**SHORT TERM EFFECTS OF INTENSIVE GRAZING ON
LISTRONOTUS BONARIENSIS AND SOME OTHER EPIGEAL
INVERTEBRATES IN A DAIRY PASTURE**

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Beginning in late autumn, dairy cattle are typically stocked at high densities of 250-500 cows (1750-3500 stock units)/ha/day on a limited area of the farm in order to conserve and accumulate feed on the remainder of the farm for late winter-spring when calving and milking commence. Pasture is not so rigidly rationed to milking herds, which are rotated around pastures at stocking rates of 50-80 cows (350-560 SU)/ha/day. There is limited information available on the impact of high winter stocking rates on the invertebrate fauna of dairy pasture.

Green (1920) reported that when hay was fed to dairy cattle on grass grub (*Costelytra zealandica* (White)) infested pasture, many grubs were crushed by stock treading. East and Pottinger (1975), East (1979), and van Toor *et al.* (1989) quantified the effect of this widely used winter grazing practice, showing increased grass grub mortalities ranging from 0 to 40% at sheep and cattle stocking rates of 1125-2800 SU days/ha. High mortalities only resulted from intensive stocking at high grass grub population densities, at a time when a large proportion of grubs were near the soil surface and their feeding activity resulted in loose, easily compactible upper soil layers (East and Pottinger 1975). Pottinger *et al.* (1985) and R.N. Wrenn (unpubl.) have shown that high stocking rates of dairy cattle during the winter feed rationing period effected 75-90% mortality in lucerne flea (*Sminthurus viridis* L.), while the stocking rates commonly used for milking herds do not prevent population increases. By contrast, high stocking rates with dairy cattle have been demonstrated to have no effect on overwintering black beetle (*Heteronychus arator* (F.)) (R.N. Watson and R.N. Wrenn, unpubl.). With sheep grazing, Ferguson *et al.* (1989) showed that stocking rates of 1500 SU days/ha can effect in excess of 90% mortality in slugs (*Deroceras reticulatum* (Müller)).

In the present study we sought to quantify the direct physical effects of treading and herbage removal, by highly stocked dairy cattle, on an overwintering population of Argentine stem weevil (*Listronotus bonariensis* (Kuschel)). The impacts on other elements of the epigeal fauna were also recorded.

At Ruakura Agricultural Research Centre, 34 non-milking dairy heifers were given 24 hour access to 0.06 ha strips of pasture behind a temporary electric fence; this stocking rate equates to 567 heifers (2800 SU)/ha/day. The pasture was comprised predominately of white clover (*Trifolium repens* L.), red clover (*T. pratense* L.), annual poa (*Poa annua* L.) and perennial ryegrass (*Lolium perenne* L.). The ryegrass occurred as widely spaced plants. Prior to the first grazing on 7 July 1980 a visual estimate was made of the ground cover comprised by ryegrass in fifty randomly placed 930 cm² quadrats. Invertebrate populations were estimated by soil sampling each of five pasture strips immediately prior to commencement of grazing and at completion of the 24 h. grazing period. On each occasion the sampling comprised 120 soil cores, 75 mm dia., taken randomly and 120 cores centred over ryegrass plants.

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TABLE 1: Population estimates (No./m²) for epigeal invertebrates in a Waikato pasture before and after intensive grazing by dairy cattle, with sampling at random or over ryegrass plants.

	Sampling	Before Grazing	After Grazing	Difference	t-value ¹
Coleoptera Curculionidae					
<i>Listronotus bonariensis</i> (Kuschel)	random	23.4	21.6	1.8	1.36 ns
	ryegrass	121.6	126.4	4.8	0.25 ns
Coleoptera Carabidae					
<i>Haplaner</i> sp.	random	10.8	9.0	- 1.8	1.20 ns
	ryegrass	70.4	92.2	21.8	3.60 *
<i>Rhytisternus miser</i> Chaudior	random	1.6	0.0	- 1.6	1.02 ns
	ryegrass	9.0	9.3	0.3	0.30 ns
<i>Clivina rugithorax</i> Putzeys	random	0.0	1.8	1.8	1.52 ns
	ryegrass	5.4	3.6	-1.8	1.15 ns
Coleoptera Staphylinidae					
<i>Xantholinus</i> sp.	random	5.4	3.2	-2.2	1.49 ns
	ryegrass	28.8	30.0	1.2	0.31 ns
<i>Atheta</i> spp.	random	50.4	30.6	-19.8	4.82 **
	ryegrass	110.4	114.2	3.8	0.53 ns
Coleoptera Pselaphidae					
<i>Pselaphophus atriventris</i> (Westwood)	random	3.6	5.4	1.8	1.06 ns
	ryegrass	54.0	39.6	-14.4	3.77 *
Coleoptera Coccinellidae					
<i>Rhizobius ventralis</i> (Erichson)	random	0.0	3.6	3.6	1.44 ns
	ryegrass	5.4	43.4	38.0	6.93 ***
Hymenoptera Formicidae					
<i>Chelaner antarcticus</i> (White)	random	10.8	9.0	-1.8	1.09 ns
	ryegrass	371.0	282.2	-88.8	1.29 ns
Chilopoda Henicopidae					
<i>Lamyctes emarginatus</i> (Newport)	random	0.0	0.0	0.0	-
	ryegrass	14.4	14.4	0.0	-
Mollusca Agriolimacidae					
<i>Deroceras reticulatum</i> (Müller)	random	1.2	0.0	-1.2	1.35 ns
	ryegrass	26.2	18.0	-8.2	3.63 *

¹ ns = Differences not significant

*, **, *** = Differences significant at P< 0.05, P< 0.01 and P< 0.001 respectively

The presence or absence of ryegrass plants was noted for each core. On return to the laboratory, the cores were held at 4°C for 3 days before the invertebrates were extracted and enumerated by the wet sieving and flotation method of Barker and Addison (1989).

Ryegrass comprised 20.3% of the ground cover as estimated from visual assessment of the randomly placed quadrats, while 18.9% of randomly taken soil cores contained

ryegrass plants. Comparison of population estimates for the random samples and those taken over ryegrass plants indicated that the invertebrates investigated were highly aggregated under ryegrass (Table 1).

The grazing treatments had no apparent direct effects on populations of *L. bonariensis*, the carabids *Rhytisternus miser* Chaudior, *Clivina rugithorax* Putzeys, the staphylinid *Xantholinus* sp., the formicid *Chelaner antarcticus* (White), or on the hemicipid *Lamyctes emarginatus* (Newport) (Table 1). In the case of the carabid *Haplaner* sp. associated with ryegrass plants there was a significant increase in the abundance of insects after grazing, indicating increased aggregation and/or better survivorship in the ryegrass crowns. The abundance of the *Atheta* species complex of small staphylinids in the random samples was reduced 39% by grazing. The pselaphid *Pselaphophus atriventris* (Westwood) and the agriolimacid *Deroceras reticulatum* were highly aggregated in ryegrass plants before grazing and their abundance in the ryegrass was reduced 27 and 31% respectively by grazing (Table 1). Sampling prior to grazing indicated a small resident population of the coccinellid *Rhizobius ventralis* (Erichson), with the insects apparently associated with ryegrass plants. This species occurred in higher abundance after grazing, again predominately in association with the ryegrass. This suggested significant immigration into the pastures during the grazing period.

These results suggest that intensive stock of dairy pastures during the winter has modest direct effects on the abundance of the epigeal meso- and macro-fauna. In this study the soil was moist and the pasture became extensively pugged during the 24 hour grazing period. The soft, somewhat fluid nature of the soil substrate may have afforded the fauna some protection from treading. Further studies are needed to assess the longer term impact of such grazing treatments.

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