Aquatic weeds workshop

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Alligator weed – an aquatic weed present in Australian backyards

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Summary

Alligator weed, *Alternanthera philoxeroides* is considered to be one of the worst aquatic weeds in the world. The aquatic form of the plant has the potential to become a serious threat to waterways, agriculture and the environment. The terrestrial form grows into a dense mat with a massive underground rhizomatous root system. The canopy can smother most other herbaceous plant species. Alligator weed was recently discovered being mistakenly grown as the leafy vegetable Mukunu-wenna or sessile joyweed (*Alternanthera sessilis*), a popular leafy vegetable in Sri Lanka, in all Australian states.

In Victoria, an information campaign has been conducted to educate the public about the impact and identification of *A. philoxeroides*. This was followed by an eradication campaign conducted with the co-operation of the Sri Lankan community. The supply of alternative plants is crucial to the success of the eradication campaign. Two forms of the Australian native species *A. denticulata* (lesser joyweed), one with larger leaves and one with smaller leaves, are accepted by the Sri Lankan community as alternative herbal species. The larger leaf form is more popular and is easy to grow.

Introduction

Alligator weed, *Alternanthera philoxeroides* (Mart.) Griseb., originates from the Parana River system in Argentina and was unintentionally transported to Australia via Newcastle by post World War II cargo ships in 1946. It has become widespread in tropical and warm temperate regions including USA, Burma, Thailand, India, China, New Zealand and Australia (Julien 1995). A large persistent infestation near the mouth of the Hunter River at Williamstown, north of Newcastle, now covers in excess of 2000 ha of swampy land including paddocks.

It is considered as one of the worst aquatic weeds in the world and has been declared a noxious weed in all Australian states. It is a prohibited weed in Victoria and Tasmania. Classification of the weed as a state prohibited weed under the Catchment and Land Protection Act of Victoria 1994 requires that the plant be eradicated from the State. It has the potential to become a serious threat to waterways, agriculture and the environment. The pest status of *A. philoxeroides* in waterways results from extremely prolific growth that restricts recreational use of water, alters aquatic ecology and excludes growth of other plant species. It causes problems with water flow, flooding and sedimentation and provides habitats for disease vectors and insect pests such as mosquitoes (Julien *et al*. 1979). Unlike most other aquatic weeds, *A. philoxeroides* has the ability to grow vigorously in terrestrial situations including pasture lands. On land it forms a dense mat with a massive underground rhizomatous root system that is very difficult to control. Roots can grown to 60–90 cm deep (Julien 1995). Herbicides are unable to translocate through the terrestrial root system and, although above ground parts may die, regrowth quickly occurs from underground material.

Although *A. philoxeroides* used to be considered a tropical plant, it can tolerate a wide variety of climates and has become a problem in cool and warm temperate regions. It requires a warm growing season, but will tolerate cold winters including severe frosts (Coulson 1977). This is illustrated by its recent discovery in areas with cooler climates such as Victoria and Tasmania where it has been grown as a leafy vegetable by the Sri Lankan community since the 1960s.

When the problem was recognized in Victoria the Department of Natural Resources and Environment implemented a program to eradicate infestations of alligator weed in Victoria. This paper reports on a program that was undertaken to investigate the extent of alligator weed distribution, develop public awareness of the plant and associated problems, improve management options and develop an alternative vegetable plant for consumption by Sri Lankans in Australia.

Method

The main aim of the project was to survey the extent of alligator weed infestations in Victoria. Firstly, an alligator weed identification leaflet was produced and distributed amongst Sri Lankan groceries, Buddhist temples, local libraries and local papers. All the Sri Lankan names and their addresses and telephone numbers were extracted from Victorian telephone directories. Nearly 4000 names were identified and in late 1996 a survey form, identification leaflet and reply paid envelope were mailed out.

Discussions with community groups and the use of ethnic radio programs also created awareness and collected information on the distribution of alligator weed. A public awareness campaign was used to spread the message across the state. Five different leaflets, a bookmark and a fridge magnet were published for distribution to the public. More than fifty newspaper articles were produced. Five TV segments, seven radio programs and seven information workshops were also conducted during this period.

To evaluate the suitability of alternative *Alternanthera* species for use as food items alligator weed and two forms of *Alternanthera denticulata* were grown in glasshouse conditions in 15 cm pots. Plants were replicated four times. One-month old shoots were then harvested and dried in an oven for five days at 65ºC. The dried samples were analysed for chemical composition by the State Chemistry Laboratory at Werribee, Victoria.

An alligator weed eradication program started in November 1997. All known infestations were ranked according to the risk of naturalization using proximity to waterways, size of the infestation, and vacated house gardens as criteria. Two hundred and twenty five infestations were ranked as high priorities for treatment. There is no herbicide registered to control alligator weed in terrestrial situations in Victoria. Thus three herbicides (metsulfuron methyl, dichlobenil and glyphosate) were used on an experimental basis in backyards with the consent and knowledge of property owners. Herbicide was applied as a spot-spray using a 5 L knapsack sprayer. The herbicide used depended on the backyard situation and types of plants associated with alligator weed.

Results and discussion

The mail survey was very successful. Nearly 50% of survey form recipients responded (2000 people). More than 300 backyard infestations of alligator weed were discovered within four months of the campaign's start. Most of the infested backyards were visited. As a result of the intensive media campaign, an additional 700 backyard infestations and seven sites where the weed had naturalized were located in 125 suburbs of Melbourne by April 1998.

The eradication campaign has been very successful so far. Priority infestations (225 backyards) and all naturalized alligator weed infestations were treated with the herbicides by May 1998. All treated backyard infestations were closely monitored from October to December 1998. The monitoring program showed that dichlobenil at 60 kg ha^{-1} rate worked well in backyard situations (Table 1) without damaging non-target species such as garden ornamentals or fruit trees. Eradication of alligator weed is being continued during the 1998/99 summer mainly using dichlobenil at 60 kg ha^{-1}.

Alligator weed has a very similar appearance to the South American species *A. sessilis* (L.) R.Br. ex DC. (sessile joyweed or Mukunu-wenna) a leafy vegetable which is very popular in Sri Lanka. However most Sri Lankans in Australia have confused the leafy vegetable *A. sessilis* with alligator weed growing in Australia.

The soft stems and leaves of *A. sessilis* are cut into small pieces and desiccated coconut, sliced onion and spices are added. The next step is to bake the mixture or fry it using oil to produce the tasty Sri Lankan curry dish. Some older people have been cultivating and unknowingly using *A. philoxeroides* as a leafy vegetable for over 25 years. Most people have used the meal as part of their regular diet. They believe that this vegetable contains high levels of vitamins, protein and fibre. Thus it has been passed from family to family throughout Australia as a valuable and most essential herb. As a result of the public awareness campaign, the majority of Sri Lankans in Australia now recognize the difference between their real vegetable plant, *A. sessilis*, and alligator weed and have realized that they have used the wrong plant.

The supply of alternative vegetable plants is crucial to the success of the eradication campaign. Two types of the Australian native species, *A. denticulata* (lesser joyweed), are accepted as alternative vegetable plants by the Sri Lankan community. The chemical composition (Table 2) of these plants is similar although the two types of *A. denticulata* generally have lower levels of nutrients than *A. philoxeroides*. More than 3000 replacement plants have been distributed through Buddhist temples and personal contacts. The Sri Lankan community is very keen to grow these new plants in their backyards and have already started to distribute them from family to family. The cut bunches of *A. denticulata* (larger leaf type) is now distributed through 20 Asian grocery and vegetable shops across Melbourne and appears to be very popular.

This program has demonstrated that preventative management can offset the long term problems and costs associated with the impact of noxious weeds. Further, it shows it can be undertaken with active community involvement and support.

Table 1. Alligator weed treatments monitoring results.

Treatments	Rate	No. of treated infestations	No. of [A] retreatments
Dichlobenil	60 kg ha^{-1}	50	1
Brushoff	80 g ha^{-1}	9	2
Brushoff followed by dichlobenil	80 g ha^{-1} and 30 kg ha^{-1}	50	8
Brushoff + glyphosate followed by dichlobenil	1.7 kg ha^{-1} and 30 kg ha^{-1}	80	11
Glyphosate only	6.4 kg ha^{-1}	24	4
Glyphosate followed by dichlobenil	6.4 kg ha^{-1} and 30 kg ha^{-1}	12	2
Totals		**225**	**28**

[A] Number of sites where follow up treatment was required to kill regrowth after the original application herbicide.

Table 2. Chemical composition of three *Alternanthera* species expressed on a dry weight basis.

Chemical	*A. philoxeroides*	*A. denticulata* (small leaves)	*A. denticulata* (larger leaves)
Protein (%)	28	12	7.5
Phosphorus (%)	0.74	0.50	0.35
Potassium (%)	7.1	3.7	3.0
Calcium (%)	0.92	0.38	0.34
Magnesium (%)	0.69	0.29	0.32
Sodium (%)	0.47	0.11	0.19
Sulphur (%)	0.34	0.18	0.20
Oxalic acid (%)	27.1	3.2	8.4
Crude fibre (%)	11.6	11.7	12.8
Nitrogen (%)	4.5	1.9	1.2
Manganese (mg kg^{-1})	120	310	430
Iron (mg kg^{-1})	140	120	85
Copper (mg kg^{-1})	32	15	18
Zinc (mg kg^{-1})	>160	>160	>160
Lead (mg kg^{-1})	0.3	0.2	0.2
Cadmium (mg kg^{-1})	0.12	0.08	0.13

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