

# Use of an electric blanket for winter field collection of Argentine stem weevil, *Listronotus bonariensis* (Kuschel) (Coleoptera: Curculionidae)

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## ABSTRACT

Maintenance of large populations of the parasitoid *Microctonus hyperodae* Loan demanded high numbers of its host the Argentine stem weevil *Listronotus bonariensis* (Kuschel). To fulfil this requirement under winter conditions a very effective technique using an electric blanket was devised to collect up to 450 weevils day<sup>-1</sup> irrespective of weather conditions.

Under warmer spring conditions fewer weevils were trapped and there were indications that the method may have biased catches towards weevils that had been opportunistically parasitised by the *Sitona discoideus* Gyllenhal parasitoid, *Microctonus aethiopoidea* Loan. Possible reasons for these results are discussed, as is the potential of the method as a surveying tool.

## INTRODUCTION

Argentine stem weevil, *Listronotus bonariensis* (Kuschel), is well known as a major pest of New Zealand pasture (e.g. Pottinger 1961a) and cereal crops (e.g. Blair & Morrison 1949). Research over the last 35 years has indicated that insecticides are of limited value in off-setting damage (e.g. Pottinger *et al.* 1984). Consequently the emphasis of research into the pest's management has been towards the development of plant resistance; particularly that conferred by *Acremonium lolii* Latch, Christensen and Samuels (e.g. Pottinger *et al.* 1985). Recently, study into the potential of biological control has commenced, using the parasitoid *Microctonus hyperodae* Loan (Goldson *et al.* 1990a). An obvious requirement of such an approach is an adequate supply of field-collected weevils for both quarantine procedures and eventually, mass-rearing prior to release.

Substantial populations of *L. bonariensis* are difficult to extract when *in situ* in turf under day-light conditions (e.g. Barker & Addison 1989). As a consequence, the usual method of collecting large populations has been to sweep-net them off ryegrass pasture after dusk. Goldson (1979) has reported that thousands of weevils  $\text{h}^{-1}$  could be collected by dragging a net from a vehicle travelling at ca  $15 \text{ km h}^{-1}$  when air temperatures were  $>14^\circ\text{C}$  and wind speeds  $<25 \text{ km h}^{-1}$ . Under cooler conditions he reported that dew and the concomitant arrival of slugs confounded these efforts. In essence therefore, in dry areas under summer conditions, adequate numbers of *L. bonariensis* may be collected. Conversely however, under winter conditions many if not all areas of New Zealand are either too cool and/or humid for *L. bonariensis* to be collected in useful numbers by sweeping.

The ongoing winter demand for weevil populations during quarantine made it imperative to develop a rapid and relatively cheap method of collecting ca 2000 *L. bonariensis* a week. This contribution describes how such a demand was fulfilled.

## MATERIALS AND METHODS

Earlier observations had indicated that under winter conditions, *L. bonariensis* tended to gather beneath tarpaulins spread out on ryegrass pasture on sunny days. The deduction was that insolation was necessary to raise the microclimate temperature sufficiently to induce the movement of the weevils. Such conditions were found to be rare on winter days and yields of weevils were generally low. In an attempt to remedy this, a 140W, 240v  $1.45 \text{ m} \times 1.33 \text{ m}$  double electric blanket was positioned on the top of a  $2.5 \text{ m} \times 2.5 \text{ m}$  tarpaulin placed in a 2-year old cv. Manawa (*Lolium multiflorum*  $\times$  *perenne*) paddock. This system was refined further by insulating the electric blanket with a layer of Sisalation<sup>R</sup> aluminium foil and another  $2.5 \text{ m} \times 2.5 \text{ m}$  tarpaulin. The whole arrangement was pegged down and left for ca 2-3 h after which the lower tarpaulin was peeled back and weevils collected either manually or with a Dust Buster<sup>R</sup> vacuum cleaner. Later the assembly was mounted on a plywood backing so that it could be readily moved as a unit from site to site within the paddock. Throughout the experiment the blanket was set on 'high' with electricity provided by a 240v 1kW generator. When positioned near buildings, mains electricity was used in conjunction with an isolating transformer.

Samples of *L. bonariensis* obtained from both the electric blanket and by sweep-netting were periodically monitored by dissection for apparently opportunist parasitism by the *Sitona discoideus* Gyllenhal parasitoid, *Microctonus aethiopoulos* Loan. This had been recently observed by D. N. Gassen & M. R. McNeill (unpublished data).

## RESULTS AND DISCUSSION

### Applicability of the technique:

The technique was found to be completely adequate for maintaining the requisite number of *L. bonariensis* demanded by quarantine procedures. Between 27 June and 20 August 1990 twenty collections of weevils were made with a mean 'catch' of  $153 \pm 34$  per 'blanket' or  $79 \pm 18 \text{ m}^{-2}$ . Given the required heating time of 2-3 h, it was theoretically possible to collect ca 450 weevils per 8 hour day. Additionally it was quite feasible to use more than 1 electric blanket thus providing multiples of this catch. Neither time of day nor prevailing weather affected each catch. Conditions ranged from cold southerlies with rain and frosts to occasionally warm north-westerly winds. Similarly pasture condition was apparently unimportant as catches were made equally from heavily frosted ( $-6^\circ\text{C}$ ), wet or dry pasture.

### Efficiency of weevil recovery:

Absolute ground densities of the weevil population were not assessed during the development of this technique. However, Gassen (unpublished data) found July-August (1988 and 1989) ground densities in nearby low endophyte perennial ryegrass to be of the order of ca  $100\text{-}150 \text{ m}^{-2}$ ; this would indicate that the electric blanket technique probably gave a recovery rate of ca 63% of the ground population. Irrespective of the technique's precise rate of recovery, it may be possible by calibration or repeated trapping in one place, to use the method as a quantitative sampling tool. Further work is required

to evaluate this possibility, particularly with reference to any confounding effects that may arise from varying pasture heights, plant composition and edaphic conditions.

### Variation in weevil response:

Catches of *L. bonariensis* declined abruptly between late August and mid October (Table 1). This apparently was attributable to a change in the weevil's behaviour rather than a sudden decline in the ground population. Pottinger (1961b) and Gassen (unpublished data) have shown that winter-spring populations of *L. bonariensis* are stable or in a state of gradual decline; they found no abrupt discontinuity as in Table 1.

**Table 1:** Mean number of weevils  $m^{-2}$  collected under winter and spring conditions showing the significant decline in catch numbers with the advent of warmer spring conditions.

| Collection dates | Mean No. recovered $m^{-2}$ | 95% confidence limits | No. of sampling occasions |
|------------------|-----------------------------|-----------------------|---------------------------|
| 26/6/90-20/8/90  | 79                          | 18                    | 20                        |
| 16/10/90-7/11/90 | 9                           | 8                     | 12                        |

The reasons for this apparent change in behaviour are not known. However, it may be that during the winter months feeding was opportunistic as suitable occasions were rare. With the advent of warmer spring conditions the population could feed more often and thereby be more continually satiated; thus the imperative to feed in peculiar conditions, such as beneath an electric blanket, was reduced. From a practical point of view this reduction in catch efficiency was not important as by this time weather conditions permitted the resumption of nocturnal sweep-netting.

Unexpectedly high levels of parasitism by *M. aethiopoidea* were briefly found in those weevils trapped using the electric blanket. On 4 July, 5 July and 26 July 1990 these levels were 22% (N = 277), 28% (N = 208) and 33% (N = 49) respectively although by 7 August 1990 they had dropped to 2% (N = 47). Thereafter, until 7 November 1990, parasitism remained at about this level. This pattern is contrary to what has been found in *S. discoideus* populations where *M. aethiopoidea* infection showed a definite peak in October resulting from the onset of attack by large populations of recently-emerged overwintered wasps (Goldson *et al.* 1990b). In contrast to these electric blanket results, peak parasitism in weevils obtained by sweeping in the same vicinity was much lower, never > 14% and usually < 2%. These data therefore indicate that the electric blanket may have selectively attracted parasitised weevils. While this deduction requires further investigation, it may be speculated that parasitoid infection increased the metabolic demand of the weevils and thereby induced them to feed more intensively and therefore opportunistically. In his review Slansky (1986) has noted this to be a frequent response to parasitism, although more commonly elicited by gregarious species. In this case however it may be argued that *L. bonariensis* is a poorly adapted host of *M. aethiopoidea*, a parasitoid of the larger *S. discoideus*, and as such considerable additional metabolic demand was imparted. This view is somewhat supported by the highly variable size of *M. aethiopoidea* adults from *L. bonariensis* compared to those from *S. discoideus* (McNeill unpublished data). An alternative explanation may be the adaptive advantage conferred to the parasitoid by inducing its host to move further up plant stems thus reducing the possibility of hyperparasitism. Such a phenomenon has been observed in the lepidopteran *Euphydryas phaeton* Drury when parasitised by *Apanteles euphydryidis* Muesebeck (Stamp 1981).

There also seemed to be a thermophilic response by the weevils as they were found to orientate themselves along the heating wires. Since it may be supposed that the strips of concentrated heat caused by the wires would have led to additional agitation, this alignment is difficult to explain.

### The technique as a survey tool:

Irrespective of possible biases, a useful application for this technique could be as a survey tool for measuring the rate of spread of *M. hyperodae* (Hymenoptera: Braconidae),

should permission be given for its release. The method is obviously quicker than taking soil cores back to the laboratory and extracting weevils manually. It also presents far fewer logistical problems than sweeping for weevils at night which demands the right conditions.

The technique may also provide a quick method for assessing the presence of *L. bonariensis* in ecological surveys; trials in ryegrass pasture revealed that few if any other species were recovered using the method.

### CONCLUSIONS

The technique employing an electric blanket was a satisfactory method of collecting large numbers of *L. bonariensis* during cool winter conditions. Efficiency of collection appeared to diminish with the advent of spring conditions; however this was of no practical importance.

Indications were that while the technique may bias catches towards parasitised weevils it could be a useful survey tool.

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