RELATIVE SUSCEPTIBILITY TO FEEDING BY ARGENTINE STEM WEEVIL AMONG WARM-SEASON WEED GRASSES

G.M. BARKER and A.C. FIRTH

*AgResearch, Ruakura Agricultural Research Centre,
Private Bag 3123 Hamilton*

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

Perennial ryegrass (*Lolium perenne* L.) is the main forage grass used in New Zealand but it is ill-adapted to the summer environment in the north of the country. Heat and moisture stress, intensive grazing and infestations by pests such as Argentine stem weevil (*Listronotus bonariensis* (Kuschel)) contribute collectively in summer to reduce ryegrass persistence. Ingress during summer by warm-season grasses and in winter by annual poa (*Poa annua* L.) is common in deteriorating ryegrass swards (Percival 1977, 1978; Field and Forde 1990; Baars *et al.* 1991; Wardle *et al.* 1994). Weed grass ingress is attributed to further weakening and displacement of the ryegrass and the nitrogen-supplying clovers through such effects as interspecific competition, allelopathy and elevation of invertebrate pest infestations (Campbell and Wardle 1994). Barker *et al.* (1989) and Barker (1993) showed that annual poa was important to Argentine stem weevil population recruitment and hence a source of infestation by this insect in ryegrass pastures infested by this weed. The significance of warm-season weed grasses in the ecology and pest status of Argentine stem weevil in pastures has not been fully explored, though the susceptibility of several species has been examined (eg. Barker *et al.* 1984; Barker 1989; Firth *et al.* 1993).

In the present work the relative susceptibility of several warm-season weed grasses to feeding by adult Argentine stem weevil was determined by bioassay of leaf segments in the laboratory, with 'Grasslands Nui' perennial ryegrass (not infected by *Acremonium lolii* Latch, Christensen & Samuels) included as a standard. Leaf material was collected from vegetative plants in pastures near Hamilton, New Zealand on 6 February 1994 and leaf segments, 6 cm long, of a single species were taped parallel to each other on moistened filter paper in each of 10 replicate Petri dishes. In order that approximately equal leaf area be presented in each dish, only two leaf segments of barnyard grass (*Echinochloa crus-galli* (L.) Beauv.) were included in a dish, while for crowfoot grass (*Eleusine indica* (L.) Gaertn.), Indian doab (*Cynodon dactylon* (L.) Pers.), Kikuyu grass (*Pennisetum clandestinum* Hochst. ex Chiov.), Mercer grass (*Paspalum paspaloides* (Michx.) Scribn.), paspalum (*P. dilatatum* Poir.), rough bristle grass (*Setaria verticillata* (L.) Beauv.), summer grass (*Digitaria sanguinalis* (L.) Scop.), smooth witchgrass (*Panicum dichotomiflorum* Michx.) and perennial ryegrass four segments were used. Leaf segments were arranged with alternate abaxial and adaxial surfaces uppermost. Five Argentine stem weevil adults were confined to each Petri dish and these were arranged in a randomised block experimental design on the laboratory bench under ambient conditions. Feeding on each leaf segment was recorded after 12 and 84 h by counting the feeding scars and by visual scoring of the leaf area removed (0-10 scale: 0 = no feeding, 10 = ca. 300 mm² consumed).

There were marked differences in weevil feeding on the different plant species, with the susceptibility ranking of species changing little between 12 and 84 h assessments (Table 1). Analysis of variance of feeding scars and scores indicated that the grass species could be separated into three groups. Group one, characterised by low mean and variance of weevil feeding, was comprised of rough bristle grass, smooth witchgrass, Kikuyu and paspalum. Within this group, paspalum generally was more susceptible than the other three species. Group two, with higher mean and more

Proc. 47th N.Z. Plant Protection Conf. 1994: 284-286

variable weevil feeding, comprised Mercer grass, Indian doab, crowfoot grass, barnyard grass and summer grass. The cool-season standard, perennial ryegrass, was the most susceptible.

TABLE 1. Bioassay assessment of susceptibility of various warm-season grasses to Argentine stem weevil adult feeding.

	12 hours				84 hours			
	Feeding scars		Feeding scores		Feeding scars		Feeding scores	
	Total	adaxial-abaxial ^a	Total	adaxial-abaxial	Total	adaxial-abaxial	Total	adaxial-abaxial
Warm-season grasses								
rough								
bristlegrass	1.6	-1.2	0.6	-0.3	14.9	-7.3	3.9	-2.2
smooth								
witchgrass	2.8	-2.2	1.1	-1.0	13.0	-11.8	2.2	-2.1
Kikuyu	5.7	-4.9	1.0	-0.8	21.3	-18.7*	3.1	-2.7
paspalum	10.7	1.7	1.7	0.5	38.6	-1.2	5.9	0.2
Mercer grass	16.3	0.7	3.8	-0.1	55.2	-12.2	12.1	-3.1
Indian doab	20.3	-3.5	4.7	-0.9	62.2	-4.4	13.4	-1.2
crowfoot grass	17.9	-6.1	5.1	-1.9	62.8	-12.8	14.3	-2.9
barnyard grass	16.8	4.8	4.6	1.0	63.8	5.6	15.2	1.1
summer grass	18.7	-3.3	4.9	-0.7	90.7	-4.3	20.9	-1.2
Cool-season standard								
perennial								
ryegrass	26.6	-7.8*	7.8	-2.5*	106.3	-7.7	31.2	-0.5
SED average	4.13	3.92	0.95	1.00	9.91	8.12	2.23	1.72
species 1-4	2.62		0.65		7.74		1.50	
species 5-10	4.88		1.11		11.12		2.60	

^a Differences between feeding on adaxial and abaxial leaf surfaces.

* abaxial leaf surface preferred over than of adaxial surface ($P < 0.05$).

Larvae, resulting from eggs deposited in the sheath tissues, are the principal damaging stage of Argentine stem weevil. Grass species evaluation of oviposition preference is therefore more important than that based on adult feeding. Assay of adult weevil feeding does, however, provide a first approximation of resistance as grasses unfavourable to adult feeding are not generally acceptable as oviposition hosts (Barker 1989). The converse, that grasses favourable for adult feeding are favourable for oviposition, does not always apply as some warm-season grasses are rejected as oviposition sites despite being utilized for feeding by gravid female weevils (Barker *et al.* 1993; Firth *et al.* 1993). The present results indicate that rough bristle grass and smooth witchgrass are unfavourable food sources for adult weevils and unlikely to be important in pastures as oviposition hosts. This is consistent with our earlier results for smooth witchgrass (Firth *et al.* 1993). The moderate susceptibility to adult weevil feeding of the remaining seven warm-season grasses in the bioassay is consistent with their occasional utilization as food plants by adult weevils in pasture (G.M. Barker and K. Coffey, unpubl.). Their role in population recruitment in pastures requires further investigation, although earlier studies (Barker *et al.* 1993; Firth *et al.* 1993) suggest that Kikuyu, paspalum and summer grass, at least, are acceptable oviposition hosts.

The species considered here are part of an accession collection being currently used to determine modes of Argentine stem weevil resistance in grasses. Barker (1989) found no relationship between the density of trichomes on the leaf surfaces and weevil

feeding intensity for a range of grasses, which included paspalum, summer grass and ryegrass. In the present study there was also no such relationship. High feeding scar numbers and scores were recorded for the pubescent summer grass, while among the other species, which were glabrous or nearly so, a range of susceptibilities were recorded. There were differences between species, however, in the leaf surface preferred (Table 1), with weevils tending to prefer the abaxial surface in some species and the adaxial surface in others. At the individual species level, only in ryegrass (12 h assessment) and Kikuyu (84 h assessment) did weevils exhibit a clear preference for one leaf surface (viz. abaxial). The role of leaf structure and secondary metabolite chemistry in weevil host plant selection and feeding site preferences are being investigated.

REFERENCES

- Baars, J.A., Goold, G.J., Hawke, M.F., Kilgariff, P.J. and Rollo, M.D., 1991. Seasonal patterns of pasture production in the Bay of Plenty and Waikato. *Proc. N.Z. Grassld. Assoc.* 53: 67-72.
- Barker, G.M., 1989. Grass host preferences of *Listronotus bonariensis* (Coleoptera: Curculionidae). *J. Econ. Entomol.* 82: 1807-1816.
- Barker, G.M., 1993. Contribution of the weed grass *Poa annua* to population phenology and recruitment of Argentine stem weevil in northern New Zealand pastures. *Proc. 6th Australasian Conf. Grassl. Invert. Ecol.*: 155-160.
- Barker, G.M., Pottinger, R.P. and Addison, P.J., 1984. Effect of Argentine stem weevil on productivity of grasses in the Waikato. *N.Z. J. Agric. Res.* 27: 93-102.
- Barker, G.M., Firth, A.C. and Addison, P.J., 1993. Susceptibility of warm-season grasses to Argentine stem weevil. *Tests Agrochem. Cultivars* 14: 140-141.
- Barker, G.M., Pottinger, R.P. and Addison, P.J., 1989. Population dynamics of the Argentine stem weevil (*Listronotus bonariensis*) in pastures of Waikato, New Zealand. *Agric. Ecosyst. Environ.* 26: 79-115.
- Campbell, B.D. and Wardle, D.A., 1994. Report on 1993 Research Workshop on Subtropical Grass Invasion of North Island Dairy Pastures. AgResearch, Hamilton.
- Field, T.R.O. and Forde, M.B., 1990. Effects of climate warming on the distribution of C4 grasses in New Zealand. *Proc. N.Z. Grassld. Assoc.* 51: 47-50.
- Firth, A.C., Barker, G.M. and Addison, P.J., 1993. Susceptibility of warm-season grasses to feeding and oviposition by the Argentine stem weevil (*Listronotus bonariensis*). *Proc. 46th N.Z. Plant Protection Conf.*: 215-218.
- Percival, N.S., 1977. Survey of paspalum in New Zealand pastures. *N.Z. J. Expt. Agric.* 5: 219-226.
- Percival, N.S., 1978. Survey of Kikuyu grass (*Pennisetum clandestinum* Hochst.) in New Zealand pastures. *N.Z. J. Expt. Agric.* 6: 19-21.
- Wardle, D.A., Barker, G.M., Nicholson, K.S. and Addison, P.J., 1994. Cyclic oscillations between a summer-annual (C-4) and a winter-annual weed grass in Waikato dairy pastures. *Proc. 47th N.Z. Plant Protection Conf.*: this volume.