

Processes leading to the detection of tropical weed infestations during an eradication program

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Summary We identify and track processes that have resulted in the detection of six tropical weeds targeted for eradication. The habitats and distributions of these species make detection by field officers and members of the public more likely than targeted searches. The eradication program is increasing the scope of detection processes by conducting and documenting activities to improve weed recognition amongst public, government and industry stakeholders.

Keywords Eradication, detection, delimitation, *Limnocharis*, *Mikania*, *Miconia*, *Clidemia*.

INTRODUCTION

To eradicate a weed species all occurrences must be found, contained and treated to extinction. Even with highly effective treatments, eradication will not be attained unless all infestations are identified. Therefore, measures of eradication progress need to reflect increasing confidence that all infestations have been found. Eradication programs often use a combination of methods to add confidence as to the extent of an incursion. For species occurring in open vegetation types, a common delimiting method is to search in the vicinity of known infestations via ground (Correl and Marvanek 2006), air or water (NRMW 2004). Specific searches can yield absence data on a large scale which is useful for modelling and delimiting weed occurrence (Panetta and Lawes 2005). The spread of potentially contaminated agricultural materials has been traced locally (Secomb 2006) and/or beyond infested catchments (NRMW 2004). Information on the deliberate dispersal of an eradication target enables rapid delimitation (Dodd 2004). Members of the public can also be engaged via extension programs to report plants (Gunasekera *et al.* 2006, NRMW 2004). Professional officers (e.g. water resource officers, L. Gunasekera pers. comm. 2006) can include surveillance within other field duties.

A national cost sharing weed eradication program, the 'Four Tropical Weeds Eradication Program' (4TWP) targeting six species of four genera commenced in 2001. The 4TWP species are *Clidemia hirta* (L.) D. Don., *Limnocharis flava* (L.) Buchenau.,

Miconia calvescens DC., *Miconia nervosa* (J.E. Smith) Triana., *Miconia racemosa* (Aubl.) DC. and *Mikania micrantha* (Kunth). The majority of locations of 4TWP species are in the wet and seasonally dry tropics along the north east coast of Queensland. The processes resulting in the detection of these species were identified, and the 4TWP is developing mechanisms to record and increase the effectiveness of these processes.

MATERIALS AND METHODS

Information on the date, people and activities involved in the discovery of 4TWP species locations was sought from Department of Primary Industries and Fisheries Land Protection Officers, Australian Quarantine Inspection Service (AQIS) botanists, local government pest management officers and field staff from weed and re-vegetation projects.

RESULTS

The method of detection for each location was allocated into one of four categories (Table 1).

By July 2007, 73 locations of 4TWP species had been identified; this includes 31 locations with single or contained garden plants and 42 naturalised populations. The discovery of locations in each category, for all species, between 1996 and July 2007 is plotted in

Table 1. Number of 4TWP species locations allocated between four categories of detection processes.

Species ^A in Four Tropical Weed Eradication Program	Recognition by professional weed officers	Public Information	Tracing information	Specific search
<i>Limnocharis flava</i>	9	6	4	0
<i>Miconia calvescens</i>	19	11	7	0
<i>Mikania micrantha</i>	4	1	3	6
Total	35*	18	14	6

^A Single infestations of *Clidemia hirta*, *Miconia nervosa* and *Miconia racemosa* were all identified after local government weed officers reported suspicious non-native Melastomataceae species in the field.

Figure 1. There was a notable surge in new detections between 2001 and 2004 with the commencement of the eradication program and fewer (smaller) discoveries beyond 2004.

Forty-eight percent of locations were detected by Local, State or Federal Government officers who **recognised** a 4TWP species as a direct result of employment in a weed related field. This category includes eight cases of detection resulting from surveillance by AQIS botanists, or nursery inspections by local and state government weed officers. These activities cover a range of alert list and locally or state declared weeds. This category also includes eight cases of 4TWP species recognised during specific surveys for other weed species: ground or boat surveys for *Chromolaena odorata* L., aquatic Weeds of National Significance or a different 4TWP species. Similarly, in four cases field officers, who were searching for one 4TWP species, reported suspicious plants (to AQIS) which were then identified as *C. hirta*, *M. racemosa*, *M. nervosa* and *M. micrantha*. Eleven infestations were spotted by weed officers during normal field duties, while four more were detected when Land Protection staff were off duty or attending a meeting. Across a range of situations in this category, detection has resulted from the ability of people employed in a weed related field to recognise a 4TWP species, or a close exotic relative. As detections occurred fortuitously or during activities targeting many, or a different weed species, they are not the result of specific searches. Given the breadth of people and activities, it is difficult to determine the total resources that could have led to the detection of a 4TWP species. This process also yields very little direct absence data.

The **public information** category includes two *L. flava* and nine *M. calvenscens* locations reported by members of the public after viewing plant displays, newspaper or gardening magazine articles, or identification cards. This category also includes another four *L. flava* cases reported after university students and a government officer had viewed warning brochures. Other extension activities, including tailored industry packs, posters, radio reports, TV footage and rural show visits have not yet directly resulted in detection. One *M. micrantha* and two *M. calvenscens* infestations were reported when landholders became concerned by their rampant growth. In each year since 1997, 13 to 26% of all locations have been reported by the public.

New sites have not yet been identified by trace forward activities, but the **tracing** category includes seven locations traced back through information from landholders about the source of their plants. Of these locations, three *M. micrantha* and three *L. flava*

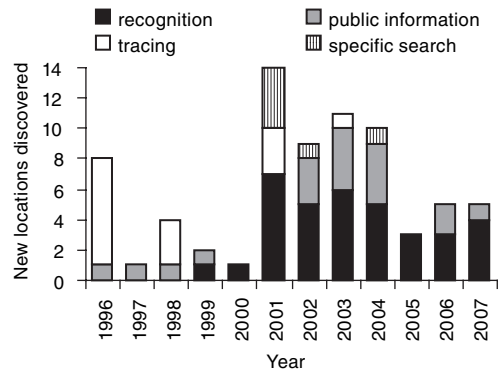


Figure 1. The method of discovery of locations of all 4TWP species between 1996 and July 2007.

infestations were traced soon after the first Australian infestations were discovered (Brooks and Galway 2006). The seven *M. calvenscens* locations in this category came from background and desktop enquires to local and interstate botanical gardens, herbaria, plant collectors and nurseries in 1996, in preparation for the state pest plant declaration of *Miconia* spp. (S. Csurhes pers comm. 2004).

In 2001 the Hinchinbrook Shire weed officer recognised two *M. micrantha* infestations at eastern and western points along the Palm Creek system near Ingham. Subsequent ground and boat **searches** identified six *M. micrantha* infestations between these two points (but none beyond). These are the only 4TWP infestations identified by specific search activities and reflect the more aggregated nature of infestations resulting from the abiotic dispersal of seed or stem fragments along this creek system.

DISCUSSION

Between 2001 and 2007 recognition became an increasingly prominent method for detecting new locations of 4TWP species (Figure 1). Therefore, it is essential that officers employed in weed related field jobs can recognise the target species. In addition to a professional knowledge of declared and alert list weed species, this ability has been built up through field visits, live weed displays, operational meeting presentations, photos, weed identification publications, joint survey exercises, job rotation and field knowledge of native plants. The 4TWP communication strategy (2006–2009) (unpublished report) includes the targeting, expanding and tracking of weed awareness and recognition skills amongst field based stakeholders (including local, state and federal government agencies and related industry bodies). A lower rate (or no) new discoveries, if accompanied by documented expansion

in target species awareness amongst stakeholders, can raise confidence that the eradication program is managing the full extent of each incursion.

The prominence of detection by recognition rather than specific searches has resulted from the distribution and biology of the target species. The deliberate cultivation of 4TWP species has created a broad spread of isolated infestations mostly originating from house blocks and spreading into natural areas (not primary production areas). A successful trial search by helicopter was conducted near *M. calvescens* and *M. micrantha* infestations under cyclone damaged rainforest canopies (T. Sydes pers. comm. 2007). However, tall vegetation and restricted suburban flying heights limited the detection of *M. calvescens* in a helicopter survey near Kuranda (P. Horrocks pers comm. 2004). The shade tolerant rainforest shrubs *C. hirta*, *M. racemosa* and *M. nervosa*, as well as the herbaceous *L. flava* (less than 1 m tall) could not be readily detected from the air. Overall, the disparate nature of infestations of 4TWP species and spread from suburban sources restricts specific searches to on ground areas within the likely dispersal buffers of known infestations, which were detected by the other three methods.

Tracing links and information helped to determine the initial local threat from some species (e.g. *M. calvescens*) and the spread of cultivated *L. flava* (Brooks and Galway 2006). While information on the source of infestations may not be forthcoming, tracing sources and desktop enquiries remain an important, fast and relatively cheap method of detection. Tracing forward and back information and vectors of spread, including historical references, should be a part of investigating all new incursions and infestations.

Information from the public has consistently identified a quarter of locations over the past six years and is particularly important for the cultivated *L. flava* and the very recognisable *M. calvescens*. Under the communication strategy the 4TWP has identified stakeholders such as community groups, adjacent landholders and the general public. The program will record extension activities and assess their impact (e.g. recall and willingness to report weeds) over time, in a similar process to the tracking of passive surveillance by the delimitation survey for *C. odorata* (NRMW 2004). Importantly, these activities also extend to weed officers in other areas of Queensland and interstate where a 4TWP species could establish, as well as through networks like the 'Weed Spotter Program' (Morton 2006).

Eradication programs use different combinations of detection methods depending on the distribution, dispersal, habitat and biology of the target species. Over the past 11 years, detection of 4TWP species has also involved a variety of processes and people. By recog-

nising, documenting and expanding these processes, particularly in recognition of species by weed professionals and public stakeholders, the 4TWP can provide increasing evidence on the extent of each incursion.

ACKNOWLEDGMENTS

Detection information came from Vic Little, Steve Matheson, Travis Sydes, Rebecca Breaden, Patric Lawler, Matt Buckman, Kylie Charleston, Peter Logan, Russell Wild and Barbara Waterhouse.

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