

# Pest plant risk assessment

## Navua sedge

*Cyperus aromaticus*

**Steve Csurhes and Dr Yuchan Zhou**

Biosecurity Queensland  
Department of Primary Industries  
and Fisheries, Queensland  
GPO Box 46, Brisbane Qld 4001

August 2008

The Department of Primary Industries and Fisheries (DPI&F) seeks to maximise the economic potential of Queensland's primary industries on a sustainable basis.

While every care has been taken in preparing this publication, the State of Queensland accepts no responsibility for decisions or actions taken as a result of any data, information, statement or advice, expressed or implied, contained in this report.

© The State of Queensland, Department of Primary Industries and Fisheries 2008.

Copyright protects this material. Except as permitted by the *Copyright Act 1968* (Cwlth), reproduction by any means (photocopying, electronic, mechanical, recording or otherwise), making available online, electronic transmission or other publication of this material is prohibited without the prior written permission of the Department of Primary Industries and Fisheries, Queensland.

Inquiries should be addressed to [copyright@dpi.qld.gov.au](mailto:copyright@dpi.qld.gov.au) (tel: +61 7 3404 6999), or:

Director  
Intellectual Property Commercialisation Unit  
Department of Primary Industries and Fisheries  
GPO Box 46  
Brisbane Qld 4001

# Contents

Summary	2
Identity and taxonomy	2
Description	3
Reproduction, seed longevity and dispersal	3
Origin and worldwide distribution	4
Ecology and preferred habitat	4
Distribution in Queensland and Australia	5
History as a weed overseas	5
Impact in Queensland	6
Uses	7
Pest potential in Queensland	7
Related species with weed impact	8
References	8

## Summary

*Cyperus aromaticus* (Navua sedge) is a 30–60 cm tall, perennial sedge, native to tropical Africa. Dispersal occurs from seeds and from broken fragments of rhizomes.

Anecdotal evidence suggests it was accidentally introduced to North Queensland in the late 1970s. It has since spread north to Mossman, south to Ingham and west to wetter parts of the Atherton Tablelands.

*C. aromaticus* is listed as a weed in Fiji, New Caledonia, Western Samoa, the Solomon Islands, Vanuatu, French Polynesia, Singapore and Christmas Island. Its impact is perhaps at its worst in Fiji, where it is described as a significant weed of tropical pastures in high-rainfall areas. It prefers open (full sun), wet habitats such as roadside drains and poorly drained pastures in high-rainfall tropical areas (annual rainfall in excess of 2500 mm, without a distinct dry season). Heavy grazing of pastures appears to facilitate its invasion and experience from Fiji suggests that perhaps the best way to manage the problem is to re-sow with vigorous, improved pasture grasses.

While there is no doubt that *C. aromaticus* is a weed in many tropical islands of the Pacific, this study was unable to find quantitative data on its actual impact; only subjective descriptions and somewhat anecdotal evidence of impact could be found. Critical analysis of the available evidence suggests, however, that *C. aromaticus* can form pure stands within specific habitat types—namely wet, poorly drained, heavily grazed tropical habitats. There is a possibility that such habitats are relatively low-value, in terms of their contribution to the Queensland economy. Hence, further study is required to quantify the value of these habitats, so that the impact of *C. aromaticus* can be compared to other weed species and its management priority ranked in an objective manner.

**Important note:** Please send any additional information, or advice on errors, to the authors.

## Identity and taxonomy

**Taxa:** *Cyperus aromaticus* (Ridley) Mattf. and Kukenth.

**Common names:** Navua sedge

**Synonyms:** *Kyllinga polyphylla* Willd. ex Kukenth; *K. aromatica* Ridley

**Family:** Cyperaceae

The Cyperaceae (sedge family) has about 90 genera, containing c. 4000 species. The genus *Cyperus* comprises about 600 species of annual and perennial plants occurring throughout warm regions of the world. About 130 species of *Cyperus* are native to Australia. They are tufted or rhizomatous, culms triquetrous to terete, with leaves sometimes reduced to sheaths. Flowers are greenish in umbel-like or head-like spikelets with radially arranged leaf-like bracts (PlantNET, n.d.).

## Description

*C. aromaticus* is a clump-forming, perennial, rhizomatous sedge, 30–60 cm tall (occasionally to 2 m) (Parsons & Cuthbertson 2001). It has a continuously growing underground stem (rhizome) that produces shoots at regular intervals along its length (QNRW 2006). Its culms are closely spaced and triangular in cross-section. Leaves are lanceolate, about 15 cm long and 3–5 mm wide, glabrous and generally clustered at the base of the plant. Flowers are arranged as clusters at the apex of the flower stalk, subtended by six leaf-like bracts. The seeds are egg-shaped, brown to black, with a hook on one end.

## Reproduction, seed longevity and dispersal

Dispersal occurs from seeds and broken segments of rhizomes, which can both be carried as contaminants of mud adhering to machinery. Seeds can be dispersed by passing through the digestive system of animals (QNRW 2006). Cultivation of the soil with ploughs can scatter rhizome fragments to new areas (QNRW 2006).

In New Zealand, *C. aromaticus* has been detected as a contaminant of imported coconut peat used in pot plants (Biosecurity New Zealand, n.d.).

Seedlings develop quickly and flower 10 weeks after emergence. At the time of flowering, a new shoot is also produced on the underground stem. This process is repeated and results in a gradually expanding colony of stems growing from an interconnected underground rhizome network (QNRW 2006).

The plant usually flowers from summer to autumn. The seed heads on each shoot generally produce about 250 seeds each. Seed production per hectare is extremely high with estimates well in excess of 200 million seeds (QNRW 2006).

The lifespan of the seeds exceeds five years (unpublished DPI&F Queensland research).

The seeds can germinate at any time of the year, but the highest germination occurs when temperatures alternate between 15 °C and 25 °C. The seeds require exposure to sunlight for germination to occur.

# Origin and worldwide distribution

*C. aromaticus* is native to tropical Africa. According to the USDA's GRIN database (2008), its native range is as follows:

**AFRICA:**

- North-east tropical Africa:* Somalia
- East tropical Africa:* Tanzania
- West central tropical Africa:* Congo
- West tropical Africa:* Ghana; Guinea; Nigeria
- South tropical Africa:* Angola
- Southern Africa:* South Africa–Natal
- Western Indian Ocean:* Madagascar; Mauritius

*C. aromaticus* has been introduced to a number of countries, including Australia, Sri Lanka, the Malay Peninsula, Fiji, Vanuatu, New Caledonia, French Polynesia, Samoa, Tahiti, Solomon Islands, Malaysia, Singapore, Mauritius Island and Christmas Island (QNRW 2006; PIER 2006).

## Ecology and preferred habitat

### Preferred climate

*C. aromaticus* prefers a tropical climate where annual rainfall exceeds 2500 mm, without a distinct dry season. In Fiji, it is most abundant in the wettest parts of the islands.

### Preferred soil types

This study was unable to find detailed information on this species' preferred soil types. However, Swarbrick (1997) stated that 'it grows best in moist, fertile soil that is seldom cultivated and in full sunshine.'

### Preferred habitat types

Subjective descriptions of preferred habitat in the overseas literature, combined with field observations in North Queensland, suggest that *C. aromaticus* prefers wet (poorly drained) pastures (especially if overgrazed), roadside drains and other open (full sun), low-lying cleared areas. For example, in Samoa, *C. aromaticus* is 'very prevalent in pastures and along roadsides and other disturbed places' (PIER 2006).

### Tolerance of fire

This study was unable to find information on this species' tolerance of fire.

## Distribution in Queensland and Australia

Parsons and Cuthbertson (2001) stated that *C. aromaticus* was accidentally introduced to North Queensland in late 1970s, with anecdotal evidence that it was first detected on a footpath in Cairns in 1979. Over the last 29 years, it has spread over a substantial area of the Wet Tropics from Mossman in the north, south to Ingham and west to high-rainfall parts of the Atherton Tablelands (around Milla Milla and Kuranda). It has not been recorded outside tropical North Queensland (Figure 1).

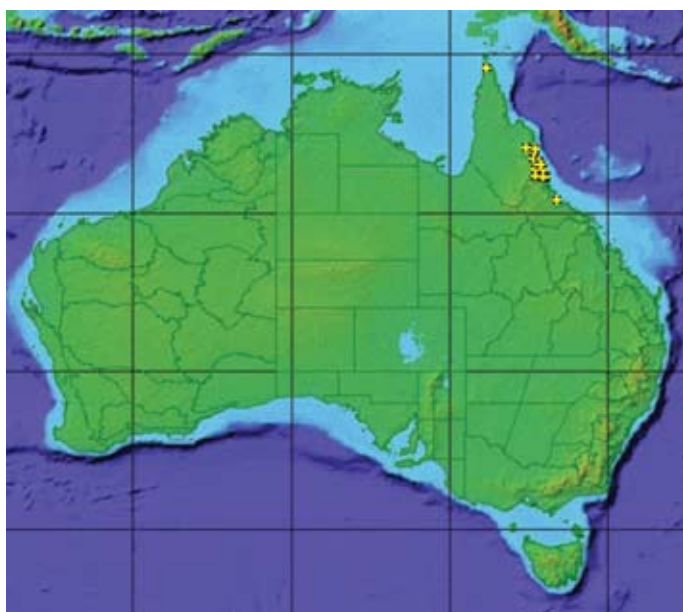


Figure 1. Locations where herbarium specimens of *C. aromaticus* have been collected (AVH 2008)

## History as a weed overseas

*C. aromaticus* is listed as a weed in Fiji (Taveuni Island, Vanua Levu Island, Viti Levu Island), French Polynesia, New Caledonia, Western Samoa Islands, Solomon Islands, Singapore and Christmas Island (PIER 2006). In these areas, it is listed as a weed of mainly improved pastures, but also in crops, gardens, plantations and roadsides.

In Fiji, some authors, such as Manueli (n.d.), list *C. aromaticus* among the island's worst weeds, together with lantana and guava. Similarly, Smith (1979), described it as a 'a vigorous and noxious weed, occurring near sea-level along roadsides, on hillsides and river banks, and in pastures, open swamps, and rice fields' of Fiji. However, at a Fijian Regional Technical Meeting on Plant Protection (RTMPP) workshop in March 2002, a list of the island's top 10 weeds was developed and ranked by participants; while *C. aromaticus* did not rate in the top 10, it did rate in the top 20. The top 10 regionally important weeds were: *Mikania micrantha* (mile-a-minute weed), *Merremia peltata* (merremia), *Cyperus rotundus* (nutgrass), *Mimosa diplotricha* (giant sensitive weed), *Mimosa pudica* (Sensitive plant), *Lantana camara* (Lantana), *Sphagneticola trilobata* (Wedelia), *Bidens pilosa* (Cobbler's peg), *Eichhornia crassipes* (Water hyacinth), and *Spathodea campanulata* (African tulip tree).

*C. aromaticus* is declared noxious in the Republic of Vanuatu, where it is an abundant weed of the Melee plain and is spreading in plateau areas of Efate (AGPC, n.d.).

In Samoa, it is 'very prevalent in pastures and along roadsides and other disturbed places' (PIER 2006).

While there is no doubt that *C. aromaticus* is listed as a weed in many tropical islands of the Pacific, this study was unable to find quantitative data on its actual impact; only subjective descriptions could be found. In the absence of such data, it is possible that *C. aromaticus* is simply an abundant plant in certain habitats. Abundance and impact are not always correlated, particularly if the habitat types being invaded are low value (e.g. abandoned land, poorly drained pastures etc.). Critical analysis of the evidence, however, does suggest that *C. aromaticus* can become a dominant plant within poorly drained, high-rainfall tropical habitats, such as pastures, roadsides and other areas where grasses or other tall vegetation has been damaged or removed. Further study is required to quantify the value of these habitats so that the impact of *C. aromaticus* can be compared to other weed species and its management priority ranked in an objective manner.

## Impact in Queensland

When growing in favourable habitats in poorly drained, high-rainfall, disturbed sites within lowland, coastal areas of the Wet Tropics, *C. aromaticus* has been recorded to form pure stands. Some landowners claim that *C. aromaticus* can replace palatable tropical pasture species. Moreover, there is anecdotal evidence that heavy grazing pressure can reduce abundance of desirable pasture plants and facilitate a rapid increase in the abundance of unpalatable species such as *C. aromaticus*. Once a pasture is dominated by *C. aromaticus*, it has little value for grazing cattle (QNRW 2006).

Field observation by the author and Vic Little (former DPI&F regional field officer), suggests that *C. aromaticus* is generally confined to wet (poorly drained), low-lying pastures, roadside drains and waste places. It appears to be absent from well-drained pastures and any areas where there is a taller canopy of vegetation.

Once *C. aromaticus* has been allowed to dominate a pasture, control can be expensive and very difficult. There is currently no economical way of controlling *C. aromaticus* using herbicides. Hence, landowners need to consider other land management options, namely increased fertiliser, pasture development (sowing improved pasture), rotational grazing and decreased stocking rates (AGPC weed control, n.d.). Pasture management work in Fiji suggests that re-planting with certain types of vigorous pasture is perhaps the only economical option to manage the problem.

*C. aromaticus* can be a problem in sugarcane crops, but only where the crop is sparse with poor canopy cover (DPI&F, n.d.).

## Uses

The juvenile hormone has been detected in *Cyperus* species, including *C. iria* and *C. aromaticus*. Juvenile hormones are a group of structurally related sesquiterpenoids which play critical roles in the regulation of metamorphosis and reproduction in most insect species. Presence of these compounds may protect the plant against insect herbivores (Bede et al. 1999). As such, *Cyperus* species might be a potential source of novel insecticides.

## Pest potential in Queensland

There is considerable evidence in the literature (and from field observation in North Queensland) to suggest that *C. aromaticus* has the potential to become a dominant weed of specific habitats in Queensland. In particular, it has a history as a significant weed in Fiji and has naturalised on numerous other Pacific islands. Its impact in Vanuatu was sufficient to justify listing as a noxious weed.

In order to predict which areas of Queensland may be at risk of invasion by *C. aromaticus*, this study reviewed available information on the species' native range and the climatic parameters that appear to define its distribution. *C. aromaticus* is native to tropical parts of Africa and has naturalised in many tropical Pacific islands, generally in areas that experience high-rainfall (in excess of 2500 mm per annum). This suggests that *C. aromaticus* is well-adapted to coastal lowlands of the Wet Tropics region of North Queensland, probably extending to some of the higher altitude plateaus such as the eastern Atherton Tablelands (wherever annual rainfall is above 2500 mm). While it might persist in tropical areas with a distinct dry season, it will most likely only colonise habitats that remain wet for much of the year (e.g. low-lying areas such as roadside drains). This climate-based prediction is supported by visual observation of the species' current distribution in North Queensland, which extends from Mossman south to Ingham and also around Milla Milla in the wettest part of the Atherton Tablelands. Based on climatic parameters alone, *C. aromaticus* is not predicted to become a problem outside high-rainfall areas of North Queensland.

Habitat types at risk of invasion in Queensland are difficult to predict due to the lack of detailed information on habitats occupied by *C. aromaticus* within its native range. However, based on subjective descriptions of preferred habitat in the overseas literature, combined with field observations in North Queensland, it seems reasonable to predict that *C. aromaticus* poses a threat primarily to poorly drained pastures (especially if overgrazed), roadside drains and other open (full sun), low-lying cleared areas in areas where annual rainfall exceeds 2500 mm. While it could invade poorly-drained areas of sugarcane crops, its impact is not expected to be significant.

Hence, this study concludes that, based on the evidence of 'history as a pest elsewhere' (in similar climates), combined with visual observations of the plant's behaviour in North Queensland, *C. aromaticus* should be considered a 'high-risk' species, but only in very specific habitat types (wet, poorly drained pastures). It is debatable whether such habitat types make a significant contribution to the state economy.

## Related species with weed impact

*C. rotundus* and *C. esculentus* ('nut grasses') are among the worst agricultural weeds in temperate to tropical regions worldwide. They are difficult and expensive to control and can form dense colonies in crops, reducing crop yields. *C. rotundus* in particular, ranks as one of the world's worst weeds. It is a serious weed in 52 crops in more than 90 countries, and has impacts on pasture, cropping, horticulture, floriculture, orchards, vineyards, gardens and parks. Affected crops include cotton, corn (maize), sugarcane and tobacco.

## References

- AGPC (n.d.), FAO Crop and Grassland Service, Common weeds in Vanuatu, [www.fao.org/Ag/AGP/agpc/doc/Publicat/FAOBUL2/B201.htm](http://www.fao.org/Ag/AGP/agpc/doc/Publicat/FAOBUL2/B201.htm)
- AGPC (n.d.), Weed control: FAO Crop and Grassland Service, Weed Control, [www.fao.org/Ag/agp/agpc/doc/publicat/PUB6/P613.htm](http://www.fao.org/Ag/agp/agpc/doc/publicat/PUB6/P613.htm)
- AVH, Australia's Virtual herbarium, [www.anbg.gov.au/avh/](http://www.anbg.gov.au/avh/)
- Bede, JC, Goodman, WG & Tobe, SS (1999), 'Developmental distribution of insect juvenile hormone III in the sedge, *Cyperus iria* L.', *Phytochemistry* 52: 1269–1274.
- Biosecurity New Zealand (n.d.), *A guide to weeds found in imported coco peat*, [www.biosecurity.govt.nz/files/regs/imports/plants/coco-peat/new-to-nz-weed-guide.pdf](http://www.biosecurity.govt.nz/files/regs/imports/plants/coco-peat/new-to-nz-weed-guide.pdf)
- CDFA, California Department of Food and Agriculture, California Government, [www.cdfa.ca.gov/PHPPS/IPC/weedinfo/cyperus.htm](http://www.cdfa.ca.gov/PHPPS/IPC/weedinfo/cyperus.htm)
- DPI&F (Department of Primary Industries and Fisheries, Queensland), Queensland Government, [www.dpi.qld.gov.au/cps/rde/xchg/dpi/hs.xsl/4790\\_7328\\_ENA\\_HTML.htm](http://www.dpi.qld.gov.au/cps/rde/xchg/dpi/hs.xsl/4790_7328_ENA_HTML.htm)
- FAO (n.d.), [www.fao.org/ag/agp/agpc/doc/publicat/PUB6/P613.htm](http://www.fao.org/ag/agp/agpc/doc/publicat/PUB6/P613.htm)
- FLORIDATA (n.d.), [www.floridata.com/ref/C/cypa\\_inv.cfm](http://www.floridata.com/ref/C/cypa_inv.cfm)
- Invasive species (n.d.), [www.invasive.org/](http://www.invasive.org/)
- James Cook University (n.d), <http://cms.jcu.edu.au/discovernature>
- Manueli, P (n.d.), Country paper: Fiji. [www.fao.org/ag/agP/AGPC/doc/publicat/PUBB/PBo34.htm](http://www.fao.org/ag/agP/AGPC/doc/publicat/PUBB/PBo34.htm)
- PACLII (Pacific Islands Legal Information Institute), [www.paclii.org/vu/legis/consol\\_act/posonwa405.rtf](http://www.paclii.org/vu/legis/consol_act/posonwa405.rtf)
- Parsons, WT & Cuthbertson, EG (2001), *Noxious weeds of Australia*, 2nd edition, Inkata Press, Melbourne and Sydney.
- PIER (2006), Pacific Islands Ecosystems at Risk, [www.hear.org/Pier/species/kyllinga\\_polyphylla.htm](http://www.hear.org/Pier/species/kyllinga_polyphylla.htm)
- PlantNET (n.d.), New South Wales flora online, <http://plantnet.rbgsyd.nsw.gov.au/>

Queensland Department of Natural Resources and Water (2006), Navua sedge (*Cyperus aromaticus*): fact-sheet, [www.nqccs.com.au/library/weeds/navua\\_sedge.pdf](http://www.nqccs.com.au/library/weeds/navua_sedge.pdf)

Smith, AC (1979), *Flora Vitiensis nova: a new flora of Fiji*, vol. 1, National Tropical Botanical Garden, Lawai, Kauai, Hawaii.

Swarbrick, JT (1997), *Environmental weeds and exotic plants on Christmas Island, Indian Ocean*, a report to Parks Australia.

USDA–GRIN (2008), USDA-ARS, National Genetic Resources Program. Germplasm Resources Information Network–(GRIN) [Online Database]. National Germplasm Resources Laboratory, Beltsville, Maryland, [www.ars-grin.gov/cgi-bin/npgs/html/taxon.pl?447348](http://www.ars-grin.gov/cgi-bin/npgs/html/taxon.pl?447348)

Weeds Australia (n.d.), Weed identification, [www.weeds.org.au/cgi-bin/weedident.cgi?tpl=plant.tpl&ibra=all&card=E50](http://www.weeds.org.au/cgi-bin/weedident.cgi?tpl=plant.tpl&ibra=all&card=E50)

