

1.0 Organism description

Scientific name

Cleome viscosa L., Capparaceae.

Common names (PIER)

Asian spiderflower, tickweed, cleome, wild mustard.

Synonyms (USDA)

Cleome icosandra (L.)

Polanisia viscosa (L.) DC.

Cultivars, strains, or variants

None found.

Previously recorded in New Zealand

No (Ministry of Agriculture and Forestry, Landcare Research).

2.0 Summary

- *C. viscosa* is a hispid, annual, erect, branched herb, sometimes becoming woody at base and growing to 1m tall.
- Pan-tropical distribution; mostly tropical or sub-tropical climates but it also grows in hot, arid areas of Australia and Arabia, and in humid continental North America, where cool temperatures sometimes occur.
- Common habitats include cultivated and fallow land, coastal dunes, roadsides and disturbed areas as well as riparian zones and open woodlands, grasslands and shrublands.
- In New Zealand, it would probably be restricted to coastal and lowland localities in the northern North Island, but may extend further south as far as the northern South Island. It is possible, but unlikely, that it could also establish in hot, dry parts of New Zealand such as the central South Island.
- Economic impacts overseas are low to moderate and appear restricted to tropical countries. The main crops affected are rice and tobacco, with impacts also on annual herbaceous and root crops. No environmental impacts overseas are known.
- In New Zealand, its economic impacts in crops and nurseries would probably be minor, and it is unlikely to be any threat to pastoral agriculture. While it has the potential to grow in disturbed natural areas, environmental impacts are also

unlikely. It could be a nuisance weed in home gardens, amenity areas and roadside plantings.

3.0 Basic biology and ecology

3.1 Overseas distribution

- Pantropical – Asia, Africa, Arabia, America, Caribbean, Australia and Pacific Islands.
- Africa (tropical/sub-tropical/arid); West Africa from Cape Verde Islands and Senegal to Egypt, Ethiopia and Zanzibar. Absent from South Africa (Jansen 2004).
- Indian Ocean (tropical); Madagascar, Mauritius and other Indian Ocean islands (PIER).
- Arabia (arid); widespread in peninsular Arabia (Jansen 2004).
- Asia (tropical/sub-tropical); India, Sri Lanka, Japan, Philippines, Cambodia, Myanmar, China, Hong Kong, Indonesia, Malaysia, Singapore, Thailand and Vietnam (PIER, GBIF, Waterhouse 1993).
- North America (sub-tropical/humid continental); introduced to North America. Found in Georgia, Florida and Louisiana as well as Pennsylvania (USDA).
- Central America/South America/Caribbean (tropical/sub-tropical); introduced and naturalised in tropical Central and South America and the Virgin Islands. A noxious weed in Puerto Rico (USDA, Hanelt & IPK 2001).
- Australia (tropical/sub-tropical/arid); native to Australia. Found in the Northern Territory, Queensland, Western Australia, New South Wales and South Australia. Widespread in northern and central Australia and extending as far south as Sydney on the east coast, and Adelaide on the south coast (AVH, Flora of Australia, eFlora).
- Pacific (tropical/sub-tropical); Mariana Islands, Cook Islands, Galapagos Islands, Micronesia, Fiji, French Polynesia, Guam, Papua New Guinea, Kiribati, Nauru, New Caledonia, Niue, Palau, Western Samoa and the Solomon Islands (PIER).

3.2 Ecology/habitat

- Annual, erect, branched herb, sometimes becoming woody at base and growing to 1m tall. Sticky leaves and stems with strong smelling flowers (Brock 2001).

- Preferred habitats include open woodlands, grasslands, shrublands, cultivated and fallow land, coastal dunes, roadsides and disturbed areas (Jansen 2004). Sometimes invades pasture (PIER) and often associated with riparian zones such as river beds, creeks and waterholes in Australia (eFlora, ANHSIR). It is generally found in lowland or coastal locations but it grows to about 1000m altitude in Africa (Jansen 2004) and to 1500m in the Himalayas (Maikhuri et al. 2000).
- Grows mostly in warm humid conditions but also tolerates seasonally dry areas (Jansen 2004). Generally prefers sandy soils, sometimes on rocky soils or alluvium (Jansen 2004, ANHSIR).
- When grown in a glasshouse in New Zealand, it appeared less competitive than *C. rutidosperma*, and was slower to reach maturity. However, the seeds are larger which may enable it to establish more readily in natural environments (James pers. comm.).
- In favourable habitats, plants start flowering 3-4 weeks after emergence and the entire life cycle takes about 3 months (Jansen 2004). In New Zealand, the time to reach reproductive maturity is longer (James pers. comm.).
- Propagation is by seed. The fruit is a dehiscent pod containing numerous, ribbed seeds up to 1.5mm diameter. Seeds have no dormancy and germinate readily after shedding (Jansen 2004, Flora of Australia). The relatively large seed is likely to be persistent in the seedbank under favourable conditions.
- Scarified seed germinated best at 32° C, and decreased at lower temperatures. At 14 ° C there was almost no germination. Seeds germinated equally well in continuous light or darkness, with a decrease in germination under conditions of decreased light intensity or duration. Emergence was the same on the soil surface and at 1cm depth (Menon & Kulkarni 1987).
- It is not grazed by cattle or attacked by insect pests due to its sticky nature and strong pungent odour (Jansen 2004).
- Cultivated in South East Asia as a medicinal plant and leaf vegetable (Hanelt & IPK 2001).

4.0 Likelihood of establishment and spread

4.1 Environmental tolerances overseas and comparison with New Zealand

4.1.1 Environmental tolerances overseas

- Mostly tropical or sub-tropical climates with associated high humidity and warm temperatures but also recorded in humid continental North America (Pennsylvania) and arid central Australia and Arabia.
- Australia (tropical/sub-tropical); the climate of northern Australia is characterised by hot humid summers and hot to mild winters. In this broad region, mean daily minimum temperature ranges from 12-24° C, average annual rainfall is 800-3200mm, rain days (>1mm) number 50-150 days per year, frost days range from 0-10 days per year and humidity is 60-90% (Bureau of Meteorology).
- Australia (arid); climate through most of central Australia is classed as ‘hot dry summer, cold winter’ with mean daily minimum temperature ranging from 9-15°C, average annual rainfall 0-300mm, 10-30 rain days (>1mm) per year, 30-50% humidity and 10-50 days of frost per annum (Bureau of Meteorology).
- Arabia (arid); peninsula Arabia typically experiences average daily winter temperatures of 8-20° C, average summer temperatures of 27-43° C. There is a strong diurnal temperature range, with temperatures dropping rapidly at night (although frosts are very infrequent). Average annual rainfall is about 100mm (World Climate).

4.1.2 Comparison with New Zealand

- New Zealand; the closest match to its sub-tropical environment overseas are the warmer regions of Northland, Auckland and coastal Bay of Plenty where average annual rainfall (1200-1500mm), rain days (>1mm) per year (111-137 days) and humidity (78-86%) are comparable, although mean daily minimum temperatures (10-11.8° C) are lower, and ground frosts more frequent (1-42 days per year) (NIWA).
- Note that the Australian, North American and Arabian distribution suggests that *C. viscosa* tolerates both hot, dry conditions, and cooler conditions. In New Zealand, it would probably be restricted to coastal and lowland localities in the northern North Island, but may extend further south as far as the northern South Island. It is possible, but unlikely, that it could also establish in hot, dry parts of New Zealand such as the central South Island.

4.2 History of spread in other countries

- Recorded for the first time relatively recently in United Arab Emirates (Karim 1993) but common in other parts of the Arabian Peninsula.
- Noxious weed in Puerto Rico and naturalised in tropical America (Hanelt & IPK 2001)
- Listed as invasive on Mariana Islands, Galapagos, Fiji, French Polynesia, Guam, Kiribati, Nauru, New Caledonia, Niue, Palau, and the Solomon Islands (PIER).

4.3 Natural dispersal mechanisms and human assisted means of spread

4.3.1 Natural dispersal mechanisms

- *C. viscosa* appears to have no specialised means of dispersal. Seeds drop to the ground close to, or beneath the parent plant (ePic). The wind may subsequently move seed short distances. No information found regarding avian dispersers.

4.3.2 Human dispersal mechanisms

- Human mediated dispersal is probable in contaminated machinery, produce, and soil or stock feed.

4.4 Distribution of potential habitat in New Zealand

- Probably limited by climate to coastal and lowland localities in the northern North Island but possibly extending to cooler areas of the South Island, including hot, dry central areas.
- Primary habitat in New Zealand is likely to be cultivated and fallow land, roadsides, waste areas, coastal dunes and riparian zones.
- Secondary habitats may be disturbed areas in indigenous forest, forest margins and scrub.

4.5 Constraints to spread and predicted rate of spread in New Zealand

4.5.1 Predicted rate of spread

- Slow to moderate rate of spread by wind/gravity seed dispersal from local infestations.

- Could form widespread populations quickly via water borne seed dispersal and human vectors (e.g. in contaminated soil, produce and machinery).

4.5.2 Constraints to spread

- Probably limited by climate in New Zealand but this is uncertain given the range of habitats and environments it is known from overseas.
- Host for various plant parasitic nematodes and insect pests overseas (Jansen 2004, Olabiyi & Adesina 2006, Patricio et al. 2005, Jagadish & Jayaramaiah 2005, Sanchez et al. 2001, Kalaiyarasan & Palanisamy 2004)
- Not considered palatable to mammalian browsers (Jansen 2004).

5.0 Consequences

5.1 Overseas impacts

5.1.1 Economic impacts

- In South East Asia the principal crops affected are rice and tobacco, with impacts also on tomatoes, soybeans, maize, sugarcane, sweet potato, taro, cotton, and ground nut.
- It is reported to be widespread and important in Singapore and the Philippines; locally important in Myanmar and Malaysia; and present but not important in Thailand, Cambodia, Vietnam and Indonesia (Waterhouse 1993).
- In the Pacific, it is reported to have medium impacts in annual herbaceous and root crops, and minor impacts as a weed of plantations, wet-land crops, gardens, and pasture (Swarbrick 1997). In Papua New Guinea, it sometimes invades pasture but is rarely troublesome in cultivation (PIER).
- The direct costs are reduced growth and yield of crop plants through competition for light, water and nutrients. Indirect costs are associated with increased herbicide use of manual weed control.

5.1.2 Environmental impacts

- No references found describing *C. viscosa* as an environmental weed.

5.1.3 Other impacts

- None known.

5.2 Potential impacts in New Zealand

5.2.1 Economic

- *C. viscosa* is likely to have negligible economic impacts in intensive cropping areas and nurseries, and is unlikely to be a threat to pastoral agriculture. Its growth habit is not of major concern, and it appears to be less aggressive and slower to mature than *C. rutidosperma*.

5.2.2 Environmental

- Unlikely to be an environmental threat in New Zealand. While it has the potential to grow in disturbed natural areas, including forest margins, scrub, coastal areas, and riparian habitats, impacts are likely to be minor. There is no history of environmental impact overseas, its growth form is of no particular concern, and it is unlikely to invade undisturbed habitats.

5.2.3 Other impacts

- Could be a nuisance weed in home gardens, amenity areas and roadside plantings.

6.0 Control techniques

- An acceptable range of control techniques are available. Herbicides available in New Zealand are underlined.
- Pre-emergent applications of S-metolachlor (1kg/ha) and alachlor (1kg/ha) in soybeans and tomatoes; CGA 362 + ametryn (3kg/ha) in sugarcane; atrazine (1kg/ha) and metolachlor (1kg/ha) in maize; pendimethalin in groundnut (Reddy et al 2007, Gana et al. 2006, Praveen & Murthy 2005, Chandrika 2004, Reddy et al. 2003, Hongyuan et al 1989)
- Hand weeding.

7.0 Uncertainty summary

- Given the range of habitats and environments it is known from overseas, its potential distribution in New Zealand is uncertain.

8.0 References

- ANHSIR. Australian National Herbarium Specimen Information Register.
<http://www.cpbr.gov.au/cgi-bin/ansir?040=cleome%20viscosa> (28 April 2008).
- AVH. Australian Virtual Herbarium.
<http://www.anbg.gov.au/cgi-bin/avh.cgi> (28 April 2008).
- Brock, J. 2001. Native Plants of Northern Australia. Reed New Holland, Sydney.
- Bureau of Meteorology. Australian Government Bureau of Meteorology
http://www.bom.gov.au/climate/averages/index.shtml?map_type=cdio&code=3 (14 April 2008).
- Chandrika, V. 2004. Integrated weed management in groundnut (*Arachis hypogaea* L.) during rabi season. *Legume Research* 27(4): 243-248.
- eFlora. Electronic Flora of South Australia. Fact sheet for *Cleome viscosa*.
<http://www.flora.sa.gov.au/cgi-bin/texhtml?form=speciesfacts&keyname=cleome%20viscosa&submit=Search> (28 April 2008).
- ePic. Royal Botanic Gardens, Kew. Seed Information Database.
<http://epic.kew.org/searchepic/summaryquery.do?searchAll=true&scientificName=Cleome+viscosa> (28 April 2008).
- Flora of Australia. Online data derived from Flora of Australia Volume 50 (1993).
<http://www.anbg.gov.au/abrs/online-resources/flora/redirect.jsp> (28 April 2008).
- Gana, A.K., Ndarubu, A.A. & Busari, L.D. 2006. Efficacy of CGA 362 and ametryn with pre-emergence herbicides on weed control in sugarcane. *Sugar Technology* 8(1): 88-90.
- GBIF. Global Biodiversity Information Facility data portal.
<http://data.gbif.org/species/13741948/> (28 April 2008).
- Hanelt, P. & IPK (eds.). 2001. Online version of Mansfeld's Encyclopaedia of Agricultural and Horticultural Crops. http://mansfeld.ipk-gatersleben.de/pls/htmlldb_pgrc/f?p=185:45:0::NO::P7_BOTNAME:cleome%20viscosa (28 April 2008).

- Hongyuan, T., Xuee, W. & Zi, Y. 1989. Distribution and infestation of major weeds in cotton fields in China and their control. *Acta Agriculturae Shanghai* 5(3): 51-58.
- Jagadish, K.S. & Jayaramaiah, M. 2005. Distribution pattern of the tobacco aphid *Myzus nicotianae* (Homoptera: Aphididae) and its comparative biology. *Journal of Ecobiology* 17(3): 229-234
- James, Trevor. Pers. comm. Weed Scientist, AgResearch, New Zealand.
- Jansen, P.C.M., 2004. *Cleome viscosa* L. Internet Record from Protabase. Grubben, G.J.H. & Denton, O.A. (Editors). PROTA (Plant Resources of Tropical Africa / Ressources végétales de l'Afrique tropicale), Wageningen, Netherlands. <<http://database.prota.org/search.htm>> (28 April 2008).
- Kalaiyarasan, S. & Palanisamy, S. 2004. Life table and intrinsic rate of increase of sesame pod bug, *Elasmolomus sordidus* Fabricius on *Sesamum indicum* and *Cleome viscosa*. *Annals of Plant Protection Sciences* 12(2): 260-262
- Karim, F.M. 1993. New records of the flora of the United Arab Emirates (part 3). *Arab Gulf Journal of Scientific Research* 11(3): 391-401
- Landcare Research. Flora of New Zealand online search page. Taxon search. <http://floraseries.landcareresearch.co.nz/pages/Search.aspx> (28 April 2008).
- Maikhuri, R.K., Semwal, R.L., Rao, K.S., Nautiyal, S. & Saxena, K.G. 2000. *Cleome viscosa* (Capparaceae): a weed or a cash crop? *Economic Botany* 54(2): 150-154.
- Menon, A. & Kulkarni, A.R 1987. Ecological studies in *Cleome viscosa* L. seed and seed germination. *Indian Botanical Reporter* 6 (1): 1-7
- Ministry of Agriculture and Forestry, New Zealand.
Plants Biosecurity Index (version 1.6.0)
<http://www1.maf.govt.nz/cgi-bin/bioindex/bioindex.pl> (28 April 2008).
- NIWA. National Institute of Water and Atmospheric Research. Crown Research Institute, New Zealand.
<http://www.niwa.cri.nz/edu/resources/climate> (17 April 2008).
- Olabiyyi, T. I. & Adesina, G. O. 2006. Weed as host of plant parasitic nematodes. *Crop Research Hisar* 32(3): 512-516
- Patricio, M.G., Ocampo, V.R. & Cadapan, E.P. 2005. Biology and abundance of the striped flea beetle, *Phyllotreta striolata* (F.) (Coleoptera: Chrysomelidae), on pak-choi (*Brassica campestris* var. *chinensis* L.), and management options against the insect pest. *Philippine Entomologist* 19(1): 49-77

PIER. Pacific Island Ecosystems at Risk.

http://www.hear.org/pier/species/cleome_viscosa.htm (28 April 2008).

Praveen, V.L. & Murthy, B.B. 2005. Relative efficiency of herbicides in maize and cowpea intercropping system for green fodder. *Indian Journal of Weed Science* 37(1): 123-125.

Reddy, M.M., Vilatha, A.M. & Rao, L.J. 2007. Integrated weed management in pigeonpea (*Cajanus cajan*) and soybean (*Glycine max*) intercropping system on vertisol under rainfed conditions. *Indian Journal of Agricultural Sciences* 77(3): 177-178.

Reddy, S.M., Reddy, G.P. & Reddy, B.S. 2003. Weed management in soybean, *Glycine max* L. *Journal of Oilseeds Research* 20(2): 292-294.

Sanchez, M.V., Aguero, R. & Rivera, C. 2001. Host plants of *Aphis gossypii* (Aphididae), a virus vector for the cantaloupe *Cucumis melo* (Cucurbitaceae) in Costa Rica. *Revista de Biologia Tropical* 49(1): 305-311

Swarbrick, J.T. 1997. Weeds of the Pacific Islands. Technical Paper No. 209. South Pacific Commission, New Caledonia.

USDA, ARS, National Genetic Resources Program.

Germplasm Resources Information Network - (GRIN) [Online Database].

National Germplasm Resources Laboratory, Beltsville, Maryland.

http://www.ars-grin.gov/cgi-bin/npgs/html/tax_search.pl?Cleome%20viscosa (27 April 2008)

Waterhouse, D.F. 1993. The Major Arthropod Pests and Weeds of Agriculture in Southeast Asia. Australian Centre for International Agricultural Research, Canberra.

World Climate. Online weather, rainfall and temperature data.

<http://www.worldclimate.com/cgi-bin/place.pl?pla=dubai>