

# An introduction to the Four-O’Clocks of southern Africa

Madeleen Struwig & Stefan Siebert

A. P. Goossens Herbarium, North-West University, Private Bag X6001, Potchefstroom, 2520, South Africa.

E-mail: madeleen.struwig@nwu.ac.za; stefan.siebert@nwu.ac.za

## Introduction

The Nyctaginaceae is a relatively small family (c. 30 genera, 400 species) that occurs mainly in tropical and subtropical regions of the New World (Mabberley 1997) with a few species in India, the Mascarene and Pacific Islands, and Africa (Jordaan 2000). It is commonly known as the Four-O’Clock family, as most of the species have flowers that open in the late afternoon or early evening (Levin *et al.* 2001).

The family is best known to South Africans by the variety of Bougainvillas that are widely cultivated in gardens. The genus *Bougainvillea* is a native of South America and derived its name from Louis Antione de Bougainville (1729–1811), an admiral in the French Navy who encountered the plant in Brazil in 1768 and first introduced it to the rest of the world.

By and large, Bougainvillas are regarded as colourful shrubs or small trees with spiny branches. The most interesting feature of this plant, however, is its strange

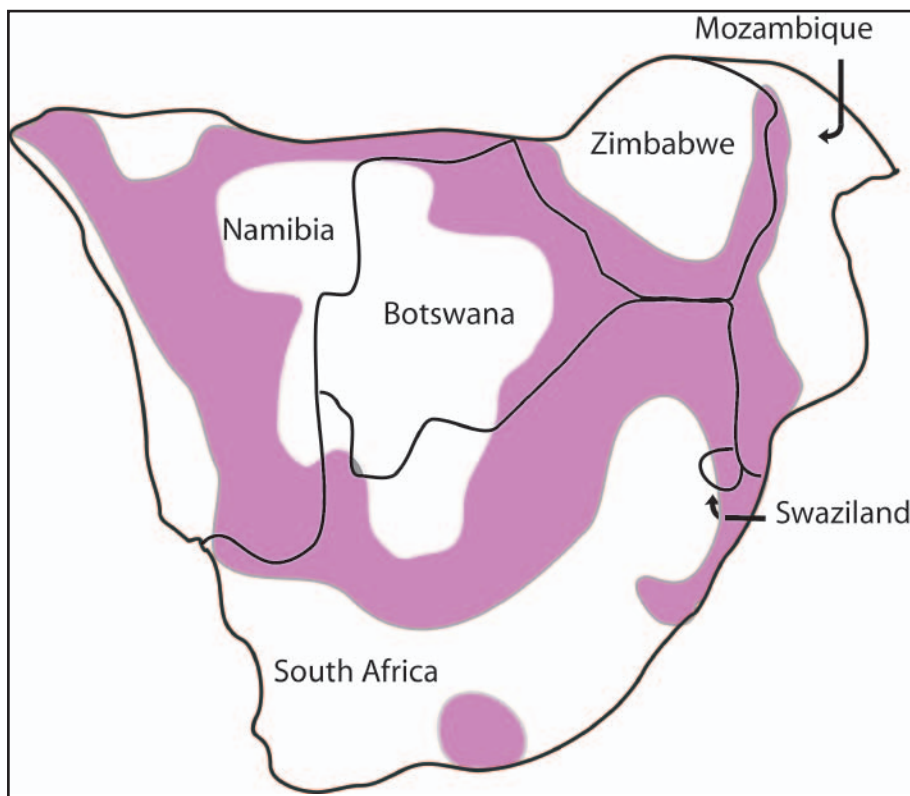
flower. If you peel away the ‘petals’, a surprise awaits you! The seemingly single flower becomes three! These three flowers (Figure 1) are arranged in an inflorescence (cyme) and are collectively enclosed in three brightly coloured bracts (Dequan & Gilbert 2003).

Another interesting feature of this family is its fruit, called an accessory fruit or anthocarp. The actual fruit, which is an achene, is enclosed by the perianth that persists during fruit formation (Bogle 1974). This accessory fruit can vary in sculpturing, either forming ribs, which can elongate into wings, or covered in sticky, glandular hairs and warts, or it can be rough (Spellenberg 2004). The accessory fruit is thought to aid in dispersal (Douglas & Manos 2007).

The family is readily used as medicine in Asia, Brazil and Mexico to treat dysentery, diarrhoea, muscular pain, abdominal colic, and as poultices for boils, abscesses and scabies (Aoki *et al.* 2008; Hiruma-Lima *et al.* 2000). In southern Africa, roots of some indigenous species are



**Figure 1.** The inflorescence of *Bougainvillea spectabilis* enclosed by purple bracts. Photo: David Styles.



**Figure 2.** Main distribution of the Nyctaginaceae in southern Africa based on records from the national herbaria of Namibia and South Africa.

eaten as a vegetable and some species are herbage plants that are excellent for stock (Riley 1963; Pooley 1998), but accounts of medicinal use are scant. Poisoning of children has been reported after consumption of roots, seeds or fruits of *Mirabilis jalapa* (Munday 1988). Apart from its medicinal uses, the flowers of *M. jalapa* are steeped in water to provide a crimson dye used in China for tinting cakes and jellies prepared from seaweed. A cosmetic powder is made in Japan from the powdered seeds (Bogle 1974).

### Local Diversity

In southern Africa (Figure 2), south of the Zambezi River *i.e.* Botswana, southern Mozambique, Namibia, South Africa, Swaziland and Zimbabwe, five genera occur naturally of which one is monotypic (*Phaeoptilum*) and one introduced (*Mirabilis*), comprising 20 species of which six are endemic (Appendix 1) (Germishuizen & Meyer 2003). The five genera are morphologically variable and each genus is described briefly to highlight the differences.

*Boerhavia* species are annual or perennial herbs with slender stems (Figure 3). The leaves are opposite, petiolate, and vary from ovate to lanceolate to elliptic. The margins are entire or sinuate. The flowers are small and arranged in an inflorescences (cyme), and the perianth is brightly coloured in white, pink and purple, and campanulate in shape. The anthocarp has 3–5 ribs or wings, and are glabrous or glandular pubescent (Jordaan 2000).

*Commicarpus* species (Figure 4) appear notably similar to the *Boerhavia* species, but are distinguished by their more scrambling or climbing habit, flowers with a funnel-shape perianth and an anthocarp that has 10 ribs

with large viscid and mucilaginous glands (Stannard 1988).

Species of the introduced genus *Mirabilis* (Figure 5) are erect, perennial herbs. The leaves are thin, opposite, ovate to ovate-cordate and the lower leaves have petioles, while the upper leaves are sessile. Flowers are subtended by a calyx-like involucre. The flowers are purple, red, yellow or white, open in the late afternoon and are fragrant at night. The anthocarp is black, hard and ribbed (Jordaan 2000).

*Phaeoptilum* (Figure 6) is a shrub up to 3 m tall, with branch tips modified into spines. The bark is greyish yellow or brown. The leaves are entire, opposite or fascicled, sessile or subsessile, linear and nearly fleshy. The flowers are creamy yellow, scented, solitary or in fascicles, and usually on leafless branches. The anthocarp is yellowish-green turning pink, red or purple with age and the wings

are more or less semi-circular, broad and parchment-like with the central portion fusiform (Coates Palgrave 2002).

One species of *Pisonia* (Figure 7) occurs in southern Africa. It is a climbing shrub with paired, axillary, recurved thorns. The bark is whitish to pale brown. The leaves are petiolate, alternate to subopposite, oblong and the margins are entire or slightly wavy. The flowers are arranged in an inflorescence (cyme), cream to yellow and sweetly scented. The anthocarps are ribbed and the ribs have soft, viscid, prickle-like glandular hairs (Coates Palgrave 2002).

These five genera are distributed throughout southern Africa, except for the extreme southern part. Available distribution data (Figure 2) shows a zig-zag pattern beginning in Namibia and Botswana, moving down into the northern parts of the Northern Cape, up through the Free State, Northwest and Gauteng to Limpopo (and beyond into Zimbabwe), and then down to coastal KwaZulu-Natal and Mozambique. At this stage the available distribution data for Botswana, Mozambique and Zimbabwe are patchy, and collaboration with regional herbaria will address this deficiency.

### Research questions

The Nyctaginaceae is poorly studied in southern Africa and experiences a number of unsolved issues:

- Are *Boerhavia* and *Commicarpus* really two different genera, considering that they are morphologically so similar?
- Does the group have any medicinal or traditional uses in southern Africa, and if so, what?

- What is the true distribution of the family in southern Africa, considering that very few point data are available for Botswana, Mozambique and Zimbabwe?
- Are all the family's species from southern Africa described, or are there unknown species lurking about?

These are just some of the questions that need answering in a taxonomic study concerning this group and we are, therefore, greatly in need of assistance in finding more localities and fresh material of species.

#### *How can you help?*

- Keep your eyes open for the family wherever you botanise. When a species is spotted, please take a picture if possible and record its locality (GPS readings will be greatly appreciated). Contact the authors as soon as possible by e-mail or telephone number 018 299 2505/7.
- Please provide us with information of any medicinal or traditional uses of the family of which you may be aware.
- Any additional information you have on this family will also be welcome.

So please, look out for the Four-O'Clocks next time you go awandering! Remember, the weedy types are also very common in urban areas.



**Figure 3.** Purple, campanulate flowers of *Boerhavia*. Photo: Geoff Nichols.

#### **Glossary**

Based on Leistner (2000) and Harris & Harris (1994).

**achene:** a small dry fruit, not splitting when ripe.

**anthocarp:** a false fruit formed by the union of floral parts with the fruit.

**axillary:** arising from the axil, this being the angle between the leaf and the axis bearing it.

**campanulate:** bell-shaped.

**cyme:** a flat-topped or round-topped determinate inflorescence, paniculate, in which the terminal flower blooms first.

**fascicle (adj. fascicled):** a cluster of flowers arising at about the same point.

**fusiform:** spindle-shaped, thick but tapering towards each end.

**involucre:** a number of bracts, such as those surrounding the base of an umbel of flowers.

**perianth:** the floral envelope, consisting of a calyx or corolla or both.

**petiolate:** having a petiole or leaf stalk.

**recurved:** curved downwards or backwards.

**viscid:** sticky.



**Figure 4.** White, funnel-shaped flowers of *Commicarpus plumbagineus*. Photo: Stefan Siebert.



**Figure 5.** *Mirabilis jalapa*. Photo: Geoff Nichols.

#### Acknowledgements

Richard Boon, Geoff Nichols, David Styles, and Braam van Wyk are thanked for providing photographs.

#### References

AOKI, K., CORTÉS, A.R., DEL CARMEN RAMÍREZ, M., GÓMEZ-HERNÁNDEZ, M. & LÓPEZ-MUNOZ, F.J. 2008. Pharmacological study of antispasmodic activity of *Mirabilis jalapa* Linn. flowers. *Ethnopharmacology* 116: 96–101.

BOGLE, A.L. 1974. The genera of Nyctaginaceae in the southeastern United States. *Journal of the Arnold Arboretum* 55: 1–37.

COATES PALGRAVE, M. 2002. *Keith Coates Palgrave Trees of southern Africa*. 3rd ed. Struik, Cape Town.

DOUGLAS, N.A. & MANOS, P.S. 2007. Molecular phylogeny of Nyctaginaceae: taxonomy, biogeography and characters associated with a radiation of xerophytic genera in North America. *American Journal of Botany* 96: 856–872.

DEQUAN, L. & GILBERT, M.G. 2003. Nyctaginaceae. *Flora of China* 5: 430–434.

GERMISHUIZEN, G. & MEYER, N.L. 2003. Plants of southern Africa: an annotated checklist. *Strelitzia* 14: 749–750. National Botanical Institute, Pretoria.



**Figure 6.** *Phaeoptilum spinosum* branch with branch tips modified into spines and reddish fruit with parchment-like wings. Photo: Braam van Wyk.

HARRIS, J.G. & HARRIS, M.W. 1994. *Plant identification terminology: an illustrated glossary*. Spring Lake Publishing, Spring Lake, Utah.

HIRUMA-LIMA, C.A., GRACIOSO, J.S., BIGHETTI, E.J.B., GERMONSÉN ROBINEOU, L. & SOUZA BRITO, A.R.M. 2000. The juice of fresh leaves of *Boerhaavia diffusa* L. (Nyctaginaceae) markedly reduces pain in mice. *Journal of Ethnopharmacology* 71: 267–274.

JORDAAN, M. 2000. Nyctaginaceae. In: O.A. Leistner (ed.), *Seed plants of southern Africa: families and genera*. *Strelitzia* 10: 424–426. National Botanical Institute, Pretoria.

LEISTNER, O. A. 2000. Seed plants of southern Africa: families and genera. *Strelitzia* 10. National Botanical Institute, Pretoria.

LEVIN, R.A., RAGUSO, R.A. & MCDADE, L.A. 2001. Fragrance chemistry and pollinator affinities in Nyctaginaceae. *Phytochemistry* 58: 429–440.

MABBERLEY, D.J. 1997. *The plant book: a portable dictionary of higher plants*. 2nd ed. Cambridge University Press, Cambridge.

MUNDAY, J. 1988. *Poisonous plants in South African gardens and parks: a field guide*. Delta Books, Craighall.

POOLEY, E. 1998. *A field guide to wild flowers. KwaZulu-Natal and the eastern region*. Natal Flora Publication Trust, Durban.

RILEY, H.P. 1963. *Families of flowering plants of Southern Africa*. University of Kentucky Press, Lexington.

SPELLENBERG, R.W. 2004. Nyctaginaceae. *Flora of North America* 4 (Web:) [http://www.efloras.org/florataxon.aspx?flora\\_id=1&taxon\\_id=10617](http://www.efloras.org/florataxon.aspx?flora_id=1&taxon_id=10617) (Date of access: 25 January 2008).

STANNARD, B.L. 1988. Nyctaginaceae. *Flora Zambesiaca* 9(1): 12–28. Halesworth Press, London.

**Appendix 1: Nyctaginaceae genera and species occurring in southern Africa, including known common name (\* = exotic, <sup>E</sup> = endemic to southern Africa)**

***Boerhavia***

- coccinea* var. *coccinea* (Hog Weed, Hog Feed, Patagon, Scarlet Spiderling)
- \* *cordobensis* (Kleefbossie)
- <sup>E</sup> *deserticola*



**Figure 7.** Creamish-green flowers of *Pisonia aculeata*. Photo: Richard Boon.

- \**diffusa* var. *diffusa* (Red Spiderling, Spreading Hogweed)
- \* *erecta* (Erect Spiderling, Regop Boerhavia)
- <sup>E</sup> *hereroensis*
- repens* subsp. *repens* (Alena)

***Commicarpus***

- chinensis* subsp. *natalensis*
- <sup>E</sup> *decipiens*
- <sup>E</sup> *fallacissimus*
- <sup>E</sup> *fruticosus*
- helenae* var. *helenae*
- pentandrus* (Veld Batatas, Cerise Stars)
- pilosus*
- plumbagineus* var. *plumbagineus* (Plumbago Stars)
- <sup>E</sup> *squarrosus*

\* ***Mirabilis***

- jalapa* (Four O’Clock Plant, False Jalap, Marvel of Peru)
- viscosa* (Mirabilis, Four O’Clock)

***Phaeoptilum***

- spinosum* (Brittle-thorn; Brosdoring)

***Pisonia***

- aculeata* (False Bougainvillea, Pullback, Pull- and Hold-back, Black thorn, Wild Bougainvillea, Devil’s claw, Cock-spur, Valspapierblom)

**Note:** *Boerhavia deserticola*, *Commicarpus fruticosus* and *C. squarrosus* are endemic to Namibia only.