IMPLICATIONS OF A HIDDEN SEED BANK FOR THE ERADICATION OF RED WITCHWEED

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ABSTRACT

The successful eradication of a small infestation of *Striga asiatica* (L.) Kuntze*,* near Habana, Queensland, is dependent on the accelerated depletion of the soil seed bank and prevention of plant emergence using a range of ongoing treatments. A glasshouse experiment was conducted to investigate the relationship between *Striga* emergence in the presence of corn (*Zea mays* L.) (a true host of red witchweed (RWW), and RWW seed bank density. Overall, only 1.18% ± 0.19 of the available seed bank attached to corn roots during the 4 months study irrespective of seed bank density.

Keywords: *Striga asiatica*, red witchweed, seed bank, eradication.

INTRODUCTION

Striga asiatica (red witchweed or RWW) is a parasitic plant that is currently the target of an eradication program managed by the Queensland Department Agriculture and Fisheries. The infested area is contained on 109.1 ha (Calvert, M., 2019) approximately 25 km NW of Mackay, at Habana QLD and is the only known population of RWW in Australia (Vitelli *et al*., 2016 and Austin *et al.,* 2017). A significant challenge for eradicating RWW is the plants diminutive height, quantity of seed produced and small seed size. RWW seeds are less than 0.35 mm long and 0.2 mm wide (Bebawi *et al*., 1984b) with individual plants 5 to 40 cm in height capable of producing up to 450,000 seeds (Bebawi *et al*., 1984a). This minute size, in conjunction with its brown-black colouring, makes its detection in soil very difficult. Consequently, eradication progress relies on continuous surveillance for emerged RWW plants, but it is unclear how this relates to seed bank depletion, which is required for eradication.

A glasshouse experiment was conducted to understand the link between RWW soil-seed bank density and its emergence in the presence of a host. Five RWW seed bank densities were tested. The seed bank densities equate to between 65,000 to 1.03 million seeds/m^2 and reflect previously recorded seed bank densities present in the field at Habana (Vitelli J.S., 2019).

MATERIALS AND METHODS

RWW seeds were collected between Jan 1 to April 30 2015 from *Striga* plants grown in a quarantine glasshouse at the Ecosciences Precinct, Dutton Park, and stored at 35^{O}C until needed. Five replicates of 250, 500, 1000, 2000 and 4000 RWW seeds were counted under a dissecting microscope. 330 g (dry weight) of a 2:1 Kurosol:Sand mix was weighed into containers to which known densities of RWW seeds were added and stirred thoroughly. Holes 3.5 cm in diameter were drilled into the base of each 350 ml pot and

then lined with nylon mesh. RWW-inoculated soil was later added to each pot and planted with a 2 - 3 cm tall corn seedling.

Potted plants were placed in a completely randomised design on felt matting, suspended over a water bath to provide constant watering. Host plants were fertilised and treated for pests as necessary to support healthy growth.

Pots were monitored twice weekly and the number of days to first emergence and number of emerged RWW plants were recorded. On emergence RWW plants were cut to soil level and marked with pink paint, to observe ongoing recruitment during the experiment. After 4 months, when the corn was senescing, each pot was washed free of dirt and the number of RWW attachments assessed.

RESULTS

The first RWW seedlings to emerge were observed during the sixth week after planting in the 1000, 2000 and 4000 seed density treatments. Above ground RWW growth continued until the pots were removed and RWW attachment determined. There were a greater number of RWW attachments with increasing RWW seed density (Table 1). When expressed as percent of available seed bank, the number of attachments was static across all seed bank densities.

Table 1. *Striga asiatica* seed density and emergence.

Rww seed density	Av. Days to first emergence	Av. Number of rww attachments to corn roots	% attachment of known rww soil seedbank
250	60 ± 2.3	3.2 ± 1.6	1.3 ± 0.7
500	63 ± 7.4	5.8 ± 2.4	1.2 ± 0.5
1000	49.5 ± 3.9	12.4 ± 4.7	1.2 ± 0.5
2000	46.2 ± 2.0	17.8 ± 3.8	0.9 ± 0.4
4000	46.6 ± 3.5	52.2 ± 15.2	1.3 ± 0.4

The number of above ground RWW stems were found to not reflect the number of RWW attachments due to below ground branching. There were far fewer attachments than the number of above ground visible stems.

DISCUSSION

This experiment showed that the number of RWW attachments resulted from an average of 1.18% ± 0.19 irrespective of the available seed bank, and in three replicates, no RWW attachments were found. The number of emergent RWW in the field, including absence or low numbers, does not reflect the size of the available soil seed bank and should not be used as an indicator of soil seed bank density.

In two replicates RWW plants persisted through to flowering after the above ground foliage of the host was dry, brittle and appeared to be dead (Figure 1). Therefore, if a control strategy only “burns off” or removes the above ground host foliage (e.g. through contact herbicides, such as paraquat, slashing or burning) without killing the entire host plant, including its root system, attached RWW plants can survive through to reproduction.

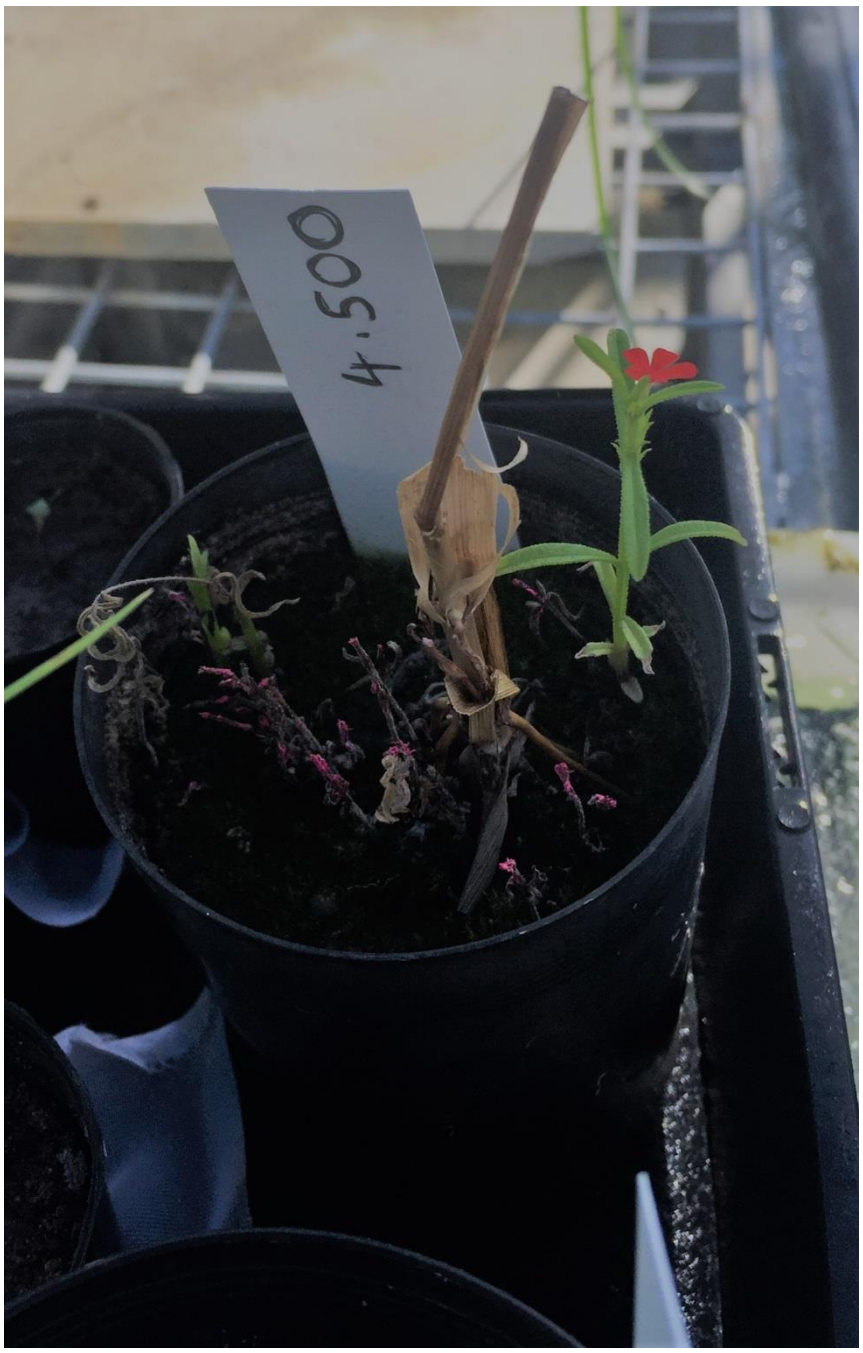

Figure 1. Flowering *Striga asiatica* attached to corn that appears dead but has a live root system.

Acknowledgment of these RWW characteristics is crucial to successful RWW management as absence of RWW detections in surveillance activities cannot be interpreted as an absolute sign of a depleted soil seed bank.

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