SUSCEPTIBILITY OF WARM-SEASON GRASSES TO FEEDING AND OVIPOSITION BY THE ARGENTINE STEM WEEVIL (*LISTRONOTUS BONARIENSIS*)

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SUMMARY

Susceptibility among warm-season (C4) grass species to feeding and egg deposition by Argentine stem weevil (*Listronotus bonariensis*) was assessed in the laboratory. Among species occurring in New Zealand pastures, feeding and egg laying were highest on Kikuyu (*Pennisetum clandestinum*) and intermediate on summer grass (*Digitaria sanguinalis*) while smooth witchgrass (*Panicum dichotomiflorum*) was unacceptable to weevils. Few eggs were deposited in paspalum (*Paspalum dilatatum*), despite this grass being acceptable for feeding. All species were from nil to moderately susceptible to egg laying. Little bluestem (*Schizachyrium scoparium*), Indiangrass (*Sorghastrum nutans*), caucasian bluestem (*Bothriochloa caucasica*) and free-tail (*Bothriochloa laguroides*) were acceptable to weevils for feeding but not for egg laying. For warm-season grasses oviposition bioassays give a more reliable guide to Argentine stem weevil resistance.

Keywords: Argentine stem weevil, *Listronotus bonariensis*, feeding damage, oviposition, warm-season grasses

INTRODUCTION

The most favoured pasture grass in New Zealand is the cool-season perennial ryegrass (*Lolium perenne* L.). However, in northern pastures, perennial ryegrass dry matter production and plant persistence are compromised by a combination of dry summers, intensive grazing, and pest attack. Warm-season grasses may be better adapted to northern pasture conditions and the agronomic potential of some species has been evaluated (eg. Lambert 1967; Rumball 1991). In environments experiencing high summer temperature warm-season grasses offer advantages over cool-season species in better drought tolerance, insect and disease resistance, a capability to grow under low fertility coupled with a good response to fertiliser, and also have a good nutritive value (Jung *et al* 1985; Jung 1986).

Argentine stem weevil (*Listronotus bonariensis* (Kuschel)) is a major and widespread pest of most agronomically important grasses in New Zealand. Because insecticide use is uneconomic, current controls for Argentine stem weevil focus on plant resistance and biological control. Infection of perennial ryegrass by the endophytic fungus *Acremonium lolii* Latch, Christensen and Samuels confers some resistance to Argentine stem weevil feeding and oviposition, but has the undesirable side effect of inducing toxicosis in grazing animals (Prestidge *et al.* 1982). While the resistance to Argentine stem weevil of two warm-season species has been determined (Barker 1989), the resistance of others has not been adequately explored.

The two laboratory bioassays reported here investigate the relative susceptibility of warm-season grasses to feeding and egg laying by Argentine stem weevil.

METHOD

The warm-season grass species used in the bioassays are given in Table 1. Paspalum (*Paspalum dilatatum* Poir.), summer grass (*Digitaria sanguinalis* (L.) Scop.), and smooth witchgrass (*Panicum dichotomiflorum* Michx.), occurring as

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volunteer species, were obtained from pasture at Ruakura Agricultural Centre, and were transplanted directly to pots containing a peat - sand potting medium. Seed for the remaining species was obtained from the Forage Germplasm Centre, Grasslands Division, D.S.I.R. (now AgResearch). The cool-season (C3) *A. lolii*-free perennial ryegrass cultivar "Ellett", obtained from commercial sources, was used as a standard. Seed was germinated on moist filter paper in Petri dishes and transferred to pots. The plants were housed in a screenhouse with regular watering, fertiliser, and trimming to maintain vegetative tillering.

Experiment 1

Leaf segments 6 cm long of similar width and age were cut on 14 January 1991 from 10-15 plants of each grass species. Four segments were taped parallel to each other on moistened filter paper in Petri dishes. Five Argentine stem weevil adults were confined to each Petri dish and these were arranged in a randomised block experimental design with eight replicates. Feeding scar number and visual score of feeding intensity (0-10 scale: 0=no feeding, 10=all segments consumed) were recorded at 24 and 48 hours after inclusion of the weevils. Feeding scar number and feeding score data were subjected to analysis of variance, the former after square root transformation and the latter after arcsine transformation.

Experiment 2

Two plants of each species were transplanted on 22 January 1992 into each of six replicate arenas (17 cm X 17 cm by 19 cm deep). Thirty adult Argentine stem weevils were confined to the plants in each arena by a gauze cover. The arenas were arranged in a randomised block design in a screenhouse. The number of ovipositions and eggs deposited were recorded after 96 hours. The data were subjected to analysis of variance after square root transformation.

RESULTS

Experiment 1

There was little change between the rankings of species based on stem weevil feeding after 24 and 48 hours, so only data for the latter are given (Table 1). All species except Kikuyu (*Pennisetum clandestinum* Hochst. ex Chiov.), free-tail (*Bothriochloa laguroides* (D.C.) Herter), and paspalum, ranked less susceptible than the perennial ryegrass standard when considering the feeding scar data. There was wide variation in the susceptibility of species to feeding by adult weevils.

The amount of leaf area eaten per feeding scar varied among the species. Feeding by weevils on less favoured species consisted predominantly of test bites, rather than prolonged feeding. However, only minor changes in ranking of the species occurred when the feeding was visually scored for leaf area removed (Table 1). The exception was free-tail, a species that suffered a high number of feeding sites but ranked only moderately susceptible on the basis of leaf area removed. All species had damage scores significantly lower than the perennial ryegrass standard.

Experiment 2

Oviposition frequency and the number of eggs per plant pair were significantly higher in the perennial ryegrass standard than in the warm-season species (Table 1). No eggs were deposited on little bluestem (*Schizachyrium scoparium* (Michx.) Nash), Indiangrass (*Sorghastrum nutans* (L.) Nash), Caucasian bluestem (*Bothriochloa caucasica* (Trin.) C. E. Hubb.) and free-tail, despite these species being subject to moderate levels of feeding damage. Klein grass (*Panicum coloratum* L.) and big bluestem (*Andropogon gerardii* Vitman) had an intermediate resistance to feeding and egg laying, while switchgrass (*Panicum virgatum* L.) had low resistance. Among species occurring as volunteer species in New Zealand pastures, feeding and egg laying were highest in Kikuyu and intermediate in summer grass, while smooth witchgrass was unacceptable to weevils. Few eggs were deposited in paspalum which ranked highly acceptable in the feeding test.

TABLE 1: Bioassay assessments of susceptibility of some warm-season grasses to feeding and oviposition by Argentine stem weevil.

Species	Common name	¹ Feeding scars ^a	² Feeding score ^a	¹ Ovi-positions/plant pair ^b	¹ Eggs/plant pair ^b
Warm-season Species					
<i>Panicum virgatum</i>	switchgrass	0.4	0.01	0.9	1.1
<i>Panicum dichotomiflorum</i>	smooth witchgrass	0.7	0.01	0.3	0.6
<i>Panicum coloratum</i>	klein grass	2.4	0.13	1.6	2.6
<i>Schizachyrium scoparium</i>	little bluestem	3.0	0.13	0	0
<i>Sorghastrum nutans</i>	Indiangrass	3.5	0.15	0	0
<i>Andropogon gerardii</i>	big bluestem	3.9	0.13	1.3	1.8
<i>Bothriochloa caucasica</i>	caucasian bluestem	5.2	0.28	0	0
<i>Digitaria sanguinalis</i>	summer grass	6.2	0.41	2.2	2.7
<i>Pennisetum clandestinum</i>	Kikuyu	7.3	0.46	4.0	5.2
<i>Paspalum dilatatum</i>	paspalum	7.5	0.36	0.5	0.7
<i>Bothriochloa laguroides</i>	free-tail	8.4	0.31	0	0
Cool-season Standard					
<i>Lolium perenne</i>	perennial ryegrass	7.9	0.77	7.2	9.1
Average LSD 5%		1.0	0.10	1.3	1.7

^a after 48 hours exposure¹Means of square root transformed data^b after 96 hours exposure²Means of arcsine transformed data

DISCUSSION

In contrast to the situation in cool-season grasses (Kain *et al.* 1982; Barker 1989), the difference in susceptibility rankings provided by the bioassays indicates there may be a poor correlation between feeding and oviposition on warm-season grasses. While easier to perform, a laboratory assessment of feeding does not give a reliable guide to resistance to oviposition in these grasses. Given that larvae, resulting from eggs deposited in the sheath tissues, are the principal damaging stage of Argentine stem weevil, grass species evaluation on oviposition is more important than that based on adult feeding. That no eggs were deposited in little bluestem, Indiangrass, caucasian bluestem, and free-tail, despite moderate to high susceptibility to feeding, may indicate that host selection for oviposition is driven by different cues to that for feeding. Warm-season grasses generally contain higher levels of silica in the epidermal cell walls than cool-season grasses (Kaufman *et al.* 1985), which may act as a physical barrier to either feeding or egg deposition (Barker 1989). Some warm-season grasses also contain secondary metabolites such as calcium oxalate (McKenzie and Schultz 1983) and saponins (Munday *et al.* 1993) which may act as chemical deterrents to feeding or egg laying by Argentine stem weevil.

With the exception of Kikuyu, the warm-season species occurring as volunteer species in New Zealand pastures generally ranked low in susceptibility to oviposition and may not influence weevil populations in pasture.

Warm-season grasses included in the bioassay because of their agronomic potential were of moderate to high resistance to Argentine stem weevil. These grasses are currently being evaluated for insect resistance in the field.

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