INTERFERENCE OF ROSETTE RAGWORT PLANTS WITH FORAGE PLANT EMERGENCE, MORTALITY AND GROWTH

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Ragwort (*Senecio jacoboea)* is a weed species of major importance in New Zealand pastures and is classified as a class B noxious plant. It can constitute a significant proportion of the pasture cover and its rosette stage has the potential to compete aggressively with other forage species (Harper 1958). It also produces pyrrolizidine alkaloids which are toxic to livestock. However, the allelopathic potential and the nature of competition between ragwort and pasture plants is poorly understood (Wardle 1987). The purpose of this study was to determine any allelopathic and competitive effects of ragwort rosettes against pasture forage plants.

The experiments reported here were carried out in a glasshouse at the Ruakura Agricultural Centre between September 1991 and August 1992. All treatments were replicated five times in a randomised block design. Five ragwort seedlings were planted in a growing medium (50% soil and 50% pumice) in polystyrene trays (50 x 30 x 8 cm deep) and were thinned to one plant when established. These were left for approximately 8 months until they reached a diameter of 25-30 cm. At this stage, six treatments were set up to determine the effects of these rosette plants on five pasture species, viz. perennial ryegrass *(Lolium perenne)*, red clover *(Trifolium pratense)*, white clover *(T. repens)*, subterranean clover *(T. subterraneum)*, and lucerne *(Medicago sativa)*. The treatments were:

(1) Control. This involved establishing 10 cm diameter pots for each test species, each filled with soil-pumice media, and each planted with eleven seeds of the test species. Fifty mls of tap water was added every 3-4 days.
(2) Leaf leachates. This was set up as for (1) but instead all water added to the pots was leached through live ragwort leaves of the plants in the trays mentioned above and collected prior to reaching the soil.
(3) Root leachates. As for (1) but all water was first leached through the soil in which the ragwort plants were growing.
(4) Root zone. Seeds of each species were sown in five of the trays containing ragwort in the zone of interference created by the ragwort plants (11 seeds per tray). To exclude ragwort leaves, physical barriers (metal strips placed vertically) were set up. This enabled assessment of the overall effects of ragwort roots on the test species.
(5) Shading + leaf leachates. Pots were set up as for (1) except that they were placed under those ragwort leaves which extended over the perimeter of the trays in which they were planted. All added water thus passed through the overhanging leaves prior to reaching the pot.
(6) Shade + root zone + leaf leachate. As for (4) except that no physical barrier was present. This enabled the monitoring of the overall effects of above-ground and below-ground interference from the ragwort plants.

Seedling emergence of each test species was recorded for 3 weeks after planting. Mortality of seedlings which emerged was recorded for 11 weeks and surviving seedlings were then harvested to obtain shoot dry weight data.

There was no significant effect of any ragwort treatment on emergence of test species except for root leachates on subterranean clover (Table 1).

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TABLE 1: Mean emergence, mortality and shoot dry weight of test species under varying treatments of ragwort.

Test species	Response variable	Control	Leaf leachate	Root leachate	Root zone	Shade + leaf leachate	Shade + root zone + leaf leachate
ryegrass	% emergence	86.6a*	79.0a	81.8a	84.0a	82.2a	78.4a
	% mortality	1.6b	3.6b	1.4b	1.4b	20.6b	73.6a
	shoot dry weight (g)	0.93a	0.54ab	0.52b	0.41bc	0.02c	0.06c
red clover	% emergence	51.0a	52.6a	26.6a	49.4a	41.6a	26.8a
	% mortality	1.0b	8.0b	8.8b	11.6b	20.6b	58.8a
	shoot dry weight (g)	0.18a	0.14ab	0.06b	0.11ab	0.12ab	0.03b
white clover	% emergence	96.0a	96.8a	93.4a	95.4a	97.2a	93.4a
	% mortality	2.8c	12.6c	6.0c	14.8c	60.6b	79.8a
	shoot dry weight (g)	0.21a	0.11b	0.07bc	0.04bc	0.01c	0.00c
subterranean clover	% emergence	80.6a	79.6a	42.8b	81.0a	80.0a	70.4a
	% mortality	3.0c	26.0bc	13.0c	25.4bc	63.6ab	83.0a
	shoot dry weight (g)	0.69a	0.18b	0.22b	0.08b	0.01b	0.01b
lucerne	% emergence	41.6a	40.0a	19.2a	22.0a	37.0a	30.2a
	% mortality	4.4b	22.6b	19.6b	50.0ab	78.0a	93.8a
	shoot dry weight (g)	0.50a	0.16ab	0.04b	0.08b	0.02b	0.02b

*Within each row numbers followed by different letters are significantly different from each other at P= 0.05 (Tukey's test).

Application of leaf leachates (Treatment 2) did not affect seedling survival, but significantly reduced growth of white clover and subterranean clover. The root leachates (Treatment 3) caused considerable damage to growth of all test species, which was usually in excess of that caused by leaf leachates, although no mortality was recorded. Similar results were obtained with the root zone treatment (Treatment 4). For white clover, subterranean clover and lucerne higher seedling mortality and reduced shoot growth occurred under the shade + leaf leachate treatment (Treatment 5). Growth of ryegrass was also considerably reduced by this treatment. All test species had the highest seedling mortality in the shade + root zone + leaf leachate treatment (Treatment 6), reflecting the overall effect of rosette ragwort plant. This treatment also generally resulted in the lowest shoot growth for all test species (Table 1).

This study suggests that ragwort may significantly reduce the growth of pasture forage species by the allelopathic effects from both leaf and root leachates. Other factors such as shading also appear to create a micro environment in which it becomes difficult for forage plant seedlings to establish and/or survive.

REFERENCES

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