Prairie ground cherry: what should be done before it is too late?

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Summary The solanaceous weed prairie ground cherry (*Physalis viscosa* L.) originates in South America. In Australia it is present in most states, but has not been recorded in Tasmania and the Northern Territory. It is particularly invasive in cropping and grazing areas in New South Wales and Victoria and is likely to become more widespread in grazing systems in the future. Herbicide spraying of large infestations is effective.

Prairie ground cherry is ranked as highly invasive. A literature review recently conducted found that only one specialist arthropod appears to be associated with the weed, suggesting that the associated flora and fauna are poorly understood. Therefore, comprehensive field surveys in the region of origin with climatic characteristics similar to Australia are necessary to assess the potential for biological control of this weed and to identify potential agents.

Keywords Prairie ground cherry, sticky Cape gooseberry, *Physalis viscosa*, feasibility study, biological control.

INTRODUCTION

Prairie ground cherry (*Physalis viscosa* L., Solanaceae) was once considered to originate from North and South America. However, the origin of *P. viscosa*, *sensu stricto* has since been identified as South American (Sullivan 1985) and populations present in the USA are now considered introduced (Sullivan 1985, Whitson and Manos 2005). In South America, prairie ground cherry's distribution includes Bolivia, Argentina, Paraguay and Chile, and extends north to Mexico.

In Australia, prairie ground cherry is present in all states except Tasmania and does not occur in the Northern Territory. It is particularly invasive in northern Victoria and southern New South Wales. It is an erect, perennial herb with a vigorous, rhizomatous root system. Buds on horizontal roots close to the surface produce new aerial growth each year. Plants produce palatable, tomato-like berries readily eaten by stock, foxes and birds. Seed germination is enhanced after seeds are eaten and excreted by animals and new infestations also develop from seeds transported in contaminated hay (Parsons and Cuthbertson 1992). The weed establishes on clay or loam soils in the warm temperate climate regions of south-eastern Australia with rainfall from 300 to 500 mm (Parsons and Cuthbertson 1992), and it invades cultivated or grazed land. Due to prairie ground cherry's extensive root system, cultivation is not recommended as a mechanical control method since fragmentation of roots and rhizomes produces new plants. Chemical control is effective and 26 herbicides under different formulations are currently registered (www.apvma.gov.au). Some herbicides provide a high level of control when applied in the flowering and fruiting stages (Donaldson 1984). A Department of Primary Industries survey of 72 Victorian landholders conducted in 2003 concluded that at least 12,200 ha are infested at various densities, but it is likely that infestations in this state are underestimated. The average cost of herbicides to treat infestations in cropping and pasture situations has been estimated to be $7.30 ha^{-1}.

Due to farmer concern, Meat and Livestock Australia contracted the Victorian Department of Primary Industries to investigate the possibility of biological control of prairie ground cherry.

MATERIALS AND METHODS

A weed risk assessment was conducted to establish the potential distribution of prairie ground cherry in Australia and its impact on agriculture. The potential distribution of this weed was mapped using current climatic models for Victoria (Weiss and McLaren 2002) and Australia. A literature review of organisms associated with *P. viscosa* was conducted using electronic databases of scientific literature published in the last 95 years (CAB Abstracts 1910–2005 and Agricola 1979–2006). A climate analysis using the software CLIMATE and based on the weed's current distribution was performed to identify regions of interest in South America for biocontrol investigations.

RESULTS

Weed risk assessment Prairie ground cherry's invasiveness score was 0.726 out of 1 (highly invasive) and its impact on agriculture rated 0.474 out of 1 (medium-high impact) (Weiss 2002, http://www.dpi.vic.gov.au/vro/weeds).

Potential distribution The potential distribution of prairie ground cherry was mapped using current climatic models for Australia (Figure 1). The potential total distribution of prairie ground cherry was calculated for each state by combining climatic predictions and land use. Model predictions highlight that the majority of future infestations will affect grazing land (Table 1).

Prairie ground cherry fauna and flora As biological control of this weed was never attempted, no compilation of associated organisms has been published and no records of specialist arthropods associated with prairie ground cherry were found in the literature.

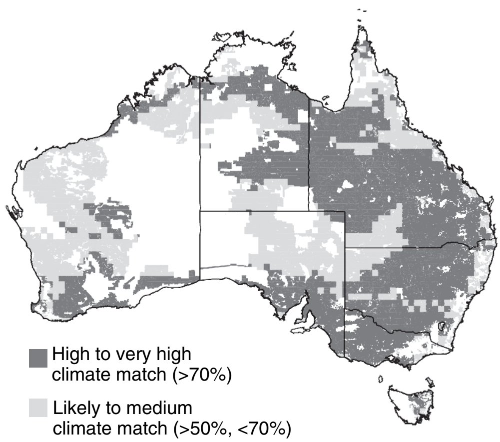

Figure 1. Potential distribution of prairie ground cherry in Australia (Kwong *et al.* 2006).

Table 1. Potential spread of prairie ground cherry in Australia and its impact on grazing land (Kwong *et al.* 2006).

State	Potential spread (Mha)	Grazing land affected (Mha)	Grazing land affected as % of total
Vic	13.19	10.6	80.4
NSW	60.40	54.99	91.0
QLD	125.98	123.93	98.4
SA	51.82	48.59	93.8
NT	60.80	60.00	98.7
ACT	0.04	0.03	77.5
TAS	1.30	1.17	90.0
WA	95.39	88.60	92.9
TOTAL	408.9	387.9	94.9

There are, however, recurrent reports of larvae of the moth *Heliothis subflexa* (Guenée) (Lepidoptera: Noctuidae) feeding on fruits of *P. viscosa* and *Physalis* spp. in the USA and Mexico (C. Blanco, M. Bateman and A. Groot pers. comm.). Several genera of fungi are recorded on a number of species within the *Physalis*, *Solanum* and *Lycopersicum* genera but no record of a fungus specific to *P. viscosa* was found in the literature or databases consulted.

DISCUSSION

The weed risk assessment conducted on prairie ground cherry found that this weed is highly invasive and, according to current climatic models, could ultimately colonise 409 million ha throughout all states and territories. Although the impact of the weed on agriculture was ranked medium-high, the climate analysis predicted that pastoral lands would be most invaded, particularly in Queensland and Western Australia.

At this stage the potential for biological control of prairie ground cherry is unknown as very few natural enemies are recorded in the literature. The only specialist arthropod recorded is the moth *H. subflexa*, which is reported to attack *P. viscosa* fruits in Mexico and the USA.

The origin of prairie ground cherry populations in Australia is unknown. As the species originates from South America, molecular studies to compare Australian and South American populations should be conducted to identify the source of Australian populations and examine any possible genetic variation between populations.

Figure 2 displays the climatic match of south-eastern Australian prairie ground cherry locations on South America. Known locations of prairie ground cherry in South America are also identified. It is very noticeable that the Australian climatic matches are disjunct with most of the South American localities apart from those near Buenos Aires and Uruguay. This indicates two points. The first is that the Australian localities are most likely close to the southern limits of the potential range of prairie ground cherry and we can expect the future range of the weed to expand into the north and central regions of Australia. Secondly, the search for suitable biological control agents for the existing infestations in Australia should concentrate in this southern part of the South American home range of the weed.

Due to the potential for infestations to spread and reach high levels in Australia, biological control should be further evaluated through surveys for natural enemies in regions climatically similar to those invaded in Australia, namely in Argentina and Chile.

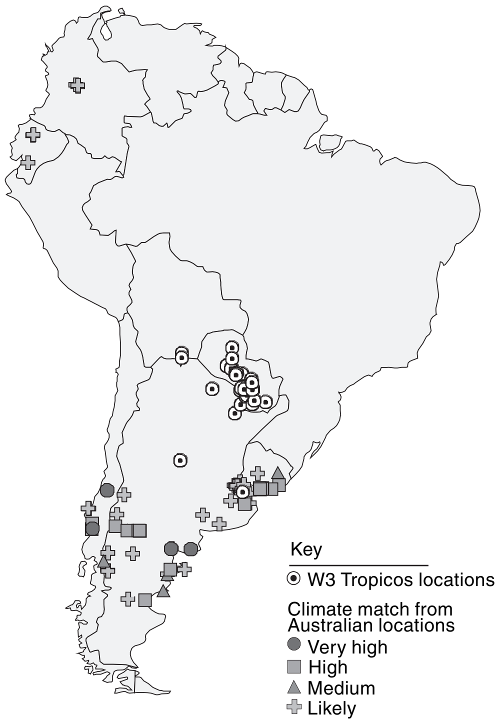

Figure 2. Climate matching of prairie ground cherry infestations from south-eastern Australia towards South America, overlaid with known prairie ground cherry locations. CLIMATE software was used to generate climate predictions. The closed circles indicate locations with a very high climate match comparable to prairie ground cherry locations in south-eastern Australia (occurring south of 32^{o}). Data source for prairie ground cherry locations (W3 Tropicos) from http://mobot.mobot.org/W3T/Search/vast.html

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