

Calotrope

Calotropis procera



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Front cover: *Calotrope in north-west Queensland*

Photo: Nathan March, Biosecurity Queensland

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Summary

Calotropis procera (calotrope) is a 2–6 m tall shrub native to a large area of tropical Asia and Africa. Dispersal is mainly via wind-blown seeds.

C. procera prefers sandy soils and a hot, dry, tropical climate (150–1000 mm rain per annum). In its native range it is a widespread pioneer of semi-desert grassland, scrub land and shifting sand dunes. Hence, it invades comparable habitats in northern Australia, being most abundant on disturbed sandy sites such as dunes, periodically flooded areas (sandy water courses/river flats), roadsides and sparsely vegetated arid and semi-arid grassland. While quick to invade areas that are either naturally sparse or have been stripped of grass cover by grazing animals, there is evidence that *C. procera* can also invade seemingly healthy pastures, but probably at a slower rate.

C. procera has a history as a weed elsewhere, including the Middle East, Central and South America, the Caribbean, Hawaii, the Seychelles, Mexico, Thailand, Vietnam and many Pacific Islands. In Australia, it is a declared (noxious) weed in Western Australia and the Northern Territory.

C. procera is currently widespread and abundant on grazing land in the tropical savannas of north-west Queensland. Based on evidence collected in this study, it seems reasonable to predict that *C. procera* has the potential to spread over much larger areas of land, where habitat is comparable to the species' natural habitat in tropical Africa and Asia. Suitable habitats include virtually any highly disturbed sites that have sparse ground cover (either naturally or as a result of grazing or other perturbation), sandy soil, and a hot, arid, semi-arid or seasonally dry tropical climate.

Introduction

Identity and taxonomy

Species identity: *Calotropis procera* (Aiton) WT Aiton

Family: Asclepiadaceae

Common names: Calotrope, giant milkweed, Sodom apple, Sodom's milkweed, rooster tree, madar (Hindi), rubber bush, rubber tree, kapock tree, Indian milkweed, cabbage tree, king's crown kapok

Synonyms: *Calotropis procera* (L.) Dryand, *C. heterophylla* Wall., *C. busseana* K.Schum, *C. syriaca* Woodson, *C. inflexa* Chiov., *Asclepias procera* Aiton (basonym) and incorrectly *C. procera* (Willd.) R.Br. ex Aiton (Forster 1992)

There are two subspecies of *C. procera*, but only spp. *procera* is naturalised in Australia (Forster 1992). In its native range *C. procera* is polymorphic. However, the population in Australia it is quite uniform, suggesting development from one or very few introductions (Forster 1992).

The genus *Calotropis* comprises three species of shrubs found in tropical and subtropical Africa, Asia and India: *C. procera*, *C. gigantea* (L.) WT Aiton and *C. acia* Buch-Ham (Rahman and Wilcock 1991).

Description

Calotropis procera is a shrub or small tree 2–4 m tall (rarely up to 6 m tall), with distinctive grey-green waxy leaves (Figure 1). As described by Grace (2006, 2009), the stems are grey-green, smooth, somewhat crooked and covered with a soft, thick, corky bark. The plant often branches at its base. When cut or broken the plant exudes a milky, sticky sap (latex). Leaves are arranged in opposite pairs along the stems and are sessile, glaucous, ovate to obovate, 5–20 cm long and 4–10 cm wide, with six prominent veins on the underside and a short, pointed tip (apex). Leaf bases are cordate (heart-shaped) and partially clasp the stem. The plant is not deciduous. Petioles are 3–4 mm long and 4–5 mm wide. The inflorescence is a dense, multi-flowered, umbellate cyme. Flower buds are globular. The open corolla is white and pink/purple, and 2–3 cm in diameter. Each flower has five petals and flowers are grouped in umbels (Figure 2).



Figure 1. *Calotropis procera* (photo: Faiz Bebawi)



Figure 2. Flowers of *Calotropis procera* (photo: Faiz Bebawi)

The fruit are choko-like, grey-green pods, 8–12 cm long and contain hundreds of seeds, each with a tuft of long (2–3 cm) silky hairs at one end (Figure 3). Seeds weigh 6–7 mg each (Amritphale et al. 1984). The roots are up to 4 m long and can form large tubers (Grace 2006).



Figure 3. Seeds and seed pod of *Calotropis procera* (photo: Faiz Bebawi)

All parts of the plant are reported to be toxic. The sap contains a compound called calotropin, which affects the heart, and causes blistering and irritation in people (Staples and Herbst 2005). While generally considered to be unpalatable to cattle and other grazing stock, there are no cases of stock poisoning (Vitelli et al. 2008).

The plant is sometimes confused with the closely related *C. gigantea*, which has more cylindrical shaped flower buds, a larger corolla (2.5–3.5 cm in diameter) with lobes that are usually reflexed, and long ovate or oblong and shorter sepals (Bailey and Bailey 1976, Flora of China 1995). *C. gigantea* is sterile but can sucker from its roots (Grace 2006).

Reproduction and dispersal

Most reproduction is from seeds. However, suckers can be produced from the roots (Weed Identification undated). While most seeds fall close to the parent plants, they have a silky pappus that enables wind-dispersal over several hundred metres (Staples and Herbst 2005, Francis 2002). They also float and can be dispersed in irrigation and drainage channels (Brandao 1995). In India, Kumar et al. (1997) reported *C. procera* germinating in cattle dung.

Flowering begins in winter (July) and is thought to start when the plant is at least two years (Parsons and Cuthbertson 2001). A mature plant can produce thousands of seeds each year. Most seeds appear to be short-lived, with germination rates reaching 89% 64 days after sowing in potting mix (Francis 2002). However, the maximum life span of the soil seed bank is unknown (Grace 2006).

In the tropics, seeds germinate at the onset of the wet season (Grace 2006). Seedlings often grow in large numbers after rainy periods, but only a few survive the first season. The plant's large taproot enables it to re-sprout year after year if burned or cut (Francis 2002).

Origin and distribution

Calotrope is native to tropical and subtropical Asia and Africa (Weed Identification undated). According to GRIN (2008), its native range includes:

- **Africa**
 - Macaronesia (Cape Verde)
 - Northern Africa (Algeria, Egypt, Libya, Morocco)
 - North-east tropical Africa (Eritrea, Ethiopia, Somalia, Sudan)
 - East tropical Africa (Kenya, Tanzania, Uganda)
 - West-Central tropical Africa (Cameroon, Equatorial Guinea–Bioko)
 - West tropical Africa (Gambia, Ghana, Guinea-Bissau, Mauritania, Nigeria, Senegal, Sierra Leone)
- **Asia—temperate**
 - Arabian Peninsula (Oman, Saudi Arabia, Yemen)
 - Western Asia (Afghanistan, Egypt–Sinai, Iran, Israel, Jordan)
- **Asia—tropical**
 - Indian subcontinent (India, Nepal, Pakistan)
 - Indochina (Myanmar, Thailand, Vietnam).

The species' naturalised range includes California, Central and South America (Brazil), the Caribbean, the Seychelles, Mexico, Thailand, Vietnam, Australia and many Pacific Islands, including Hawaii (GRIN 2008, PIER 2008, CAB International 2005)—Figure 4.

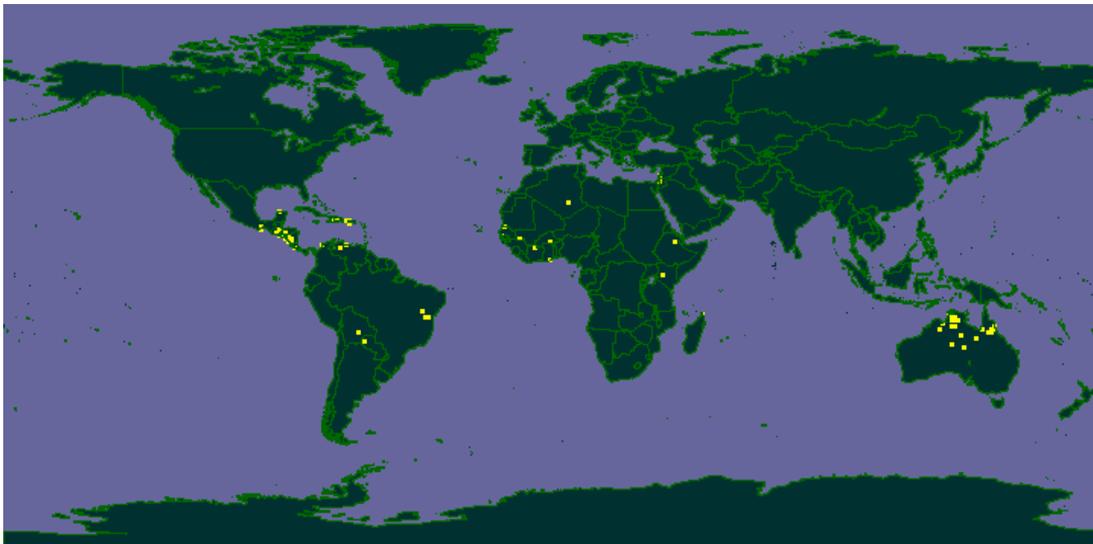


Figure 4. Worldwide distribution of *Calotropis procera*—includes native and naturalised locations (GBIF undated)

Distribution and impact in Australia and Queensland

Calotrope is believed to have been introduced into Australia as a garden plant or in the packing of camel saddles imported from India in one of Queensland's gold rushes, possibly in the early 1900s (Crothers and Newbound 1998, Parsons and Cuthbertson 2001). The first record of naturalised specimens was from around Chillagoe and Georgetown in semi-arid north Queensland in about 1935 (Parsons and Cuthbertson 2001). Currently, it is widespread in northern Australia, from tropical monsoon areas with over 1000 mm annual rainfall, south to arid areas with less than 200 mm rainfall per annum (Figure 5).

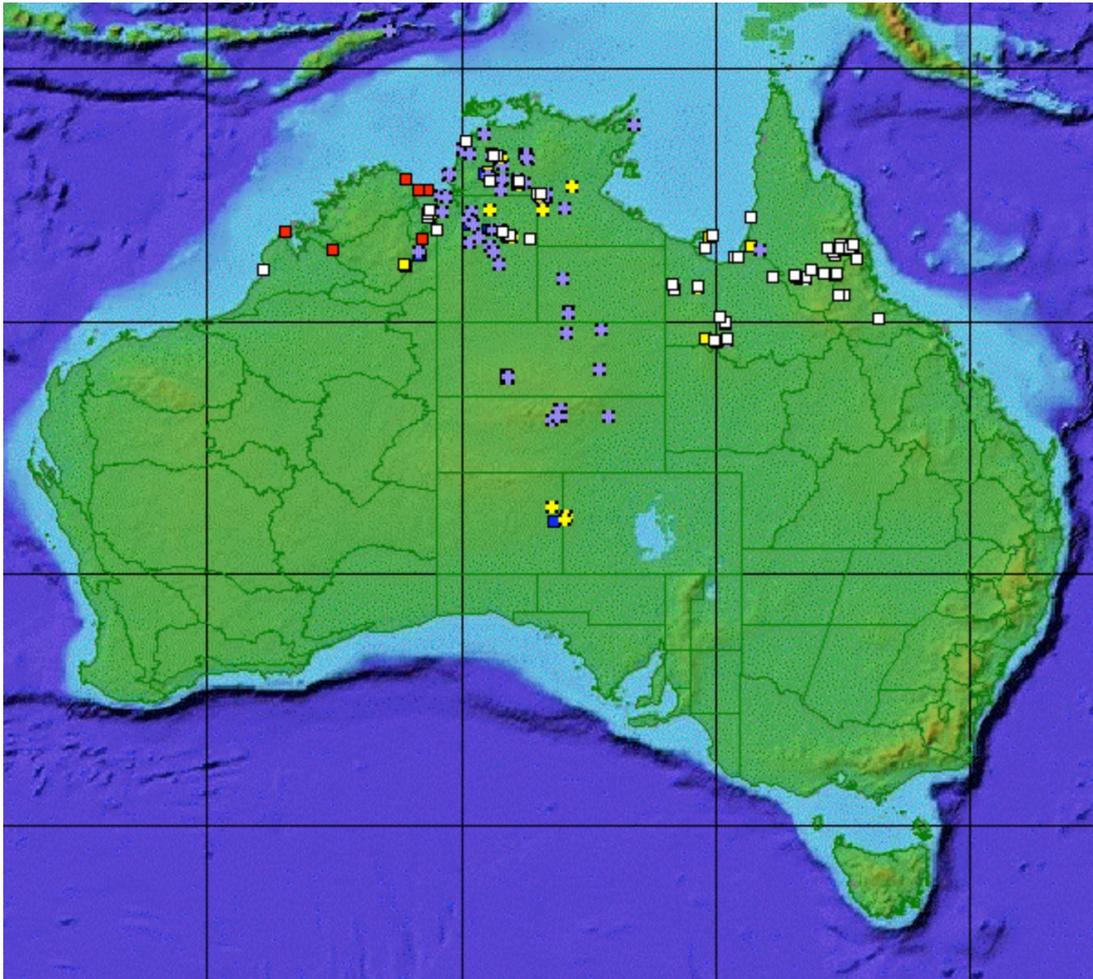


Figure 5. Distribution of *Calotropis procera* in Australia (AVH 2007)

This study was unable to find conclusive data on the economic impact of calotrope in Queensland, or elsewhere in Australia. Moreover, there is conflicting anecdotal information on its significance as a weed. Some authors state that *C. procera* reduces the grazing value of land, impedes mustering, competes with native vegetation and transforms the appearance of the landscape and is, therefore, a high priority weed (Crothers and Newbound 1998, Parsons and Cuthbertson 2001, Smith 2001). Others consider *C. procera* to be symptomatic of overgrazing and general habitat disturbance (Cheam 1984 a, b, c) and perhaps a target of control for cosmetic reasons rather than because of negative impacts on pasture production (Popay and Field 1996). Gardener et al. (2005) even suggest *C. procera* has value as a pasture during drought.

A survey of 10 experienced landholders and weed specialists in the Northern Territory, reported by Grace (2006), found that 62% of respondents believed *C. procera* was an important weed. Similarly, 72% felt that government should invest in control. Surveyed landholders spent an average of \$7625 per annum controlling *C. procera*.

Graziers in the Georgetown area (north Queensland) have reported that calotrope can form dense stands on highly productive alluvial soil associated with the Gilbert River and requires ongoing control to restrict its spread.

Regardless of the actual economic impact of *C. procera*, there is no doubt that it has become an abundant and visually conspicuous element of the tropical savannah landscape in the Northern Territory and Queensland. Field observation by experienced weed control personnel confirm that calotrope is currently invading substantial areas of north-west Queensland, primarily on floodout country and other low-lying areas associated with rivers in the Gulf of Carpentaria (Figures 6 and 7). It is also becoming increasingly common in the Burdekin catchment, where it is common along the Burdekin River channel (above the dam) and nearby frontage, with numerous very small populations scattered across the Burdekin catchment (B Shepherd [Queensland Primary Industries and Fisheries] 2009, pers. comm.).



Figure 6. *Calotropis procera* in floodout country adjoining the Liechhardt River, north-west Queensland (photo: Nathan March)



Figure 7. *Calotropis procera* in drainage lines and nearby low-lying land in the lower Gulf of Carpentaria region (north-west Queensland)—calotrope is the grey haze in the centre of the image) (photo: Nathan March)

Calotrope is often associated with areas that have been disturbed by human activity, such as ex-cultivation paddocks, roadsides and overgrazed cattle paddocks. However, it can also dominate areas where the native vegetation is naturally sparse (open), such as the Gulf of Carpentaria floodplains, sandy Gulf islands and coastal sand dunes (Figures 8 and 9).



Figure 8. An extensive areas of ungrazed sandy country on one of the Gulf of Carpentaria islands (north-west Queensland) invaded by *Calotropis procera* (photo: N. March)



Figure 9. A roadside infestation of *Calotropis procera* in north-west Queensland (photo: N. March)

C. procera can invade and persist in certain grassed habitats, including buffel grass (Figure 10).



Figure 10. *Calotropis procera* on floodplains dominated by buffel grass, Cloncurry River, north-west Queensland (photo: N. March)

Invasion of pastures presumably starts in dry times when grass cover is reduced. Grace (2006) reported that 57% of landholders and weed specialists believe *C. procera* can invade land that has good pasture cover. Moreover, Bastin et al. (2003) recorded similar plant densities in grazed and ungrazed experimental plots.

Despite having toxic sap that contains several heart poisons, there are few reports of animals becoming sick or dying after eating the plant. Goats and rats have died after ingesting large amounts of the plant's latex. However, most of the plant's latex is in its stems and there is little latex the leaves. During the dry season in northern Australia, cattle are reported to graze calotrope extensively, without obvious harm (Parsons and Cuthbertson 2001). In central Australia, however, the plant appears to be unpalatable, perhaps because the harsh conditions trigger production of defensive compounds (Lev-Yadun and Ne'eman 2004).

Calotrope is a declared (noxious) weed in Western Australia and the Northern Territory (Csurhes and Edwards 1998).

Preferred habitat

C. procera is adapted to hot (tropical) arid and semi-arid climates, and can tolerate very low rainfall (150 mm per annum) with a dry season of up to 10 months (Aluka undated). While preferring habitats that receive between 150–1000 mm of rainfall per annum, *C. procera* can persist in wetter areas provided the soil is very well drained (e.g. sand) (CAB International 2005). Mean annual monthly temperatures in the species' range are in the order of 20–30 °C. It is not frost tolerant (CAB International 2005).

While capable of surviving in a range of soil types, including alkaline and saline soils, *C. procera* prefers free-draining sandy soils. It produces deep roots and rarely grows in shallow soils over un-fractured rock. When growing on clay soils, plants tend to be stunted (Hall 1967).

Within its native range, *C. procera* is a widespread pioneer of semi-desert grassland, scrub land and shifting sand dunes (Francis 2002). It prefers open habitats where there is little competition from other plants. Since these conditions can be generated following heavy grazing by cattle and other livestock, *C. procera* tends to be an indicator of overgrazing (Francis 2002). It can become particularly abundant on badly degraded areas such as abandoned cultivation, generally on sandy soils in areas of low rainfall (CAB International 2005).

As mentioned in the previous section, there is evidence that *C. procera* can invade land with good pasture cover. However, it seems best adapted to areas that have sparse ground cover. Research is required to more fully assess its recruitment success in competition with pasture.

C. procera is absent from dense forests.

History as a pest elsewhere

C. procera is a weed of pastures and other open sites on many Pacific Islands (including Hawaii); North, Central and South America; and the Caribbean (CAB International 2005, Wagner et al. 1999, Brandao 1995, Weed Identification undated). In Brazil, *C. procera* is classified as a problem in pastures and on roadsides, as well as in natural scrub land and savannah ecosystems (Ellison and Barreto 2004). Its poisonous foliage is suspected of killing sheep and goats in the Sudan and experimental feeding of plant extracts has also killed sheep in the Northern Territory (Parsons and Cuthbertson 2001).

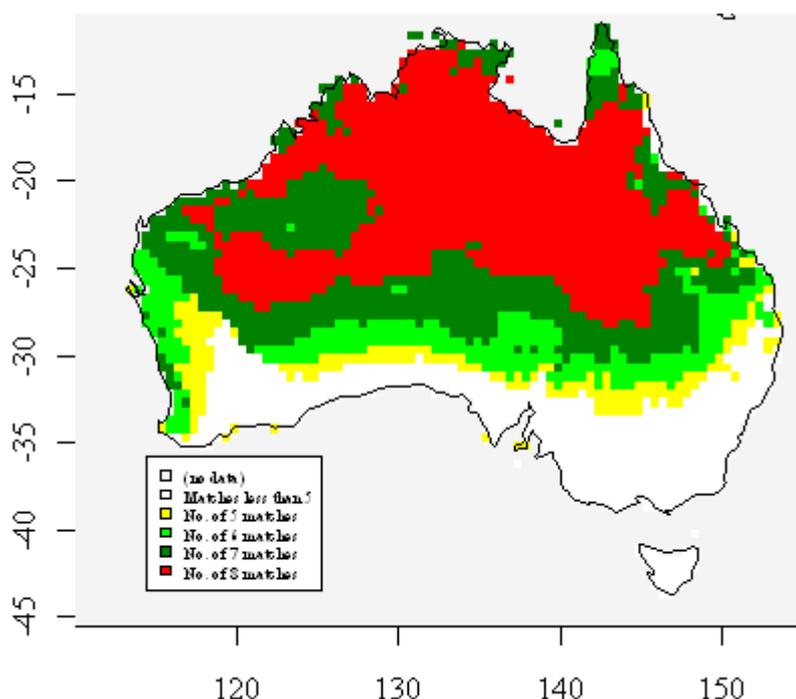
A closely related species, *C. gigantea* L. is a weed in the Hainan province of China (Wang et al. 2008).

Uses

Calotrope is cultivated for use as a medicine in some parts of China (Flora of China 1995, Parrotta 2001). It has also been used to produce fibre (Crothers and Newbound 1998, CAB International 2005) and has been suggested as suitable for bio-fuel, having a potential crop yield of about 90 tonnes per hectare twice per year (Parsons and Cuthbertson 2001).

Pest potential in Queensland

C. procera is already a widespread and abundant pest of grazing land in the Gulf region of north-west Queensland. Based on evidence collected in this study, it seems reasonable to predict that *C. procera* has the potential to spread over much larger areas of land, where habitat is comparable to the species' natural habitat in tropical Africa and Asia. Suitable habitats include virtually any highly disturbed sites that have sparse ground cover (either naturally or as a result of grazing or other perturbation), well-drained soils (sand) and a dry or seasonally dry tropical climate with annual rainfall between 150 and 1000 mm (arid, semi-arid zone and tropical savannahs). Areas where climate is suitable have been predicted using 'Climate' computer software (Figure 11).



White = areas where climate is considered unsuitable for this species
 Yellow, light green and dark green = areas where climate is marginally suitable
 Red = areas where climate is highly suitable

Figure 11. Areas of Australia where climate appears suitable for survival of *Calotropis procera* (this model was generated using 'Climate' climate-matching computer program and was based on global distribution data for the species (GBIF undated) together with Australian collection sites)

Regions at risk of invasion include the Gulf of Carpentaria, Cape York, large areas of western Queensland and the Burdekin region.

Control

Experiments to identify effective herbicides are described by Vitelli et al. (2008). The Tropical Weeds Research Centre at Charters Towers has obtained a permit from the Australian Pesticides and Veterinary Medicines Authority that allows landholders to choose from three types of herbicides to control *C. procera*.

Research has shown that adoption of pasture management practices that promote competition from perennial grasses, in conjunction with strategic chemical control, increases the effectiveness and reduces the costs of controlling this weed.

Fire appears ineffective at controlling *C. procera* with the plant re-sprouting from the base after being burnt (N March [Queensland Primary Industries and Fisheries] 2009, pers. comm.).

Detailed information on management of *C. procera* has been published by Grace (2009).

C. procera is a host plant for larvae of the lesser wanderer butterfly (*Danaus chrysippus*) (Common and Waterhouse 1981) and possibly the closely related wanderer butterfly (*Danaus plexippus*), which is known to feed on *C. gigantea*. However, the level of damage caused by these butterflies is not significant.

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