

Towards a bioherbicide for alligator weed

Ross L. Gilbert^{1,2,4}, Geoff M. Gurr², Michael J. Priest¹ and Andrew Mitchell^{3,4}

¹NSW Department of Primary Industries, Orange Agricultural Institute, Forest Road, Orange, New South Wales 2800, Australia.

²Charles Sturt University, School of Rural Management, Leeds Parade, Orange, New South Wales 2800, Australia.

³NSW Department of Primary Industries, Wagga Wagga Agricultural Research Institute, Pine Gully Road, Wagga Wagga, New South Wales, Australia.

⁴CRC for Australian Weed Management.
Email: ross.gilbert@dpi.nsw.gov.au

Summary Alligator weed, *Alternanthera philoxeroides* (Mart.) Griseb., is a major weed of riparian ecosystems throughout the world and a 'Weed of National Significance' in Australia. The core infestation extends from the southern Sydney basin northward to Bulahdelah. Other populations resisting eradication are found on the Far North Coast, North Coast, South-West Slopes and Riverina regions of NSW with new outbreaks also occurring in Queensland and Victoria. Therefore, the potential range of this weed in Australia is far from realised. This Cooperative Research Centre for Australian Weed Management project aims to investigate the development of an inundative bioherbicide using one or more fungal pathogens to assist in the management of alligator weed in Australia.

Investigations commenced in spring 2003 with a detailed survey of the diseases and their incitants found on alligator weed throughout NSW. The survey monitored and sampled up to 50 alligator weed populations for seasonal disease incidence over a three year period.

A leaf-infecting nematode *Aphelenchoides fragariae*, and leaf and stem diseases caused by pathogenic fungi in the genera *Colletotrichum*, *Fusarium*, *Phoma*, *Phomopsis*, *Sphaceloma* and *Nimbya*, were recorded. A total of up to 100 fungal species were recovered from alligator weed throughout the survey. The incidence of many diseases was influenced by season and geographic site. However, leaf and stem lesions caused by *Nimbya* species had the highest incidence at most sites and were present throughout the growing season. *Nimbya* was determined to be the preferred bioherbicide candidate over other pathogens based on a narrow host range and ability to aggressively kill both stems and leaves.

Nimbya alternantherae (Holcomb & Anton.) Simmons & Alcorn has been considered as a bioherbicide candidate for alligator weed in China (Xiang *et al.* 2002) and the USA (Pomella *et al.* 2007). Detailed morphological studies of the *Nimbya* isolates

illustrated a heterogeneous population possibly made up of several undescribed species different to *N. alternantherae* (Gilbert *et al.* 2005). This heterogeneity was also observed by differences in pathogenicity when isolates were tested using *in vitro* bioassay and *in vivo* glasshouse techniques.

Further evidence for speciation among the Australian *Nimbya* isolates was provided by *in vitro* mating experiments where viable sexual spores representing a new teleomorph species were produced in only a small number of the sampled isolates. Molecular investigations into the distribution of mating types present within the *Nimbya* populations in NSW are in progress, with the intention of shedding further light on speciation within the *Nimbya* complex. Investigations using PCR and phylogeny techniques with a set of nuclear genes have provided definitive information on the species concept within *Nimbya* on Amaranthaceae hosts within Australia and around the world.

ACKNOWLEDGMENTS

This project is made possible with funding from the CRC for Australian Weed Management.

REFERENCES

- Gilbert, R.L., Auld, B.A. and Hennecke, B.R. (2005). Leaf and stem spot of *Alternanthera philoxeroides* (alligator weed) in Australia caused by *Nimbya* sp. *Plant Pathology* 54, 585.
- Pomella, A.W.V., Barreto, R.W. and Charudattan, R. (2007). *Nimbya alternantherae* a potential biocontrol agent for alligator weed, *Alternanthera philoxeroides*. *BioControl* 52, 271-88
- Xiang MeiMei, Zeng YongSan, Liu Ren, Chen Sheng-Qing, Cai JunHong, You MingLong, Xiang, M.M., Zeng, Y.S., Liu, R., Chen, S.Q., Cai, J.H. and You, M.L. (2002). Host range, condition for conidium-producing and efficacy in alligator weed control of *Nimbya alternantherae*. *Acta-Phytopathologica-Sinica* 32, 286-7.