Effect of oral ivermectin application to pony's on the dung colonising insect fauna of a semi-natural pastureland

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1. Introduction

Large herbivores are increasingly used for the management of vegetation in nature conservation areas in The Netherlands. This creates opportunities for dung insect fauna and wildlife that feeds on these invertebrates. However, the routine application of toxic anthelmintics such as ivermectin to herbivores in conservation areas potentially affects dung fauna populations, thus hampering the realisation of nature protection goals. The negative impact of ivermectin and other macrocyclic lactones used in animal husbandry on dung fauna are well documented in the scientific literature. However, it is largely unknown to what extent these effects do also occur in conservation areas. Moreover, past research on the ecological effects of anthelmintics like ivermectin has tended to focus mostly on the insect fauna in cattle dung and less on the possible negative effects in dung of other large herbivores used for conservation purposes such as sheep and particularly horses.

We conducted a combined field and laboratory experiment in order to investigate the effects of ivermectin treatment of pony's on the dung colonising insect fauna in The Netherlands. A second goal of the study was to test a method to evaluate the effects of parasiticides on dung insects in the field.

2. Methods & Materials

The field experiment was conducted in a semi-natural grassland situated in a connective corridor of the Dutch Ecological Main Structure (EHS). The pasture is managed in a non-intensive, organic way and grazed all year round by a small herd of Dartmoor pony's. The experiment was set up according to a Before-After-Control-Impact (BACI) design and partly based on an existing method [1]. In the spring of 2010 the pony's were divided into two groups of five individuals each. The pony's were monitored for 6 consecutive days. Each afternoon the pony's were brought to a new part of the pasture where no pony's had grazed for several months. The following morning 4 dung fresh pats (<24h old) were collected from each group. In one group, after 3 days all pony's were treated with an oral dose of ivermectin paste at a nominal rate of 0.2 mg/kg body weight. The other group remained untreated.

The collected dung pats were placed on flat plastic dishes with a 1 cm layer of moisturised sand. The dishes with the dung were in turn placed on the grass of a nearby pasture according to a randomised block design and covered by cages with netting to prevent trampling and disturbance by birds. The plates were left 5 days in the field in order to let insects colonise the dung and then transported to the laboratory. In the lab each plate with a dung pat was put in a small cage consisting of two vertically opposite funnels connected by mosquito meshing. Under the lower funnel a glass jar filled with conservation solution caught any crawling insects coming out of the dung. Flying insect were captured in the funnel on top that acted as an emergence trap. The cages were held in a climate room at 20 °C and 78% relative air humidity. Insects were collected after 1, 2 and 4 weeks and after 2 and 3 months. Individuals were identified to the family level and counted. Here we only report the results for the flying insects, mostly flies (Diptera).

Results were statistically analysed using an ANOVA for BACI design [2] and using the block design. The first 3 days of the field experiment were labelled as Period 1 (*before* treatment). The second 3 days, during which the treatment group had been treated (*impact* group) and the other group remained untreated (*control* group), constituted Period 2 (*after*). A statistically significant interaction between the factors Period and Treatment Group in the ANOVA is then equal to a significant effect of the ivermectin treatment.

3. Results

More than 30,000 specimens were captured in the emergence traps of the laboratory cages and collected (dung) flies belonged to 12 families, Sphaeroceridae being the most abundant followed by Psychodidae and Sciaridae. The ivermectin treatment significantly affected the numbers of flies of three families (Figure 1 shows two examples): Sphaeroceridae (lesser dung flies), Muscidae (house flies or stable flies) and Stratiomyiidae (soldier flies). Abundant groups that were not significantly affected included the Psychodidae, Sciaridae, Chironomidae and Cecidomyiidae. Numbers of individuals of other fly families were too low or too erratic to analyse properly (Empididae, Ceratopoginidae, Sepsidae, Anthomyiidae and Limoniidae).

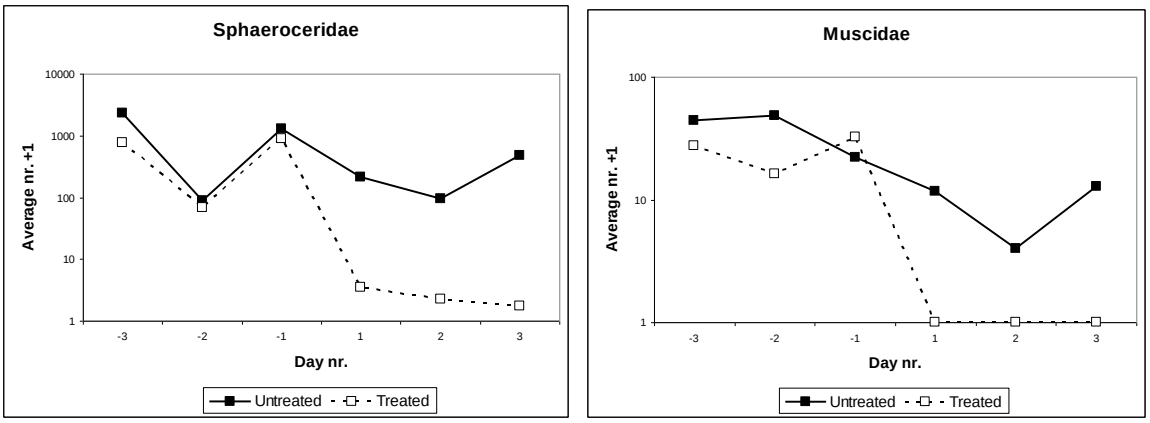

Figure 1:Emergence of adult dung flies representing two fly families, 3 days before and 3 days after treatment of Dartmoor pony's with the parasiticide ivermectin. The numbers represent the average total number (+1) emerged from four pony dung pats over an emergence period of 3 months.

4. Discussion & Conclusions

- The study demonstrated that oral ivermectin treatments of pony' s at the recommended medical dose have a negative effect on the emergence of some of the most important families of flies that colonise the dung of these animals.
- Although the study was limited - e.g., we did not investigate the duration of the ivermectin effects - the experimental design was found to be effective enough to detect ivermectin effects on the most abundant populations of flies in pony dung.
- Further taxonomic identification should reveal which species within the affected families were most sensitive.
- Although dung beetles are abundant in the study area, very few of them emerged from the pony dung incubated in the laboratory. The exact cause for this remains to be investigated, but it was observed that even in the field some dung pats were colonised by beetles and others not.
- In general, the study design is suitable to evaluate the effects of parasiticides on dung insects under field conditions such as in testing for higher-tier risk assessment. Its use for dung beetles should be improved.

5. References

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