



Fig. 265. Leaves of *Tradescantia zebrina* Heynh. ex Bosse are striped.
(Picture by Neil R. Crouch)



Fig. 266. *Tradescantia zebrina* Heynh. ex Bosse invasion.
(Picture by Neil R. Crouch)

CRASSULACEAE J.St.-Hil.

(Stonecrop, Orpine or Houseleek family; *Plakkiefamilie*)

by

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Perennial (rarely annual or biennial) herbs, subshrubs or shrubs (rarely aquatics, or tree-like, or epiphytic, or scandent), always with more or less fleshy leaves, sometimes with succulent stems, rhizomes, underground caudices or succulent roots. **Leaves** opposite and decussate or alternate and whorled, often arranged into rosettes, usually sessile/ subsessile rarely petiolate, simple (pinnate in *Bryophyllum*), usually entire, or crenate, rarely lobed or imparipinnate, glabrous or covered in hairs, papillae, bristles or wax; stipules absent. **Inflorescence** usually a many-flowered axillary or terminal cyme, corymb, or rarely true spike, raceme or panicle. **Flowers** bisexual or unisexual (then plants dioecious or rarely gynodioecious), actinomorphic (except *Tylecodon grandiflorus*), 3- to 32-merous (though often 5-merous). **Sepals** free or basally connate, persistent. **Petals** free or basally connate to form a short to long corolla tube. **Stamens** as many (in 1 series) or twice as many (in 2 series) as petals, free or fused to the petals; anthers 2-locular, basifixed, longitudinally and laterally dehiscent. **Ovary** superior or semi-inferior; carpels equal in number to petals, free or slightly fused basally, with a small to conspicuous nectary scale at or near the base; styles gradually tapering, short or elongated; ovules few to many. **Fruit** usually a dehiscent group of follicles, capsular. **Seeds** small, 1–20+ per carpel, elongate, up to 1.5–3 mm long, smooth, papillate to longitudinally ridged, mostly brownish, with little or no endosperm.

References: Egli (2003), Heywood *et al.* (2007), Thiede & Egli (2007), Moran (2009).

There are c. 1 500 species from c. 35 genera (Heywood *et al.*, 2007) in Crassulaceae making it the third largest succulent plant family (after *Aizoaceae* Martynov. and *Cactaceae* Juss.; orchids excluded). Seven of these genera occur in southern Africa i.e. *Aeonium* Webb & Berthel., *Adromischus* Lem., *Bryophyllum* Salisb., *Cotyledon* L., *Crassula* L., *Kalanchoe* Adans. and *Tylecodon* Tölken. Of these, *Adromischus* and *Tylecodon* are endemic to the region, while *Bryophyllum* and *Aeonium* are entirely exotic genera. The Crassulaceae are distributed worldwide but have centres of endemism in South Africa, Madagascar, East Asia, Mexico and Macaronesia, while being poorly represented in the wet tropics, Australia and South America (Thiede & Egli, 2007; Heywood *et al.*, 2007).

There is still some uncertainty around the generic boundaries in this family. The family was traditionally divided into six subfamilies, a division long recognised as unnatural, but more recent work resulted in a division into only three subfamilies i.e. Crassuloideae Burnett [*Crassula* (including *Tillaea* L., *Rochea* DC., *Dinacria* Harv. & Sond. and *Pagella* Schönland) and *Hypagophytum* A.Berger], Kalanchoideae A.Berger (*Adromischus*, *Bryophyllum*, *Cotyledon*, *Kalanchoe* and

Tylecodon) and Sempervivoideae Arnott (all remaining genera) (Thiede & Eggli, 2007; Takhtajan, 2009).

Most members of the Crassulaceae prefer warm, dry regions and are frequently found in arid and/or rocky habitats. The most notable exceptions are the adaptation to aquatic environments some species display, and the adaptation to frosty conditions of others (Heywood *et al.*, 2007).

Many species in the Crassulaceae are popular in the horticultural trade. The plants are frequently hardy and thus make good garden subjects. One species, *Hylotelephium spectabile* (Boreau) H. Ohba, is sometimes grown commercially for its flowers (Eggl, 2003). Plants of this family are extremely popular with succulent plant collectors and are well-known for their ability to grow easily from cuttings or even from single leaves, which has undoubtedly facilitated the movement of some species to gardens, window-boxes and pots throughout the world.

Many members of the Crassulaceae are eaten and/or used medicinally in many parts of the world (Plants for a Future, 2008; Arnold *et al.*, 2002). Locally, however, they are used largely as medicinal plants. In southern Africa the genus *Crassula* is the largest and accordingly contains more medicinal species than the other genera. *Cotyledon orbiculata* L., however, is arguably the best known and most popular species for medicinal use in the region, where it is, for instance, frequently used for treating a number of skin conditions (like warts and boils).

Four species from two genera [*Aeonium* (1) and *Bryophyllum* (3)] are naturalised in southern Africa with a further four species having potential as garden escapes.

Key to the genera of Crassulaceae occurring in southern Africa [adapted from Dreyer and Makwavela (2000)]:

- 1. Stamens equal in number to petals (***Crassula***)
- 1'. Stamens at least twice as many as petals **2**
- 2. Petals numbering 4 or 5 **3**
- 2'. Petals numbering 6 or more ***Aeonium***
- 3. Leaves opposite (rarely whorled) **4**
- 3'. Leaves spirally arranged **5**
- 4. Flowers 5-merous (***Cotyledon***)
- 4'. Flowers 4-merous **6**
- 5. Leaves persistent; inflorescence a spike-like thyrse, rarely branched.
 (***Adromischus***)
- 5'. Leaves caducous; inflorescence a single-flowered to branched thyrse
 (***Tylecodon***)
- 6. Flowers pendulous ***Bryophyllum***
- 6'. Flowers erect ***Kalanchoe***

***Aeonium* Webb & Berthel.**

Biennial or mostly perennial shrubs, subshrubs or herbs, glabrous or pubescent. **Stems** ascending, simple or densely- to few-branched, woody or fleshy, often with distinct leaf scars. **Leaves** persistent, often in rosettes at ends of branches, spirally arranged, simple, sessile; blade obovate or obovate-spathulate, sometimes ovate, elliptic or trullate, 3–15 cm long, base broad, cuneate rarely attenuate, apex acute, acuminate or rounded, margins ciliate to pectinate, fleshy to succulent, green or yellowish green, sometimes pinkish or reddish variegated, veins not conspicuous. **Inflorescence** a terminal cyme, often semiglobose, ovoid or conical, with distinct, often densely leafy peduncle; pedicels 1–16 mm long, glabrous, puberulent or pubescent. **Flowers** erect or spreading, (6–)7- to 12-(–16) or 18- to 32-merous. **Sepals** fleshy, connate basally, equal, glabrous or pubescent. **Petals** free, spreading or somewhat recurved, distinct or nearly so, apex acute or acuminate, cream to deep yellow or whitish and then often reddish variegated. **Stamens** twice as many as petals; filaments adnate on corolla base, glabrous or puberulent. **Ovary** with rounded base; pistils erect; carpels as many as petals. Nectary scales small, mostly square or rectangular, or sometimes absent. **Fruit** many-seeded erect follicles. **Seed** ellipsoid, ribbed, brownish.

References: Thulin (1993), Nyffeler (2003), Moran (2009).

The genus *Aeonium* is indigenous to Macaronesia (Canary Islands, Cape Verde Islands and Madeira), southwestern Morocco, East Africa (Ethiopia, Somalia, Kenya, Tanzania and Uganda) and Yemen (Nyffeler, 2003). It comprises c. 39 species with centres of endemism in the Canary Islands and Madeira (Thulin, 1993).

Species of this genus are popular with succulent enthusiasts and have found their way into the horticultural trade. Some species, like *Aeonium glandulosum* Webb & Berthel. and *A. glutinosum* (Aiton) Webb & Berthel., are used medicinally within their natural distribution range (Rivera & Obón, 1995) but no uses for southern Africa have been recorded.

The genus name is derived from the Greek word 'aionion' meaning everliving plant (Nyffeler, 2003).

***Aeonium arboreum* (L.) Webb & Berthel.**

In: *Histoire Naturelle des Îles Canaries* 3(2,1): 185 (1836).

Common name: tree aeonium (English).

Perennial subshrubs, rather open, up to 2 m high; stems branched, erect or ascending, 1–4 cm in diameter, fleshy; bark smooth. **Leaves** arranged in dense rosettes of 50–75-leaves 1–2.5 cm in diameter but smaller in the dry season, concave or flattish with young leaves tightly adpressed to each other, 5–15 × 1–4.5 cm, 1.5–3 mm thick; blade obovate to oblanceolate, apex acuminate, base cuneate, bright green often purplish variegated, shiny, glabrate, marginal cilia curved. **Inflorescence** a dense cyme, ovoid, 10–25 × 10–15 cm; peduncle up

to 20 cm long; pedicels puberulent. **Flowers** 9- to 11-merous, 2 cm in diameter. **Sepals** pubescent. **Petals** spreading, oblong to lanceolate, apex acuminate, 5–7 × 1.5–2 mm, bright yellow. **Filaments** glabrous. **Distribution:** SA. (Fig. 267).

References: Nyffeler (2003), Moran (2009).

Aeonium arboreum (Fig. 268) comprises three varieties. Material found naturalised in Kommetjie and Paternoster near Cape Town, in the Western Cape Province of South Africa (E. van Jaarsveld & U. Egli, *pers. comm.*), belong to the typical variety, which can be distinguished from var. *holochrysum* H.Y.Liu and var. *rubrolineatum* (Sventenius) H.Y.Liu on pubescent pedicels and sepals (Nyffeler, 2003). Var. *arboreum* is native to Gran Canaria (Canary Islands) where it grows at altitudes of 200–1 200 m (Nyffeler, 2003), while on the Californian coast, where it is also naturalised, it grows at altitudes of 0–100 m (Moran, 2009). It is also naturalised in southern Europe and northern Africa, along the Mediterranean coast and in Australia (Forster, 1996; Moran, 2009).

The tree aeonium is of commercial value in the horticultural trade with several cultivars common in cultivation (Nyffeler 2003), some having beautiful variegated or dark purple-black foliage.

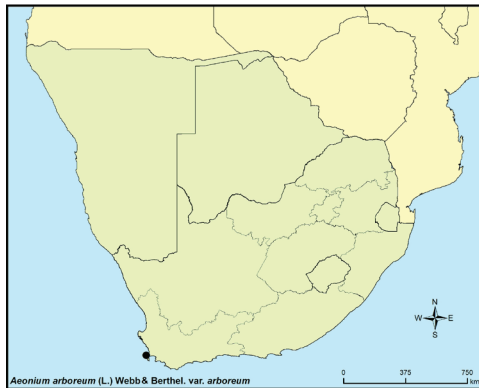


Fig. 267. Distribution map of *Aeonium arboreum* (L.) Webb & Berthel.



Fig. 268. The black-leaved form of *Aeonium arboreum* (L.) Webb & Berthel., known as 'Swartkop', is widely cultivated in South Africa, but it is the regular, green-leaved one that has become naturalised in South Africa. (Picture by Gideon F. Smith)

***Bryophyllum* Salisb.**

Biennial or perennial succulent herbs (rarely subshrubs or shrubs or liana-like), sometimes suckering at the base; roots fibrous. **Stems** usually erect, succulent. **Leaves** persistent, usually opposite and decussate (rarely 3-whorled), simple and unlobed or lobed to pinnatifid, petiolate or rarely sessile, basally subclasping, usually flat but sometimes terete; blade obovate or triangular to lanceolate or elliptic-oblong, fleshy-succulent, sometimes with bulbils along the margins or apices, 2–50 cm long. **Inflorescence** a terminal cyme, lax to dense, sometimes with bulbils. **Flowers** 4-merous, large, numerous, usually pendent, pedicellate, bisexual, mostly brightly coloured. **Calyx** cylindrical to campanulate, sometimes basally dilated, persistent, accrescent in fruit. **Corolla** gamopetalous; tube tubular to urceolate, more or less distinctly 4-angled; lobes ovate, semi-circular or triangular, spreading or reflexed, usually shorter than the corolla tube, orange, yellow-green marked with lavender, pale yellow flecked with red, orange-red, scarlet, pink, lavender, yellow-green flecked with violet-red, or greenish white with maroon distally, corolla throat frequently basally constricted against pistils. **Stamens** 8 in 2 whorls, inserted at the base or below the middle of the corolla-tube; filaments more or less exerted. **Carpels** erect, free; style 2–4 times the length of the ovary. Nectary scales 4, free, suborbicular, quadrate or linear. **Fruit** consisting of erect follicles. **Seeds** many, ellipsoid, usually grooved, ridged or rugulose, small.

References: Fernandes (1983), Wickens (1987), Fu & Ohba (2001), Descoings (2003), Moran (2009).

The genus *Bryophyllum* is included in the subfamily Kalanchoideae of the Crassulaceae which contains c. 230 species. It is also sometimes included in the genus *Kalanchoe*, which then consists of the section *Bryophyllum* along with sections *Kalanchoe* and *Kitchingia* (Descoings, 2003; Thiede & Eggli, 2007). For the purposes of this book, we follow the classification of Berger (1930) and treat it as a separate genus. It consists of c. 25 species that are endemic to Madagascar (Rauh, 1995; Descoings, 2003). Some species are widely naturalised elsewhere (e.g. Australia, Africa, Central and South America, China).

Species of the genus *Bryophyllum* are known for their ease of cultivation and can be easily grown from stem cuttings or rooted leaves (Descoings, 2003). Some species produce bulbils or plantlets on the margins or apices of their leaves, or on their inflorescences. This interesting reproductive trait has undoubtedly contributed to their popularity as garden plants. Some species are garden escapes in many parts of the world with a few becoming aggressive invaders, undoubtedly as a result of their ease of reproduction and propagation. The name *Bryophyllum* comes from the Greek words for 'sprout' and 'leaf' i.e. leaf-sprouter, which is certainly very apt (Gledhill, 2008).

Key to the 3 naturalised and 3 potential garden escapes from the genus *Bryophyllum* [adapted from Staples *et al.* (2002)]:

1. Leaves (at least lower ones) cylindrical or pencil-like, apex flaring, petiole absent or not distinct from blade. **1. *Bryophyllum delagoense* (= *B. tubiflorum*)**
- 1'. Leaves with a broad blade set off from narrower petiole **2**
2. All (or at least some) leaves compound **3**
- 2'. All leaves simple **4**
3. First leaves simple, rest mostly pinnate to 3- to 5-foliolate, streaked with purple, with orange-red margins, leaflets petiolulate, cuneate to truncate at the base **2. *Bryophyllum pinnatum***
- 3'. Leaves pinnatisect or pinnate, margins often purple, leaflets sessile on rachis or almost so, asymmetrical and decurrent at the base **3. *Bryophyllum proliferum***
4. Leaves small, up to 5 cm long, blade broadest at or above middle, apex rounded **5. *Bryophyllum fedtschenkoi***
- 4'. Leaves medium to large, 5–50 cm long, blade broadest near base, apex acute **5**
5. Leaves large, 13–50 cm long, brownish-green markings on both surfaces, crowded near base, with sinuate to coarsely crenate margins. **6. *Bryophyllum gastonis-bonnieri***
- 5'. Leaves medium sized, 5–25 cm long, purple-blotched on lower surface, evenly spaced, with serrate margins **4. *Bryophyllum daigremontianum***

1. *Bryophyllum delagoense* (Eckl. & Zeyh.) Schinz

In: *Mémoires de l'Herbier Boissier* 10: 38 (1900).

=*Bryophyllum tubiflorum* Harv.

=*Bryophyllum verticillatum* (Scott-Elliot) A. Berger

=*Geaya purpurea* Costantin & Poisson

=*Kalanchoe delagoensis* Eckl. & Zeyh.

=*Kalanchoe tubiflora* (Harv.) Raym.-Hamet, nom. illeg.

=*Kalanchoe verticillata* Scott-Elliot

Common names: chandelier plant, mother of millions, pregnant plant (English); kandelaarplant (Afrikaans); indunjane (Zulu).

Biennial or semi-perennial herbs, monocarpic, pale green with violet-brown markings, glaucous, often forming dense stands; stems erect (sometimes procumbent), unbranched, terete, 0.2–1.2 m tall, sometimes suckering from the base. **Leaves** ternate or alternate in adult plant, opposite on young shoots, evenly spaced, simple, ± caducous when flowering, seemingly sessile; blade narrowly oblong, subcylindric with adaxial groove, erect to nearly horizontally spreading, with 2–9 small conical teeth at apex frequently with bulbils borne in their axils, 3–15 cm × 3–6 mm, reddish green to gray-green with dark green or reddish brown

spots, surfaces not glaucous. **Inflorescence** a terminal, rounded thyrses, with densely clustered dichasia, up to 20 cm in diameter with long peduncles; pedicels 5–30 mm long. **Flowers** pendulous, conspicuous. **Calyx** campanulate, 8–16 mm long, reddish to green striped with red; tube 3–6 mm long; lobes triangular-lanceolate, apex acute, 5–10 × 3.7–5.7 mm. **Corolla** much exceeding the calyx, 2.2–4 cm long, pale orange to deep purplish red; tube funnel-shaped, constricted just above the carpels and widening in middle and at throat; lobes oblong-obovate, obtuse or truncate, apiculate, spreading, 7–12 × 6–9 mm. **Stamens** included, inserted below the middle of the corolla tube; anthers broadly ovate, 2–2.5 mm long. **Carpels** ovate-oblong, 5.5–6.5 mm long, fused for c. 1.6 mm; styles up to 2 cm long. Nectary scales semicircular to trapeziform, tip rounded, 0.7–2 × 0.8–1.4 mm. **Seed** obovoid, 0.6–2.5 mm long. **Distribution:** B, L, N, S, SA. (Fig. 269).

References: Fernandes (1983), Tölken (1985), Rauh (1998), Descoings (2003), Moran (2009).

Bryophyllum delagoense (Fig. 270, 271) is endemic to Madagascar, occurring mainly in the central and southern regions, where it is commonly found in open wooded grasslands, rocky slopes, and on sandy or rocky ground (Descoings, 2003). It is naturalised in many countries with warmer climates possibly including every country in southern Africa and also in southern Europe, Africa, Asia, Australia, New Zealand, southern USA and Hawaii, West Indies, northern South America and Macaronesia (PIER, 2010). In Brazil it is sometimes even pollinated by hummingbirds despite being exotic and regarded as non-ornithophilous (Mendonça and Anjos 2005). In South Africa, where it was introduced as a garden ornamental (Wells 1986) around 1765 (Witt *et al.*, 2004; Witt & Nongogo, 2010), it is naturalised in all 9 provinces (Fig. 272).

The plant is poisonous to both humans and livestock (Henderson, 2001; Kellerman *et al.*, 2005). In Australia *Bryophyllum delagoense* has been reported to cause stock losses and was found to effect myocardial degeneration (McKenzie & Dunster, 1986). Further investigation showed the cardiac glycosides (bufadienolides) responsible to be bryotoxins, also present in four other naturalised *Bryophyllum* species (McKenzie *et al.*, 1987; Steyn & Van Heerden, 1998). Despite its reported toxicity to livestock, no stock losses by *B. delagoense* have been reported in South Africa.

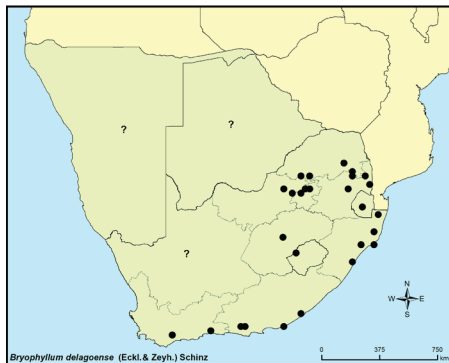


Fig. 269. Distribution map of *Bryophyllum delagoense* (Eckl. & Zeyh.) Schinz.



Fig. 270. *Bryophyllum delagoense* (Eckl. & Zeyh.) Schinz.
(Picture by Neil R. Crouch)



Fig. 271. Flowers of *Bryophyllum delagoense* (Eckl. & Zeyh.) Schinz.
(Picture by Neil R. Crouch)

Bryophyllum delagoense is traded in South Africa (Von Ahlefeld *et al.*, 2003) as a protective charm as it is a species that is 'hard to kill', with obvious reference to its drought tolerance. Many Crassulaceae, both indigenous and exotic, are cultivated around homesteads, including this species, to confer protection, e.g. from lightning, disease or evil spirits, on the inhabitants (N.R. Crouch, *pers. comm.*, October 2010).

Bryophyllum delagoense grows very easily and reproduces by means of seed, basal suckers and abundantly produced leaf bulbils (Fig. 273) thus facilitating its spread to new areas. Severed leaves and bulbils root very easily and it is often found spreading from sites where garden waste is dumped.

In South Africa this species is a declared weed (Henderson, 2001) which means it is prohibited and must be controlled. For areas of small infestations simply pulling the plants up by hand will be sufficient, but care has to be taken not to dislodge the bulbils or leave any parts behind as it will simply resprout. It is best to burn unwanted material to prevent further spread. In a recent study Witt and Nongogo (2010) found that high intensity and low intensity fires were respectively found to kill 89 and 45% of plants. Plants may grow tall with a tree-like habit. Taller plants and those growing in dense stands were more likely to escape destruction. They speculate that fire has prevented this species from becoming a major weed in South Africa as it is in Australia, where fires have a lower frequency and intensity.

Bryophyllum delagoense is a potential target for biological control. Two species of stem-boring weevils (*Alcidodes sedi* and *Osphilia tenuipes*) were recently identified as candidate biocontrol agents (Witt, 2004; Witt *et al.*, 2004). These weevils are, however, not host-specific and can complete their development on other Crassulaceae species in the region. They can also complete their life cycle on commercially grown *Kalanchoe blossfeldiana* Poelln., thus constituting a possible threat to horticultural businesses. It may be considered an option for use in Australia as there are very few indigenous Crassulaceae species that could serve as alternative hosts (Witt, 2004). Further studies are required to determine whether the weevils are safe for release in southern Africa.

Plants may be distinguished from other similar species in the region by their terete leaves (Fig. 274) measuring no more than 6 mm in width. The other *Bryophyllum* species have flatter and broader leaves, which are sometimes pinnately lobed with three or more 'leaflets'. The plants cannot be confused with any indigenous species.



Fig. 272. *Bryophyllum delagoense* (Eckl. & Zeyh.) Schinz invasion.
(Picture by Neil R. Crouch)



Fig. 273. Bulbils are produced at the apex of leaves of *Bryophyllum delagoense*
(Eckl. & Zeyh.) Schinz. (Picture by Neil R. Crouch)



Fig. 274. Leaves of *Bryophyllum delagoense* (Eckl. & Zeyh.) Schinz are tubular.
(Picture by Geoff R. Nichols)

2. *Bryophyllum pinnatum* (Lam.) Oken

In: *Allgemeine Naturgeschichte* 3(3): 1966 (1841).

=*Bryophyllum calycinum* Salisb.

=*Cotyledon pinnata* Lam.

=*Kalanchoe pinnata* (Lam.) Pers.

=*Verea pinnata* (Lam.) Spreng.

Common names: air plant, Canterbury bells, cathedral bells, curtain plant, floppers, Goethe Plant, good luck leaf, Hawaiian air leaf, leaf of life, life plant, Mexican love plant, miracle leaf, miracle plant, monkey ears, monkey's ear, mother-in-law, mother-of-thousands, never die, resurrection plant, sprout leaf plant, sprouting leaf, tree of life (English).

Perennials, completely glabrous, succulent, monocarpic; stems up to 2 m tall, stout, nearly woody below, erect or ascending, terete, simple or little branched, with red stripes or spots. **Leaves** decussate, scattered, petiolate, first leaves simple, the rest mostly pinnate to 3- to 5-foliolate, sometimes some or all reduced to terminal leaflet, leathery-fleshy, green, streaked with purple, edged with orange-red; petiole subterete, amplexicaul, broadened towards the base, 2.5–10 cm long; blade of simple leaf ovate to oblong, up to 10 × 5 cm, apex obtuse, base cuneate to truncate, margins broadly crenate, doubly crenate or crenate-dentate, with bulbils produced in the notches of leaf margins; compound leaf leaflets ± as the simple leaves or

oblong-circular, 6–20 × 4–12 cm, terminal leaflet the largest. **Inflorescence** a lax panicate cyme, 1–8 dm in diameter with branches up to 12 cm; pedicels 1–2.5 cm long. **Flowers** pendulous. **Calyx** campanulate, inflated, thinly succulent /herbaceous at anthesis, becoming papery, pale yellow to green with red to violet lines; tube 2–4 cm long; lobes ovate-triangular, apex acute-acuminate, 7–11 mm long. **Corolla** ± cylindrical, tube greenish white where hidden by the calyx, the rest red or maroon to greenish-reddish; tube basally contracted, 2.5–4 cm, sometimes somewhat glandular-pubescent; lobes oblong-ovate to triangular, apex acute-acuminate, 9–14 × 4–6.5 mm. **Stamens** inserted below the middle of the corolla tube, mostly included; anthers ovate, 2.5–3 × 1.6–2.2 mm. **Carpels** ovoid, 1.2–1.4 cm long, basally connate; style up to 3 cm long. Nectary scales ± rectangular, 1.8–2.6 × 1.4–1.8 mm, apex obtuse or emarginate. **Seed** obovate, obtuse, c. 0.8 mm long. **Distribution:** S, SA. (Fig. 275).

References: Descoings (2003), Moran (2009).

Bryophyllum pinnatum is endemic to Madagascar but is naturalised in many regions of the world (with the exception of temperate and temperate-cold regions as it does not stand frost) e.g. southern Europe, Africa, Asia, Australia, North, Central and South America, and many islands (GBIF, 2010; PIER, 2010).

This species is the best-known in the genus (Descoings, 2003). It has large light green leaves with marginal indentations (Fig. 276) and flowers are lantern-shaped, pale yellow to green with red to violet lines that turn denser as they mature (Fig. 277, 278). It is widely grown as an ornamental and medicinal plant. No medicinal uses have been recorded for southern Africa but it is used extensively elsewhere, for instance, further north in Africa (Githens, 1949; Burkill, 1985a; Oliver-Bever, 1986; Neuwinger, 2000), Brazil (Muzitano *et al.*, 2006) and the West Indies and India (Ayensu, 1981; Oliver-Bever, 1986). Conditions treated vary widely and include skin conditions (e.g. abscesses, ulcers and inflammation), deafness, snoring, epilepsy, whooping cough and it even features in an incantation for the acquisition of money (Burkill, 1985a; Oliver-Bever, 1986; Neuwinger, 2000).

Bryophyllum pinnatum is a garden escape and has naturalised in coastal KwaZulu-Natal, South Africa (Fig. 279), where it is a proposed category 1 plant and no new planting, trade or propagation is permitted (ARC-PPRI, 2007).

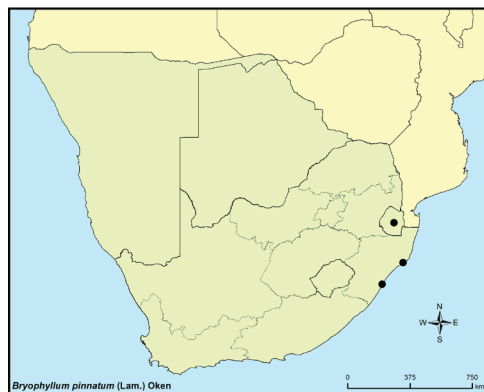


Fig. 275. Distribution map of *Bryophyllum pinnatum* (Lam.) Oken.



Fig. 276. Leaves of *Bryophyllum pinnatum* (Lam.) Oken have indentations.
(Picture by Geoff R. Nichols)



Fig. 277. Lighter flowers of *Bryophyllum pinnatum* (Lam.) Oken.
(Picture by Neil R. Crouch)



Fig. 278. Darker flowers of *Bryophyllum pinnatum* (Lam.) Oken.
(Picture by Neil R. Crouch)



Fig. 279. *Bryophyllum pinnatum* (Lam.) Oken invasion. (Picture by Helmuth G. Zimmermann)

3. *Bryophyllum proliferum* Bowie ex Hook.

In: *Botanical Magazine* t. 5147 (1859).

=*Bryophyllum rubellum* Baker

=*Kalanchoe prolifera* (Bowie ex Hook.) Raym.-Hamet

Common names: blooming boxes, green mother of millions (English).

Succulent perennials, stout, up to 3 m tall, glabrous; stems robust, up to 5 cm in diameter, erect to procumbent, \pm 4-angled, simple, almost woody below, with basal offsets. **Leaves** decussate, petiolate, pinnatisect or pinnate (rarely undivided), up to 30 cm long, fleshy, green; petiole broadened at the base, amplexicaul, up to 16 cm long; segments or leaflets asymmetrical and decurrent at the base, oblong, lanceolate to ovate-elongate, 7–15 \times 1.5–5 cm, apex obtuse, margins crenate to dentate, often purple. **Inflorescence** a very large compound panicle, 40–80 \times 20–40 cm, frequently with numerous aborted flowers and bulbils; pedicels thin, 8–15 mm long, densely papillose. **Flowers** pendulous. **Calyx** inflated, campanulate, 4-angled, green, papillose; tube 13–16 mm long; lobes semi-orbicular, acuminate-cuspidate, 3–4 \times 5–7 mm. **Corolla** tubular, green where hidden by calyx, the rest red; tube constricted above carpels, suburceolate above constriction, 1.5–2.5 cm, greenish yellow; lobes subovate, acuminate-cuspidate, 2.7–4 \times 3–4 mm. **Stamens**

inserted below the middle of the corolla tube, exserted; anthers ovate, 2–2.6 × 1.3–1.4 mm. **Carpels** basally connate, 7–8 mm long; styles 1.7–2 cm long, exserted. Nectary scales orbicular to trapeziform, 1.3–1.6 × 2–2.5 mm. **Fruit** not seen. **Distribution:** SA. (Fig. 280)

Reference: Descoings (2003).

Bryophyllum proliferum is one of the largest plants (Fig. 281) in the genus and native to Madagascar where it grows on the Central Plateau (Rauh 1995). It is cultivated as an ornamental (Wells 1986) probably for its pretty box-like flowers (Fig. 282), pinnatisect or pinnate leaves (Fig. 283) and the tendency to produce a proliferation of bulbils on the inflorescence (Fig. 284). It has become widely naturalised in numerous countries, including throughout the tropics, as a garden escape (Fernandes 1983; Rauh 1995).

Green mother of millions is used medicinally in Madagascar for treatment of local abscesses and rheumatism (Githens 1949). No medicinal use has been recorded for southern Africa (Watt and Breyer-Brandwijk 1962), but the plant is grown around rural homesteads (Fig. 285) as an intelezi plant i.e. protecting the inhabitants from any harm.

In South Africa it is a proposed category 1 plant and no new planting, trade or propagation is permitted (ARC-PPRI 2007). These plants establish easily from discarded material and it is preferable to burn or bury any unwanted plants.

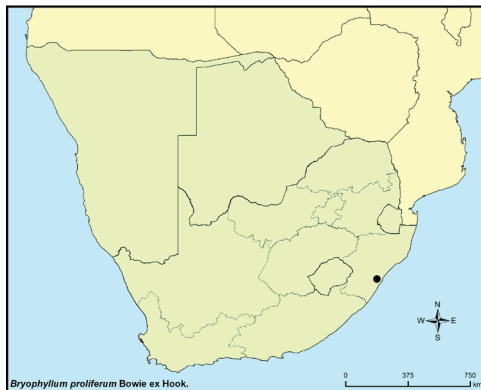


Fig. 280. Distribution map of *Bryophyllum proliferum* Bowie ex Hook.



Fig. 281. *Bryophyllum proliferum* Bowie ex Hook. (Picture by Neil R. Crouch)



Fig. 282. Flowers of *Bryophyllum proliferum* Bowie ex Hook. (Picture by Neil R. Crouch)



Fig. 283. Leaves of *Bryophyllum proliferum* Bowie ex Hook. (Picture by Neil R. Crouch)



Fig. 284. Inflorescence of *Bryophyllum proliferum* Bowie ex Hook. produces bulbillets. (Picture by Neil R. Crouch)



Fig. 285. *Bryophyllum proliferum* Bowie ex Hook. grown around rural homestead. (Picture by Neil R. Crouch)

Species of Crassulaceae to keep an eye on:

The following three species of *Bryophyllum* and one *Kalanchoe* are present and cultivated ornamentally in southern Africa. All of them have become invasive elsewhere, outside of their natural distribution ranges, and are included here as species to watch for future signs of potential naturalisation.

4. *Bryophyllum daigremontianum* (Raym.-Hamet & H.Perrier) A.Berger

In: *Die natürlichen Pflanzenfamilien*, Zweite Auflage 18a: 412. (1930).

=*Kalanchoe daigremontiana* Raym.-Hamet & H.Perrier

Common names: alligator plant, devil's backbone, maternity plant (English).

Perennial, glabrous, monocarpic herbs, with purple blotches; stems stout, mostly unbranched, erect or decumbent, terete, 5–25 dm × 0.5–2 cm. **Leaves** opposite, evenly spaced, succulent, simple, larger leaves subpeltate; petiole subterete, 1–5 cm long; blade triangular to oblong-lanceolate, 5–25 × 3–12 cm, margins serrate, apex acute, purple-blotched on lower surface, surfaces glaucous, with bulbils produced in the notches of leaf margins. **Inflorescence** a lax paniculate cyme, branches up to 15 cm long; pedicels 5–15 mm. **Flowers** pendulous or spreading, 4-merous, large, bisexual. **Calyx** not inflated, gamosepalous, 6–10 mm long, green or purplish; tube 3–4 mm; lobes triangular, acute, 3–7 × 2–4 mm, glabrous. **Corolla** campanulate, 20–30 mm long, pinkish to reddish or purple; lobes obovate, acute, 6–8 × 3.5–4.5 mm. **Stamens** inserted below the middle of corolla-tube, upper parts exerted. **Carpels** 4; ovules numerous per locule; style 11–14 mm long. Nectary scales rectangular, c. 0.6 × 1 mm. **Seed** oblong, longitudinally ridged, 0.6–1 × 0.2–0.3 mm.

References: Sarwar (2002), Descoings (2003), Moran (2009).

Bryophyllum daigremontianum (Fig. 286) is native to Madagascar, but a declared noxious weed in Australia (PlantNET, 2010) and an aggressive weed in parts of the USA (Moran, 2009). It has serrate leaves, that are purple-blotched on the lower surface (Fig. 287). It has been reported naturalised in other regions like parts of tropical and subtropical Africa and Asia. In Australia the hybrid between *Bryophyllum daigremontianum* and *B. delagoense*, known as *Bryophyllum ×houghtonii* (D.B.Ward) P.I.Forst., is widely naturalised in the Queensland and New South Wales regions (Moran, 2009; PlantNET, 2010).



Fig. 286. *Bryophyllum daigremontianum* (Raym.-Hamet & H.Perrier) A.Berger.
(Picture by Neil R. Crouch)