

1.0 Organism description

Scientific name

Cleome rutidosperma DC., Capparaceae.

Common names

Spiderplant, fringed spiderflower

Synonyms

Cleome ciliata Schmach. & Thonn. (USDA)

Cultivars, strains, or variants

None known.

Previously recorded in New Zealand

No (Ministry of Agriculture and Forestry, Landcare Research) but seed found in New Zealand previously (Popay et al. 2003).

2.0 Summary

- *C. rutidosperma* is an erect or scrambling, annual or short-lived perennial, herb with a varied growth habit. It grows up to 1m in height, and can form dense mats as well as twining through other vegetation to reach light. It grows rapidly, is fast maturing, and has a high reproductive capacity.
- Preferred habitats are ruderal, humid and hot conditions. It is often found as a weed of disturbed ground, roadsides, gardens, crops and abandoned land, and has also been found growing as an epiphyte on trees, stone walls and cliff faces.
- In its native range it is common in coastal regions but can also extend far inland and to higher elevations.
- It has a pan-tropical distribution – found throughout tropical and sub-tropical Africa, Asia, America, the Pacific, and recently, northern Australia.
- In New Zealand, it is likely to be limited by climate to the northern North Island, but may extend further south in coastal and lowland localities to the northern South Island.
- *C. rutidosperma* has moderate economic impacts overseas in a wide range of crops, where its scrambling habit smothers and stunts young crop plants. It has had environmental impacts in South East Asia and Australia.

- In New Zealand, *C. rutidosperma* has the potential to be moderately problematic in intensive cropping areas, greenhouses and nurseries. There is no indication that pastoral agriculture would be adversely affected.
- It has some potential to become an environmental weed in New Zealand, but the degree of its impact is uncertain.

3.0 Basic biology and ecology

3.1 Overseas distribution

- It has a pan-tropical distribution – found throughout tropical and sub-tropical Africa, Asia, America, the Pacific, and recently, northern Australia.
- Africa (tropical/sub-tropical); Sudan, Tanzania, Uganda, Cameroon, Congo, Equatorial Guinea, Zaire, Cote D'Ivoire, Ghana, Guinea, Liberia, Nigeria, Sierra Leone, Togo, Angola and Zambia (Jansen 2004).
- Asia (tropical); introduced and listed as invasive in many parts of South East Asia, including the Philippines, Cambodia, Indonesia, Malaysia, Singapore, Thailand and Vietnam (PIER, Weeds Australia).
- North and Central America (tropical/sub-tropical); has spread widely to become a pest in Central America, the Caribbean and Florida (USDA).
- Pacific (tropical); introduced and invasive on Nauru and Niue (PIER, Popay et al. 2003)
- Australia (tropical); a recent arrival in northern Australia, near Darwin (AVH, PIER).

3.2 Ecology

- *C. rutidosperma* is an erect or scrambling, annual or short-lived perennial, herb with a varied growth habit. It grows up to 1m in height, and can form dense mats as well as twining through other vegetation to reach light. Branches can grow to 2m long. It grows rapidly, is fast maturing, and has a high reproductive capacity (DAFF).
- In low numbers it tends to be cryptic and difficult to locate (Waterhouse 2003).
- Preferred habitat and environments are generally ruderal, humid and hot conditions. It is often found as a weed of disturbed ground, roadsides, gardens, crops and abandoned land. It has also been found growing as an epiphyte on trees, stone walls and cliff faces.

- In its native range it is common in coastal regions but can also extend far inland and to elevations of 1200m (Waterhouse 2003, Jansen 2004).
- In Africa *C. rutidosperma* flowers year round but more heavily in the rainy season (Jansen 2004). In Darwin, Australia, it germinated, flowered and seeded continuously when water was available (Mitchell & Schmid 2002).
- Propagation is by seed which is produced prolifically. *C. rutidosperma* seed is permeable to water and emergence occurs at soil depths of 0-5cm, with the highest emergence at 0-3cm depth. Germination is sensitive to temperature and light. Continuous light and temperatures of approximately 30°C promote germination. There was no germination at 20° C (Fantastico & Mercado 1985).
- Explosive pods disperse seed over short distances, and it is also dispersed by ants and water. It would also be readily dispersed by human activities.
- In Australia, seed continued to germinate for at least two years from the seedbank (Mitchell & Schmid 2002), while in New Zealand, seed that fell from container-grown plants readily germinated in spring 4 months later (James pers. comm.). If eradication is the aim, ongoing surveillance and control would be required.
- Palatable to humans and is sometimes eaten as a cooked vegetable in Africa. No records were found to indicate toxicity to people or animals (Jansen 2004).

4.0 Likelihood of establishment and spread

4.1 Environmental tolerances overseas and comparison with New Zealand

4.1.1 Environmental tolerances overseas

- Its pan-tropical distribution, ecology and history of naturalisation suggests that *C. rutidosperma* is well adapted to hot, humid, tropical climates and would be intolerant of cold, frosts and drought.
- Africa (tropical/sub-tropical); restricted to tropical regions, often near the coast and usually below 400m in areas with annual rainfall of 1700-3000mm. However, it also grows far inland and sometimes at elevations as high as 1200m (Jansen 2004).
- Australia (tropical); the climate zone of the Darwin area, the only known location of *C. rutidosperma* in Australia, is characterised as hot-humid. On an annual basis, this translates to mean daily minimum temperatures of 21-24° C, average rainfall of 1600-2000mm, 75-100 rain days (>1mm per day), 0-2 frost days, and 70-80% humidity (Bureau of Meteorology).

- Australia (sub-tropical); the predicted distribution in Australia extends from the Northern Territories (Broome through to Darwin), to coastal Queensland (Northern Cape York Peninsula south to Brisbane) (Weeds Australia). This falls mostly in hot-humid and warm-humid climate zones characterised by hot humid summers and hot to mild winters. In this broad region, mean annual minimum temperature ranges from 12-24° C, average rainfall is 800-3200mm, rain days (>1mm per day) number 50-150 days per year, frost days range from 0-10 per year and humidity is 60-90% (Bureau of Meteorology).

4.1.2 Comparison with New Zealand

- The nearest climate matches are the relatively warm, humid regions of Northland, Auckland and coastal Bay of Plenty. In these areas, average annual rainfall (1200-1500mm), number of rain days >1mm (111-137 days) and humidity (78-86%) are comparable to the above. However, mean daily minimum temperatures (10-11.8° C) are lower, and ground frosts more frequent (1-42 days per year) (NIWA).
- Note that in New Zealand, *C. rutidosperma* grew in a variety of conditions; from partially shaded outdoor tubs, to unheated glasshouses in winter (James pers. comm.). It also grows at altitudes as high as 1200m in the tropics. It is possible then that it could grow further south in coastal and lowland localities such as Gisborne, Hawke Bay, and Marlborough – particularly in irrigated crops where moisture would not be limiting.

4.2 History of spread in other countries

- *C. rutidosperma* is cited as invasive in many parts of South East Asia, the Pacific and Australia (PIER). It is reported to have expanded rapidly in Indonesia and mainland Southeast Asia (Soerjani *et al.* 1987).
- In the United States it is found only in Florida but does not appear to be widespread. No information was found on the rate of spread following its detection or introduction there (USDA).
- In Australia, the first population was found near Darwin in August 2000. Three months later, following a public awareness campaign, it was discovered at a further four sites. These populations were estimated to have been present approximately 10 years before their discovery (Mitchell & Schmid 2002). By 2001 it was known to be present at sixteen sites in rural and suburban Darwin (Schmid 2001). It is not known if these additional populations were the result of natural or human mediated dispersal from the known infestations or if they had just previously escaped detection.
- A related species, *C. hassleriana*, is a rare garden escape in Auckland, Nelson, Christchurch and Otago (Popay *et al.* 2003). However, this species has a far greater

tolerance for temperate climates e.g. in North America it grows all the way up the east coast and into Canada, while in Australia it is found as far south as Victoria (AVH, USDA).

4.3 Natural dispersal mechanisms and human assisted means of spread

4.3.1 Natural dispersal mechanisms

- Numerous, small seeds are produced in explosive pods that split at maturity, catapulting seed up to one metre from the adult (Mitchell & Schmid 2002). Wind/gravity would also disperse the seed.
- Seeds have an elaiosome and are harvested and dispersed short distances by ants (Schmid 2001).
- Seeds may also be transported in water (Weeds Australia), and possibly by animals (internal/external).

4.3.2 Human dispersal

- Longer distance seed dispersal is effected by human mediated transport e.g. seeds in contaminated hay and produce, in soil on farm machinery and footwear, or with plants and potting mix in nurseries (Mitchell & Schmid 2002).
- Its attractive flower could encourage cultivation in pots or home gardens.

4.4 Distribution of potential habitat in New Zealand

- Primary habitat in New Zealand is likely to include intensive cropping areas, waste areas, roadsides and gardens in the northern North Island, with the possibility of extending to coastal areas as far south as the northern South Island.
- Other habitats could include disturbed areas in indigenous forest, forest margins, and scrub.

4.5 Predicted rate of spread and constraints in New Zealand

4.5.1 Predicted rate of spread

- Slow to moderate rate of spread by natural dispersal from local infestations.
- Once established, it could form widespread, local populations quickly via human-assisted dispersal (e.g. in contaminated soil, produce and machinery etc).

4.5.2 Constraints to spread

- Climate is likely to be the main limiting factor to the large-scale establishment, distribution and spread of *C. rutidosperma* in New Zealand.
- The seed appears to require relatively high temperatures to germinate (>20°C).
- Little information was found to indicate the presence of predators, pathogens or browsers that might otherwise limit spread. However, in Malaysia *C. rutidosperma* is sometimes planted around cultivated crops in order to divert oviposition of diamond back moth (*Plutella xylostella*) away from cultivated plants (Jansen 2004).

5.0 Consequences

5.1 Overseas impacts

5.1.1 Economic impacts

- *C. rutidosperma* is a pest in a wide range of crops in tropical countries. It invades areas where soil has been disturbed or prepared for planting, then smothers or stunts young crop plants through competition for light, nutrients and water.
- Cited as a major weed of agriculture in Jamaica and Borneo, and important as a weed of annual crops in Cambodia, Vietnam and the Philippines (Holm *et al.* 1979). In particular, tropical annual crops such as peanuts, melons and vegetables are affected (DAFF). It is also cited as a weed of rain-fed and upland rice production (Waterhouse & Mitchell 1998).

5.1.2 Environmental impacts

- Cited as an environmental weed in Cambodia, Vietnam and the Philippines (Holm *et al.* 1977) and in northern Australia (Waterhouse & Mitchell 1998, Schmid 2001). Limited detailed information was given but presumably dense infestations smother native seedlings and cause local reductions in biodiversity. In Australia however, there was only one site where *C. rutidosperma* formed a dense mat (Mitchell & Schmid 2002).

5.1.3 Other impacts

- None known.

5.2 Potential impacts in New Zealand

5.2.1 Economic

- It has the potential to be moderately problematic in intensive cropping areas, greenhouses and nurseries, due to its growth habit, high reproductive capacity and fast maturation. It is most likely to be a problem in the northern North Island but could also be troublesome further south in irrigated crops in Hawke Bay, Gisborne and Marlborough. However, there is no reason to suspect that normal weed control techniques would not mitigate its impact.
- The direct consequence to the cropping industry would be potential losses in production. Indirect costs are those associated with increased herbicide use or manual weed control. These consequences and costs would be ongoing if *C. rutidosperma* was to establish in New Zealand.
- There is no information to suggest that pastoral agriculture would be adversely affected.

5.2.2 Environmental

- *C. rutidosperma* has some potential to become an environmental weed in New Zealand, but the degree of its impact is uncertain. Its growth habit, reproductive capacity, and fast maturity is a concern, and it may have some shade tolerance. However, it is unlikely to invade undisturbed forests or other habitats, and it may be less aggressive in New Zealand conditions. It may also be limited by climate to warmer, northern areas.
- Suitable habitat would probably be limited to disturbed areas in indigenous forests and scrub, and forest margins.
- If it was to form dense infestations it could prevent the regeneration of native plant species, inhibit natural succession, and cause local reductions in biodiversity. Use of herbicides in this context may further disturb natural environments and kill non-target species. Additional consequences would be the costs associated with ongoing surveillance, control or eradication.

5.2.3 Other impacts

- If seed has contaminated plants and potting mix from nurseries it could have impacts in restoration, or roadside plantings.
- It may have impacts on amenity values.

- Potentially a nuisance weed in home gardens.

6.0 Control techniques

- An acceptable range of control techniques exist. Underlined names are herbicides known to be available in New Zealand.
- For small, local infestations, hand pulling followed by a residual herbicide is effective and reduces the need for continued surveillance. Where the plants form a dense mat, 1% glyphosate gives 100 % kill although this treatment encourages further germination from the seed bank (the addition of mulch could prevent this). A selective herbicide is a possibility (Mitchell & Schmid 2002).

7.0 Uncertainty summary

- The main uncertainty is related to potential distribution. The assumption is that climate will limit the establishment, growth and impacts of *C. rutidosperma* primarily to northern areas of New Zealand.
- There is a paucity of information on its impacts overseas as an environmental weed, and uncertainty as to its risk to natural environments in New Zealand.

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