

The impact of the rust fungus *Maravalia cryptostegiae* on three rubber vine (*Cryptostegia grandiflora*) populations in tropical Queensland

Wayne Vogler¹ and Andrea Lindsay²

¹ Queensland Department of Natural Resources and Mines, PO Box 187, Charters Towers, Queensland 4820, Australia

² East Gippsland Catchment Management Authority, PO Box 1012, Bairnsdale, Victoria 3875, Australia

Summary Rubber vine (*Cryptostegia grandiflora*), a native of Madagascar, has become a significant weed in Queensland. It costs the north Queensland beef industry up to \$18 million annually, causes serious degradation of conservation areas and remnant vegetation, and promotes increased soil erosion through reduced grass cover.

The highly specific rust fungus *Maravalia cryptostegiae* was released during the summers of 1993–1994 by Lands Department and 1994–1995 by the Queensland Department of Natural Resources. Long-term monitoring sites established in 1997 to evaluate the efficacy of the rust have recorded significant changes to rubber vine populations across central and northern Queensland. At all sites, there has been at least a 40% reduction in the number of live plants and stems per hectare, more than a 10% reduction in the number of live stems per plant and a significant reduction in seedling recruitment – 178 ha⁻¹ in 1998 to almost zero in 2001.

Keywords Rubber vine, rust, biological control, weeds.

INTRODUCTION

In Australia, rubber vine (*Cryptostegia grandiflora*) is recognised as a weed of national significance (Thorp and Lynch 2000). This exotic plant, a native of Madagascar, was introduced into Australia during the mid to late 1800s. By the early 1900s, it had become a significant weed around Rockhampton, Charters Towers and Georgetown in Queensland. It now occurs across 20% of Queensland (Chippendale 1991) and has also been recorded in northern Western Australia. Rubber vine has been estimated to cost the north Queensland beef industry up to \$18 million annually. It also has major non-commercial impacts. It causes serious degradation of conservation areas and remnant vegetation, and promotes increased soil erosion through reduced grass cover (Agriculture and Resource Management Council of Australia and New Zealand and New Zealand Environment and Conservation Council and Forestry Ministers 2001).

During the summers of 1993–1994 and 1994–1995, large-scale releases of the highly-specific rust fungus *Maravalia cryptostegiae* (from Madagascar)

were carried out by the Lands Department and the Queensland Department of Natural Resources respectively (Tomley 1998). By 1996, most rubber vine infestations across northern Australia contained rust infections (Agriculture and Resource Management Council of Australia and New Zealand, Australian and New Zealand Environment and Conservation Council and Forestry Ministers 2001).

Typical damage observed by the authors in the field is stem and branch die-back, with new shoots arising from the base of the plant. This is commonly associated with substantially reduced flowering and pod production. The present study aimed to quantify the impacts of the rust on rubber vine at a number of locations in north and central Queensland. Impacts of the rust on rubber vine are reported in this paper.

MATERIALS AND METHODS

In mid 1997, long-term monitoring of the impacts of the rust on rubber vine began in Queensland near Rockhampton, Charters Towers and Normanton. Permanent transects were established at each site to monitor the impact of the rubber vine rust on rubber vine populations and the response of non-target plants. Impacts on rubber vine are reported in this paper.

Two 50 m long by 4 m wide transects were established at Charters Towers and two 30 m long by 2 m wide transects were established at both Normanton and Rockhampton. All rubber vine plants with stems originating within each transect were mapped and tagged for future identification. As well as plant numbers, the number of live stems were also recorded. Where plants branched less than 200 mm above the ground each branch was considered to be a separate stem, and these were tagged individually, while plants branching more than 200 mm above the ground were considered to have a single stem only. Seedlings were mapped and tagged as for adult plants. Small soft-stemmed seedlings that would be damaged by a tag were initially mapped only and tagged later when the main stem was >20 cm in height.

Annual monitoring has been conducted from July to August in each year since 1997 by recording the number of live plants, stems and seedlings in each transect. The number of pods in each transect was also

recorded. During this time of year plants are largely defoliated due to rust and the annual dry season. However enough leaf is present to allow a presence/absence assessment of rubber vine rust. Rainfall was also recorded at each site over the monitoring period.

RESULTS

At all sites, the number of original live plants and stems per hectare has declined by more than 40% since the commencement of monitoring (Figures 1 and 2). Similarly, seedling recruitment decreased from an average of 178 seedlings ha⁻¹ in 1997-98 to almost zero in 2000-2001. The number of live stems per plant

has also declined by about 10% during the monitoring period, indicating a reduction in plant vigour. There has been no significant pod production at any site during the monitoring period. Rubber vine rust has been present at all annual recording times.

Rainfall during the study period has been slightly below the long-term average at Rockhampton but above the long-term average at Charters Towers and Normanton (Table 1).

DISCUSSION

For several decades prior to the introduction of the rubber vine rust, rubber vine had been spreading and

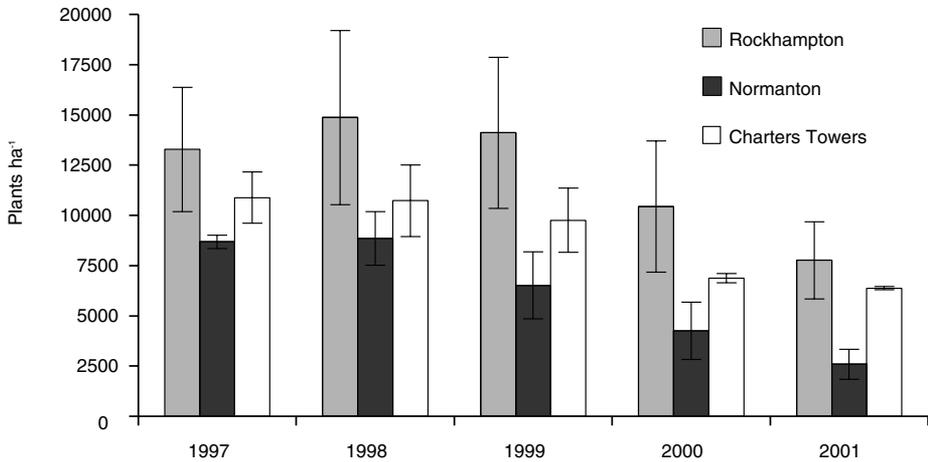


Figure 1. Mean rubber vine plants per hectare assessed annually at Rockhampton, Charters Towers and Normanton over the monitoring period. Vertical lines indicate standard error.

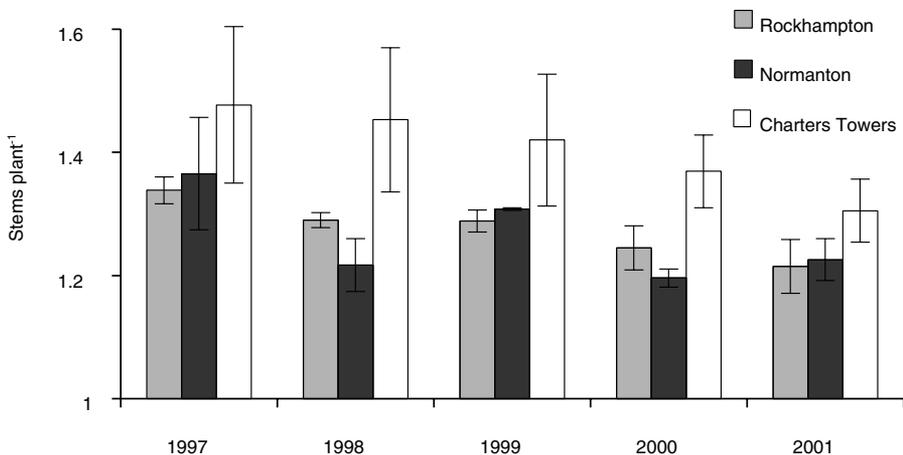


Figure 2. Mean rubber vine stems per plant assessed annually at Rockhampton, Charters Towers and Normanton over the monitoring period. Vertical lines indicate standard error.

Table 1. Long term mean annual rainfall and mean annual rainfall over the monitoring period.

Location	Mean annual rainfall over monitoring period (mm)	Long term mean annual rainfall (mm)
Normanton	1273	920
Rockhampton	600	713
Charters Towers	964	660

increasing in density in the districts where monitoring is being undertaken (Chippendale 1991 and J. Vitelli personal communication 2000). The results recorded at the monitoring sites demonstrate a reversal of this trend since the release of the rust. Rainfall recordings indicate that unfavourable weather conditions are not likely to have been responsible for the decline in rubber vine during this period (Table 1). It is most likely that this decline was due to the cumulative effects of the rubber vine rust exhausting the reserves of the plant by repeated defoliation. Further, the reduction in the number of stems per plant (Figure 2) increased the vulnerability of individual plants to fire, drought and competition from pasture.

Rubber vine rust is most active over summer, with abundance directly related to the period of leaf wetness, which is dependent on rainfall and dew (Anon. 1999). Rust activity is reduced over the dry season due to lack of leaf moisture. Rubber vine rust causes abnormal defoliation with as many as 3 defoliation events occurring through the wet season when, otherwise, vigorous growth would occur (M.P. Vitelli personal communication 2000). In large pot experiments at the Tropical Weeds Research Centre, Charters Towers, Vitelli showed the rust caused more than a 70% reduction in leaf cover, more than 40% flower reduction and more than 80% pod reduction in mature plants, while significantly delaying the onset of first flowering for juvenile plants (M.P. Vitelli personal communication 2000).

These results do not suggest that other management tools, such as fire and herbicides, should be abandoned, but rather that the rust is one effective tool in the integrated management of rubber vine. For example, the defoliation of rubber vine caused by the rust has allowed vigorous grass growth under dense infestations. This has provided fuel for fires, increasing the impact and usefulness of fire as a management tool for dense infestations (Eldershaw 2000). In contrast, the effectiveness of foliar herbicide application as a control method has been shown to be reduced by rust infestation as even minor rust infections significantly reduce the efficacy of herbicides applied in this man-

ner (Vitelli and Madigan 1999). However, the cost of herbicide control may still be within the means of land managers where rubber vine infestations have been reduced as a result of rust infection.

The reduction of seed production, seedling emergence and establishment to almost nil has provided land managers with a significant opportunity to remove the rubber vine problem from their land. It provides opportunity for the removal of existing infestations with little follow-up, as subsequent re-infestation from seedlings will be minimal. In 1992, prior to the release of the rust, seedling recruitment at one monitoring site in the Charters Towers area averaged 2150 seedlings ha⁻¹ (W. Dorney 1992 unpublished data). Under these circumstances, follow up control after the removal of the original infestation would have been expensive and a much more difficult task than after rust infection.

ACKNOWLEDGMENTS

The authors thank Catherine Setter, Simon Brooks, John McKenzie and Bill Dorney for assistance in conducting this research.

REFERENCES

- Agriculture and Resource Management Council of Australia and New Zealand, Australian and New Zealand Environment and Conservation Council and Forestry Ministers. (2001). 'Weeds of National significance rubber vine (*Cryptostegia grandiflora*) strategic plan.' (National Weeds Strategy Executive Committee, Launceston).
- Anonymous (1999). Department of Natural Resources Pest Fact: Rubber vine (*Cryptostegia grandiflora*). Queensland Government, Agdex 647.
- Chippendale, J.F. (1991). 'The potential returns to research into rubber vine (*Cryptostegia grandiflora* R.Br.) in North Queensland.' Master of Agricultural Studies Thesis, University of Queensland.
- Eldershaw, V. (ed.) (2000). Managing rubber vine: An experienced based approach to managing a weed of national significance. (Queensland, Department of Natural Resources).
- Thorp, J.R. and Lynch, R. (2000). The determination of weeds of national significance. (National Weeds Strategy Executive Committee, Launceston).
- Tomley, A.J. (1998). *Cryptostegia grandiflora* Roxb. ex R.Br. In 'The Biology of Australian Weeds, Volume 2,' eds F.D. Panetta, R.H. Groves and R.C.H. Shepherd, pp. 63-76. (R.G. and F.J. Richardson, Melbourne).
- Vitelli, J. and Madigan, B. (1999). Effect of rust on the efficacy of foliar applied herbicides on rubber vine. Proceedings of the 12th Australian Weeds Conference, Hobart, pp. 238-241.