Lu & Hartmann (2003), Vivrette (2003).

Tetragonia consists of about 60 species (Lu & Hartmann, 2003; Vivrette, 2003) with representatives in Africa, South America, East Asia, Australia and New Zealand, where they prefer tropical climates though are also found in drier climates in the southern hemisphere (Taylor, 1994; Hartmann, 2001b). Some members of the genus have naturalised elsewhere (Lu & Hartmann, 2003; Vivrette, 2003).

The name for the genus comes from the Greek words *tetra* (four) and *gone* (reproductive organs), and refers to the four-angled or four-winged fruits found in many of the species (Hartmann, 2001b).

There are 32 species of *Tetragonia* in South Africa (Germishuizen *et al.*, 2006). *Tetragonia tetragonioides* was classified in subgenus *Tetragonoides* DC. (Adamson, 1955). The subgenus is characterised by the simple fruit, 1–8-celled, with cells as many as fruit cells, stamens up to twice the number of perianth segments and ovary bulging above the insertion of the perianth (Adamson, 1955). *T. tetragonioides* can be distinguished from the other species in the subgenus that occur in South Africa with the following key [adapted from Adamson (1955)]:

Key to distinguish *T. tetragonioides*

- 1. Flowers in groups of 3–5 or more 2
- 1'. Flowers solitary or in pairs 3

- 2. Flowers sessile, ovary projecting as a cone; fruit with 3–4 flat projections at the top (*Tetragonia microptera*)
- 2'. Flowers shortly pedicellate; ovary with 2–3 obtuse projections around the styles; fruit ridged with spine-like outgrowths on the ridges
. (*Tetragonia echinata*)

- 3. Fruit covered all over with spine-like outgrowths
. (*Tetragonia acanthocarpa*)
- 3'. Fruit without spine-like outgrowths 4

- 4. Plant papillose-hairy all over; stamens as many as perianth segments; fruit ridged (*T. caesia*)
- 4'. Plant glabrous-papillose; stamens twice as many as perianth segments; fruit smooth, with horn-like projections at the top . . .
. *Tetragonia tetragonioides*

Tetragonia tetragonioides (Pall.) Kuntze

In: *Revisio Generum Plantarum* 1: 264 (1891) (as “*tetragonioides*”).

=*Demidovia tetragonioides* Pall. (basionym)

=*Tetragonia expansa* Murray

Common name: New Zealand spinach (English).

Annual herbs, prostrate to ascending, up to 60 cm tall. Stems mat-forming; internodes with densely placed bladder cells when young. **Leaves** alternate; petiole 0.5–3 cm long, thick, winged; blade rhomboid-ovate or deltoid-ovate, 0.5–10.7 × 2.5–8 cm, base truncate, pale green abaxially, dark green adaxially, epidermis with large, globose papillae abaxially, fewer along the margins,. **Flowers** solitary, rarely 3, sessile or with pedicel up to 2 mm long. **Perianth** with tube 2–3 mm long; lobes spreading, usually 4, up to 2 mm long, ovate to semi-orbicular, papillate and green outside, bright yellow to yellowish green and minutely papillate inside. **Stamens** 10–13, clustered or scattered. **Fruit** turbinate, 0.8–1.2 cm long and 1 cm in diameter; horns 4–6. **Seeds** as many as locules, pyriform, smooth, amber to light brown. **Distribution:** SA. (Fig. 67).

References: Hartmann (2001b), Lu & Hartmann (2003), Vivrette (2003).

First collected from New Zealand, this plant became known as a food plant and has spread all over the world (Hartmann, 2001b), becoming naturalised in many regions (Lu & Hartmann, 2003; Vivrette, 2003). As the common name suggests, New Zealand spinach may be eaten, raw or cooked, as a leaf vegetable and is a delicious spinach substitute (Fig. 68) (Plants for a Future, 2008). Seeds require

warm temperatures to germinate and plants are cultivated and sold as a summer spinach in temperate regions. In certain Asian cultures it is believed to be effective against enteritis and stomach ache (Sung *et al.*, 1998), as well as stomach cancer and stomach ulcers (Kato *et al.*, 1985).

It is naturalised in the coastal region of KwaZulu-Natal in South Africa. It is possible that the introduction of this species is due to plants being washed ashore from passing ships (Fox & Norwood Young, 1982). A place near Richards Bay is known as Spinach Point due to the fact that local Zulus would load their canoes with plant material from that area (Fox & Norwood Young, 1982). Plants are frost-sensitive (Plants for a Future, 2008) and unlikely to survive the cold winters of the South African interior above the Great Escarpment without protection under glass or in plastic tunnels. Thus far the species does not appear to be problematic and no eradication measures are necessary. However, where possible, known populations should be monitored for future expansion. Vegetatively plants (Fig. 69, 70) look similar to some representatives of what Smith *et al.* (1998) termed the 'weedy mesembs', but the flowers of *T. tetragonoides* are insignificant (Fig. 71), unlike the strawberry-red ones of the similar-looking *Aptenia cordifolia* (L.F.) Schwantes, for example.



Fig. 67. Distribution map of *Tetragonia tetragonoides* (Pall.) Kuntze.



Fig. 68. A dish prepared from *Tetragonia tetragonioides* (Pall.) Kuntze leaves.
(Picture by Gideon F. Smith)



Fig. 69. Colony of *Tetragonia tetragonioides* (Pall.) Kuntze.
(Picture by Neil R. Crouch)



Fig. 70. Plant of *Tetragnonia tetragonioides* (Pall.) Kuntze.
(Picture by Neil R. Crouch)



Fig. 71. Flowers and crystalline leaf surface of *Tetragnonia tetragonioides* (Pall.) Kuntze. (Picture by Neil R. Crouch)