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Brooms as part of the Australian nursery industry

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Summary

Nursery plants that come under the heading of 'brooms' are estimated to be currently worth about $1.5 million to the industry. Their taxonomic origins are often complex and uncertain, however, *Cytisus scoparius*, is the most common parent species and this and some other naturalized species are banned from sale by selected states. While the continued sales of some broom varieties closely related to weedy species may pose a threat to the environment through the opportunity of bringing in greater genetic diversity, so the activities of biological control programs against brooms pose a threat to horticultural brooms, and may lead to greater use of chemicals by gardeners. It will be important that decisions taken to manage weedy brooms, that may have an impact on the nursery industry, are done so in direct consultation with the industry. This paper discusses these issues.

Introduction

'Brooms' for the nursery industry encompasses a whole suite of species, hybrids and varieties associated with the genera *Argyrocytisus, Chamaecytisus, Cytisus, Genista, Retama, Spartium* and *Teline* (Spencer 1997). These genera also contain species that, worldwide, have either agricultural value or are recognized and noxious weeds (Holm *et al.* 1979, Parsons and Cuthbertson 1992, Hosking *et al.* 1998). As such, some of these weed species have restrictions on their sale and distribution in Australia (see http://www.weeds.org.au) and similar legislation covers weedy brooms in New Zealand. Confusion has reigned with respect to this for horticultural varieties of broom, whose origins remain hard to trace.

There has been much switching of taxonomic names of the parents of horticultural broom varieties in the botanical literature, which has led to plenty of confusion in the appropriateness of names used in the market place. For example the parent of the broom variety called 'weeping bridal veil', *Retama monosperma* (L.) Heywood, has in the past been included in both *Cytisus* and *Genista*, and many parental species have been swapped between *Cytisus* and *Genista.*

The aim of this contribution is to:
(1) discuss the taxonomic origins of the different types of broom available in nurseries,
(2) to summarize the economic importance of brooms to the nursery industry in Australia, and
(3) discuss potential impacts of efforts to manage broom (*Cytisus scoparius* (L.) Link) on the industry.

Taxonomic origins of horticultural brooms

The most important genus for brooms in the nursery industry is *Cytisus.* Species from this genus have contributed most to the broom horticultural varieties available in the market place. The main *Cytisus* species that have been parents of horticultural varieties in Australia are *C. scoparius, Cytisus multiflorus* (L'Hér.) Sweet, *Cytisus purgans* (L.) Boiss., *Cytisus ardoini* E.Fourn. in this order of frequency (D. Cooke personal communication). Horticultural brooms developed from this genus exist as varieties of wild-type species as well as hybrids developed from two or even three species. Often the exact origins of some of the commercial broom varieties, have themselves a degree of uncertainty. Table 1 shows a list of commercial varieties of broom available from one supplier of plant labels to the nursery industry (Norwoods Industries) together with flower colour and currently accepted botanical origins. Included in this list are varieties derived directly from recognized species (e.g. *Cytisus* 'Cornish cream'), from horticultural varieties of recognized species (e.g. *Cytisus* 'Andreanus'), and from hybrids between two species (e.g. *Cytisus praecox* 'Warminster broom') (Rowell 1991, D. Cooke personal communication).

The two commonest *Cytisus* species that have been used to generate horticultural varieties (*C. scoparius* and *C. multiflorus*) are both naturalized in Australia and the most frequently used parental species is *C. scoparius* (Table 1). Having stated this, however, there is not necessarily a clear relationship between the amount of parental make up that is from a known weed and the likelihood that the developed variety will pose a threat to the environment if planted. There is also no direct evidence that any of the currently marketed varieties as listed in Table 1 are of identical genetic make up to the naturalized brooms in Australia. For example, some varieties have reduced growth rates or poor seed set, although if such varieties are compatible with naturalized weeds this will provide a potential source of increased genetic diversity and hence weediness should crossovers occur (Smith 2000). There is plenty of anecdotal evidence from gardens to suggest that most varieties fail to naturalize or self-seed following planting, however clearly one or more 'Andreanus' like varieties of *Cytisus scoparius* have naturalized given the frequency of its 'egg and bacon' flower colour in weedy populations in several areas.

The value of 'brooms' to the Australian nursery industry

From the 1996/97 Australian Bureau of Statistics (ABS) report commissioned by the Nursery Industry Association of Australia (NIAA) and the Horticultural Research and Development Corporation (Atkinson 1998), there are over 3000 production nurseries with sales amounting to slightly over $539 million, at farm gate, in Australia. Approximately 55% of total sales are made to 3500 retail garden centres. Consequently the industry is strongly driven by the desires of it's main customers, the Australian gardening public. However most gardeners are after a particular 'look' rather than specific species so, with appropriate education, changes can be made to the lines sold by nurseries.

There are no direct figures available from the ABS survey for broom sales. They would mostly be included in the 'exotic trees and shrubs sold in pots sizes 76 mm to 300 mm' category which makes up 17.4% of total greenlife sales. However, working from the number of plant labels sold by Norwood Industries (confidential communication) and estimates of the average sale price per pot, the authors estimate broom sales in Australia at approximately $1.5 million annually.

Potential impacts on industry of efforts to control broom

The degree of diversity in the types of broom available through the nursery industry has an additional consequence. It is both hard to educate people about the differences in varieties and hard to police sales of species already banned from sale within Australia and varieties considered to pose a risk to broom weed management in Australia. The question remains to what extent does the continued sale of broom varieties pose a threat to the Australian environment?

Some states in the US have considered that certain nursery varieties still do pose a significant risk and have brought in legislation preventing the sale of such brooms (Isaacson 2000). However if such a stance was to be considered in Australia, then it would be extremely important to tackle this issue directly with the nursery industry through consultation. We should also consider the distribution of plants by gardeners and amateurs as these may not actually be 'sold'.

Industry would have good grounds for arguing against a blanket ban on all 'brooms' given the taxonomic diversity included under that title. There would also be justifiable concerns regarding sale of existing stock and the capital bound up in that, prior to any ban coming into effect. Appropriate 'lead in periods' should be negotiated as well as significant efforts made to educate the buying public, horticultural media and industry about the need for bans.

The introduction of biological control agents for control of broom may also impact negatively on industry. Information and research on the host specificity of potential agents must include those brooms produced by industry. Actual impact of biological control agents, which do attack plants in the trade, will have two dimensions. Firstly impacts upon stock being grown by a production nursery and secondly impacts on plants growing in garden and landscape situations.

Firstly brooms in production nurseries will be subject to some level of pest and disease management and the biological control agents may well succumb to existing control measures. However the nature of some agents would limit options for control even in nurseries e.g. boring insects are always very difficult to control. Secondly plants in gardens and landscape situations are mostly expected to flourish without active pest and disease management. The consequences of such problems over time are likely to include an undesirable increase in chemical use by gardeners and a decline in demand for brooms if they are seen as difficult to grow.

Conclusions

The sale of brooms by the Australian nursery industry is a significant trade ($1.5 million annually) that could be adversely impacted by controls on sale of brooms and introduction of biological control agents. Research on potential biological control agents must include an assessment of their impact upon brooms sold by the nursery industry. Any move towards banning the sale or movement of selected brooms would require significant resources for informing the media, and educating the industry and the buying public. However, with appropriate consultation and education, industry can move towards sale of alternative non-weedy species to the gardening public.

Table 1. 'Brooms' supplied by Norwoods (from their collection of available plant tags) together with flower colour and currently accepted parental origins (Rowell 1991, D. Cooke personal communication).

Horticulturally used latin names[A]	Variety name	Flower colour	Probable parental origins (Rowell 1991, D. Cooke personal communication)
Cytisus	'Burgundy'	Red with white	*Cytisus scoparius* var. *andreanus* × *Cytisus multiflorus*[B]
Cytisus	'Burkwoodii'	Red and white	*Cytisus scoparius* var. *andreanus* × *Cytisus multiflorus*[B]
Cytisus	'C.E. Pearson'	White and red	*Cytisus scoparius* var. *andreanus* × *Cytisus multiflorus*[B]
Cytisus	'Chocolate soldier'	Brown and white	*Cytisus scoparius* var. *andreanus* × *Cytisus multiflorus*[B]
Cytisus	'Cornish cream'	White and yellow	*Cytisus scoparius*
Cytisus	'Crimson king'	Pink and White	*Cytisus scoparius* var. *andreanus* × *Cytisus multiflorus*[B]
Cytisus	'Dorothy Walpole'	Red and white	*Cytisus scoparius* var. *andreanus* × *Cytisus multiflorus*[B]
Cytisus	'Lilac time'	Purple and white	*Cytisus scoparius* var. *andreanus* × *Cytisus multiflorus*[B]
Cytisus	'Peter Pan'	Pink and white	*Cytisus scoparius* var. *andreanus* × *Cytisus multiflorus*[B]
Cytisus	'Snow queen'	White	*Cytisus multiflorus*
Cytisus	'Andreanus'	Yellow and red	*Cytisus scoparius* var. *andreanus*
Cytisus praecox	'Warminster broom'	White and yellow	*Cytisus multiflorus* × *Cytisus purgans*
Cytisus racemosus (*Genista fragrans*)	'Yellow broom'	Yellow	*Genista canariensis* × *Genista stenopetala*
Cytisus racemosus nana	'Dwarf genista'	Yellow	*Genista canariensis* × *Genista stenopetala*
Genista lydia		Pale yellow	*Genista lydia* Boiss
Cytisus/Genista (*Genista monosperma*)	'Weeping bridal veil'	White	*Retama monosperma* (L.) Heywood

[A] As they appeared on the labels thus names in brackets may be synonyms used in the industry.
[B] The F1 hybrid from which **most** of these varieties were developed is called *Cytisus* × *dallimorei* developed at Kew in 1900, most varieties are selections of F2 or later, or possibly some back crosses (D. Cooke personal communication).

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David Cooke has put together an invaluable, unpublished list of horticultural varieties, names of brooms in Australia and their most likely parentage. Table 1 would not have been possible without this (Full list available from him at Animal and Plant Control Commission, GPO Box 1671, Adelaide, South Australia 5001). Sharon Corey, John Hosking and Kate Blood for critically reviewing the manuscript.

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Broom (*Cytisus scoparius* (L.) Link) and fire: management implications

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Summary

Fire is often employed to control populations of weeds especially over large and/or remote areas. However, how fire may favour subsequent re-invasion, either from the original or other weeds is poorly understood. There is a need to know how weed species respond to fire and to incorporate this knowledge into management strategies for both fire and weeds. This paper explores how broom (*Cytisus scoparius*) responds to fire. Fire can cause high seed mortality in broom seedbanks reducing them to less than 10% of pre-fire levels, depending on the timing and intensity of the fire. It is the only potential management tool available that can directly target the seedbank, however, remaining viable seeds in the soil are sufficient for stand replacement. Any effects of fire on seedbank germination and subsequent seedling survival in the field had negligible consequences on recruitment 12 months after the fire. However, seedbank decline in burned soil samples potted out in the glasshouse showed a marked difference compared to unburned over the same period. Burned broom plants die, but lightly scorched plants have the capacity to resprout. Using fire to control broom should be avoided, unless intensive follow-up treatments are planned as part of an integrated weed management strategy.

Introduction

Over 220 plant species were declared as noxious weeds in Australia in 1992 (Parsons and Cuthbertson 1992), and approximately ten times this number have become naturalized since the arrival of European settlers, some 210 years ago (Humphries *et al.* 1991). They occur in almost every landscape and can modify the pre-invasion disturbance regimes to their advantage and the demise of native species (Mack and D'Antonio 1998). A dominant and frequent disturbance in the Australian landscape is fire. With a long history of Aboriginal burning (Nicholson 1981) many native plant species have developed strategies to survive periodic fires. Many weed-invaded environments are subject to fires, be it a wildfire or a controlled burn. Fire is still frequently used in weed management even though very little is known about its effectiveness and how weed species respond to fire (Downey 1999). This practice may have arisen from the transfer of agriculture-based weed management to native ecosystems and the logistic constraints of broad-scale weed management in remote areas (Humphries *et al.* 1991).

Broom (*Cytisus scoparius* (L.) Link subsp. *scoparius*) is an exotic, leguminous and deciduous shrub, which invades agricultural and natural ecosystems in temperate areas of high annual rainfall. It is a major weed in many parts of the world (Hosking *et al.* 1998, Peterson and Prasad 1999, Smith 2000), often forming a dense monoculture to 5 m in height and quickly establishing large long-lived seedbanks (up to 60 000 seeds m^{-2}, P. Downey unpublished data). Broom responds well to disturbance and if subject to favourable conditions can grow 1.5 m in less than one year (P. Downey unpublished data), reaching reproductive capacity in a minimum of three years (Hosking *et al.* 1998, Downey and Smith 2000).

At present herbicides are the main control option for broom in its exotic range. Herbicides are expensive, logistically difficult and costly to apply in remote locations (Carter and Signor 2000, Schroder and Howard 2000). The biological control program in Australia is still in its infancy, but based on overseas experience could prove increasingly beneficial over time (Syrett *et al.* 1999). Due to broom vigour and longevity of its seeds, any control strategy must be long-term. Fire can deplete the seedbank to 8% of pre-fire levels either by killing or stimulating germination of seeds (Bossard 1990). Following fire there is a three-year window of opportunity to intensely manage broom seedbanks and subsequent recruitment, before freshly produced seed will re-enter the system. In light of this the potential benefits of fire are very attractive to landholders.

Rigorous and comparable experimental data on how fire affects broom seedbank size and its dormancy profile from a range of sites are hard to obtain as fire intensity varies, particularly between experimental and wild fires. Data presented here are from three sites. Two of the sites had fires deliberately lit to manage broom. These fires were relatively low in intensity and in one case no pre-fire data were available. Data from a third site were collected opportunistically following a