The effect of various herbicides on *Gloriosa superba* L. in the Moreton district of Queensland

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Summary

***Gloriosa superba* L. is an ornamental garden escape that has become naturalized in sandy coastal areas of the Moreton district in Queensland and the northern coast of New South Wales. A herbicide screening trial was conducted at Warana on the Sunshine Coast, Queensland. Sixteen treatments and a control were set up, with a tank mixture of 2,4-D (200 g a.i. 100 L^{-1}) and metsulfuron-methyl (6 g a.i. 100 L^{-1}) proving the most effective. In plants subjected to treatments containing metsulfuron-methyl, a distinct abscission layer was produced in rhizomes so that while dead tissue was present, adjacent rhizome tissue was unaffected.**

Introduction

Gloriosa superba L. is native to tropical Asia and Africa, and is often cultivated as an ornamental plant. It is a perennial climber and contains toxins that can be fatal to humans (Everist 1974). In Queensland, *G. superba* escaped from cultivation and became naturalized during the 1950s in the sandy coastal areas of the Moreton district (Batianoff and Franks 1997), where it competes successfully with other weedy species (Figure 1). It is also prevalent on the northern coast of New South Wales (Everist 1974) where it is commonly associated with the exotic species *Chrysanthemoides monilifera* ssp. *rotundata* (DC.) Norl. (Thomas 1999). *G. superba* is currently a major environmental weed in coastal dune vegetation throughout its range (Batianoff and Franks 1997, 1998). In recent times, *G. superba* has been considered of some importance in medical research, where it has been shown to have value as a cure for gout, as well as having anti-cancer properties (Gardens of Adonis P1). Its vigor has been seen to be reduced in Japan following outbreaks of Gloriosa fleck caused by a nucleorhabdovirus (Plant Viruses Online) which, unfortunately, is not host specific.

The aim of the work described in this note was to determine whether a selection of commonly-used herbicides would be effective in controlling this invasive species.

Materials and methods

Trials using various herbicides were conducted in marked sections amongst sand dune vegetation. The study site was immediately behind and north of Neilser Park, Oceanic Drive, Warana (26° 43' 44" S, 153° 7' 56" E). It fringed the seashore, with walking tracks providing ready access to the experimental area. The tree canopy was predominantly *Casuarina equisetifolia* var. *incana* Benth. (nomenclature follows Stanley and Ross 1983, 1986) in the foredunes and *Banksia integrifolia* L.f. with *Acacia sophorae* (Labill.) R.Br. in the secondary dune area. *G. superba* was associated with *Oenothera drummondii* Hook., *Canavalia rosea* (Swartz) DC., and *Hibbertia scandens* (Willd.) Gilg in the foredunes and *Cassytha pubescens* R.Br., *Stephania japonica* (Thunb.) Miers and *Dianella* spp. in the secondary dunes. The combined width of both dune areas was approximately 200 m. Suitable sections of the secondary dune area, above the swale and facing the ocean, were marked out and pegged before the spraying commenced.

The experiment was set out in randomly selected plots with a datum area within each plot containing no fewer than 100 separate shoots. The day when treatments were imposed (22 March 1999) was fine and relatively cloudless, with a temperature range between 22 and 28°C. Winds were predominantly south-easterly at 5–10 metres s^{-1}, although their effect was largely nullified by the sand dunes and vegetation.

Hand-pump Swiss-mex portable knapsacks of 15 L capacity with Rega 1 mm adjustable nozzles were used to treat the plots which were subjected to different 16 herbicide treatments (Table 1). Plots were sprayed at 1000 L ha^{-1}. A control plot was also included.

Following the herbicide applications, two assessments were made in April and May, before the onset of winter. An additional assessment was made in the following spring (October), predominantly to see what damage had been done to the underground rhizomes. Healthy rhizomes had a turgid white crisp appearance, while those affected by herbicides were flexible, with reduced sap content and grey/brown necrotic areas.

Analysis

The results were analyzed with Systat 9 (Wilkinson 1999), using a repeat measure approach. Further detailed statistical analysis was not undertaken because blocked replication was not implemented in this herbicide screening exercise. However, a graphical presentation did differentiate between the treatments (Figure 2).

Results and discussion

The tank mix of low odour 2,4-D and metsulfuron-methyl (Treatment 1) was the most effective treatment (Figure 2). The 2,4-D low odour formulation (Treatment 12) showed promise in the initial assessments but plants subjected to this treatment regenerated more completely than did those subjected to Treatment 1. The fluroxypyr treatments (3 and 4) damaged the tissue above the rhizome level, but failed to have any subsequent effect on the rhizomes themselves. Results were similarly poor for metsulfuron-methyl (7 and 8) and dicamba (15 and 16) treatments, although the regeneration from the metsulfuron-methyl treated plots appeared less vigorous in the later comparisons. This lack of vigour was even more accentuated in Treatments 5 (Amitrole) and 13 (DP600).

In most instances *G. superba* had browned out by the third assessment. However, the underground rhizome was persistent and relatively undamaged in the majority of the treatments. Rotting sections of rhizomes were observed when plants subjected to Treatment 1 were dug up at assessments 3 and 4. Furthermore, it was noticed in the treatments containing metsulfuron-methyl that a distinct abscission layer was present in the underground stem, such that decomposing tissue occurred adjacent to unaffected rhizome tissue. In thick patches of *G. superba* it can be very difficult to differentiate between the rhizomes of treated plants and those of newly emerged plants, as early growth seems to be very fast in this species.

Although many of the herbicide treatments were not successful at killing substantive amounts of the assessed plants, they did reduce the rate of spread within the datum area. A good cross-reference was a nearby area of 2 ha that was hand pulled by conservation volunteers, where regeneration was both faster and more vigorous than that which occurred in chemically treated plots. Further research is needed to refine dosages and to find formulations with more activity. This study provides information on commonly used herbicides and indicates which products may be tested in further experimentation. Chemicals that may have a place in future experimentation include 2,4-D acid and low dosages of diuron, based on feedback from Caloundra Shire Council weed control operators who have conducted field evaluations.

Table 1. Treatments applied to *Gloriosa superba*.

Treatment	Manufacturer	Trade name	Active constituent	Product dilution[A] (a.i. g 100 L^{-1})
1.	Nufarm Dupont	Amicide Lo® + Brushoff®	500 g L^{-1} 2,4-D (present as dimethylamine and triethanolamine salt) 600 g kg^{-1} metsulfuron methyl	200 6
2.	Nufarm	Amicide®	500 g L^{-1} 2,4-D (present as dimethylamine salt)	500
3.	Dow	Starane®	300 g L^{-1} fluroxypyr as methylheptyl Ester	300
4.	Dow	Starane®	300 g L^{-1} fluroxypyr as methylheptyl Ester	150
5.	Nufarm	Amitrole-T®	250 g L^{-1} amitrole, 220 g L^{-1} ammonium thiocyanate	500 440
6.	Nufarm	Oust® + Weedmaster® + LI700®	750 g kg^{-1} sulfometuron-methyl 360 g L^{-1} glyphosate (present as isopropylamine salt) 345 g L^{-1} soyal phospolipids + 355 g L^{-1} popaoic acid	20 360 86 89
7.	Dupont	Brushoff®	600 g kg^{-1} metsulfuron methyl	24
8.	Dupont	Brushoff®	600 g kg^{-1} metsulfuron methyl	36
9.	Nufarm	Banvel® M	340 g L^{-1} MCPA (present as dimethylamine salt) 80 g L^{-1} dicamba (present as dimethylamine salt)	340 80
10.	Dupont	Brushoff®	600 g kg^{-1} metsulfuron methyl	6
11.	Dupont	Brushoff®	600 g kg^{-1} metsulfuron methyl	12
12.	Nufarm	Amicide Lo®	500 g L^{-1} 2,4-D (present as dimethylamine salt and triethanolamine salt)	250
13.	Nufarm	DP600®	600 g L^{-1} dichlorprop (present as the potassium salts)	300
14.	Nufarm	Banvel® M	340 g L^{-1} MCPA (present as dimethylamine salt) 80 g L^{-1} dicamba (present as dimethylamine salt)	680 160
15.	Nufarm	Banvel®	200 g L^{-1} dicamba (present as dimethylamine salt)	200
16.	Nufarm	Banvel®	200 g L^{-1} dicamba (present as dimethylamine salt)	100
17.	Control	–	–	–

[A] In all cases the carrier was water.

Figure 1. Growth habit of *Gloriosa superba*, which often co-occurs with other sub-canopy weeds, in this case *Asparagus aethiopicus* L. cv. Sprengeri.

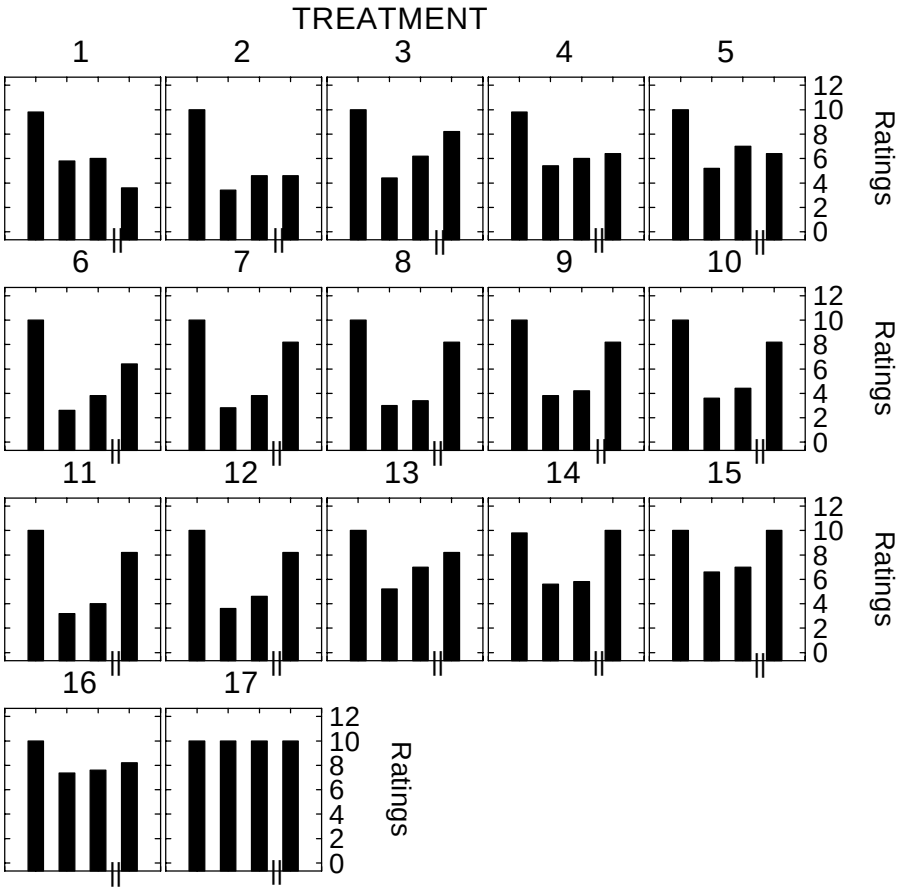

Figure 2. Treatment response of *Gloriosa superba* to 16 doses of 10 herbicides and a control (treatments listed in Table 1). Assessment ratings are (10) = No damage, (9) = Leaves yellowing, (8) = Leaves necrotic, (7) = Stem death <20 cm, (6) = Stem death >20 cm but not complete, (5) = Stem totally dead, (4) = Rhizomes unaffected, (3) = Rhizomes brown; (2) = Rhizomes with necrotic regions; (1) = Entire plant dead. Assessment dates (1) 22/03/99 (2) 23/04/99 (3) 24/05/99 (4) 29/10/99. The symbol || indicates a break in the assessment time metric of five months between the 3rd and 4th assessments and encompassing the winter dormant period.

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