

Final Project Report to NYS IPM Program, Agricultural IPM 2006-2007

Title: Identification of the Dung Beetle Complex Associated with New York Pastured Cattle

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Type of Grant: Research and Development – New

Project Locations: Tioga and Tompkins Counties

Abstract: Dung beetles play an extremely valuable role in the ecology of pasture-based cattle systems including suppression of pests and nutrient recycling. We surveyed NY dairy cattle pasture systems to determine the relative number and species diversity of dung beetles that serve as predators or competitors of face and horn flies. Four beetle genera have been identified to date, with not all of the samples fully processed. *Aphodius* species were most commonly collected with *Sphaeridium* next and *Onthophagus taurus* the least commonly collected.

Background and Justification

Dairy and beef cattle are important agricultural commodities in the Northeast with revenues from cattle sales totaling \$4.4 billion (USDA 1997). Additionally, sales of dairy and beef commodity products in the eastern US total \$15.4 billion. In the Northeast there are over 8.5 million acres of land dedicated to pasture-based animal systems making the system one of the leading land uses in the region, <http://www.umaine.edu/grazingguide>. Respondents to the Harrington et al. (1998) survey indicated that 80% of NY dairy heifers have access to pasture. Intensive grazing practitioners and organic dairy groups have expressed considerable interest in pasture fly pest IPM techniques.

The face fly and the horn fly, are the primary pests of pastured cattle in the US (Cervenka and Moon 1991). Total annual losses attributed to face fly are estimated to be \$150 million (Anonymous 1975). The damage inflicted by this pest results from its annoying eye feeding habits as well as the transmission of the causative agent of pink eye, *Moraxella bovis*. In NY face fly numbers commonly exceed several hundred flies per face. The horn fly is considered the most important pest of pastured cattle in the US (Drummond et al. 1988) and causes estimated losses of over \$730 million per year. Horn flies are blood feeders whose pernicious habits cause cattle annoyance, alteration of grazing habits, and decrease both milk production and weight gains (Byford et al. 1992). Fifty-two percent of respondents to a 1997 survey of NY dairy farmers selected flies on pastured cattle as being the most difficult pest to control and 56% indicated pasture flies were the most likely to cause economic loss (Harrington et al. 1998).

Current IPM efforts for pastured cattle include monitoring animals for populations of harmful fly pests, and preemptive use of cultural and chemical controls. Cultural practices, such as harrowing pastures to break up manure pats and disrupt the life cycle of developing fly larvae, are advocated, although practical implementation of this tactic is difficult. Additionally, producers fear decreased grazing utilization associated with pasture fouling as animals are unwilling to feed on grass growing through a dung pat smear. Insecticides registered for use on face and horn flies include feed-throughs, animal pour-ons, self-application devices and insecticide impregnated ear tags. While each of these techniques is individually helpful for a given species, their effectiveness as a single-tactic fly management strategy is greatly limited. To date, trapping methods have had very limited success with face and horn flies. Augmentative biological control of pasture pests is in its infancy. There are no arthropods currently produced at commercial insectaries that are appropriate for release into

the pasture-based system. Clearly, a better understanding of endemic natural enemies would provide a most valuable contribution to improving management of the fly pests affecting animals on pasture.

Both the face fly and horn fly require undisturbed cattle dung to complete their larval development. In fact, each species will only lay eggs in newly deposited dung, making dung beetle activity a direct threat to not only localized immature fly development, but pasture-wide fly populations, as opposed to house fly and stable fly which can develop in a wide range of organic matter (Ode and Matthyse 1967). Dung beetles are considered not only a competitor for face fly and horn fly developmental sites, but also an important nutrient recycler and helpful in watershed protection. A previous survey of the dung-associated arthropod complex conducted nearly 30 years ago near Ithaca, NY (Valiela 1969) provides a baseline to initiate this survey, however, confirmation of current coleopteran composition is necessary, as species diversity may have changed. In fact, several specimens of *Onthophagus taurus* were collected by Rutz during 2003. This species was not reported by Valiela (1969), but was the predominant species in NC in 2002-03 (D. Watson, per. comm.).

As the FQPA fosters a re-examination of pesticides, animal agriculture, which has already lost many pesticides, will likely lose most of their currently remaining non-pyrethroid products over the next few years. The additional loss of topical insecticides will serve to force farmers to use fly-active endectocides (Ivomec, etc.), feed-throughs and systemic insecticides as a fly management tool. These feed-through types of insecticides have been shown to have extremely adverse effects on the dung-inhabiting arthropod community, including a 4-fold increase in dung pat degradation time (340 vs. 80 days). (Floate 1998). As a result, a farmer behavioral shift to these materials could have highly detrimental impacts, possibly resulting in new pasture quality issues including impacts on waste management efficiency and effects on water quality. Furthermore, with the advent of Bt-corn it is highly likely that Bt-toxin will not be broken down by cattle digestion and the presence of the toxin in the feces may also have a significant impact on dung beetles. These impacts may potentially be greater than those observed with the avermectins.

This project is designed to develop a reliable, effective, non-pesticidal, alternative pasture fly management technology for farmers through the identification of the dung beetle complex. A solid understanding of the presence, diversity and importance of endemic arthropod biological control agent populations will provide extremely valuable information for sustainable long-term management of these important pasture fly pests. The information generated from this study will also be immediately incorporated into our emerging pasture-based fly IPM extension program.

OBJECTIVES

1. *Identify endemic cattle dung-associated beetles that serve as predators or competitors of pastured cattle fly pests in NY.*

Procedure

To determine beetle species composition and seasonality 2 sampling methods were used: (1) baited pitfall traps were used to collect adult dung beetles that are searching for cattle dung using the method developed by Bertone and Watson (unpub. data). Ten traps were baited weekly from 17 May 2006 through 30 August 2006 at 2 sites in central NY. Collections were made following a 24 hr exposure; and (2) manure cores (15 cm diameter) were taken weekly from the edge of 10 dung pats at each location. Dung pats were selected for sampling based on the presence of dung beetle colonization (holes in the surface of the pat). These samples were then returned to the lab and the beetles extracted into ethanol and identified.

Results

Given such large numbers of samples collected, not all of the beetles have been enumerated and identified at the time of this report. Cornell's beetle expert, Rick Hoebeke, who is helping us with our beetle identification, has been extremely busy and still has a number of specimens to identify for us. All of the manure core samples from both farms have been enumerated and identified to the genus level. The pitfall trap collections have not yet been processed.

From 160 manure core samples taken from each farm, there were 11,298 beetles collected with

6710 coming from one farm and 4588 beetles from the other. Of these, there were 3 different genera identified with a pool of unknowns that possibly contain more (Table 1). *Aphodius* species were most commonly collected with *Sphaeridium* next and *Onthophagus taurus* the least commonly collected. Unfortunately, without any data from the baited pitfall traps, the collection methods can not be compared and an accurate and complete report can not be written at this time.

Table 1. Sum of beetle numbers separated by genus and by farm.

	Farm A	Farm B	Totals
<i>Aphodius spp.</i>	1316	1358	135
<i>Sphaeridium spp.</i>	486	438	438
<i>Onthophagus taurus</i>	23	17	17
Unknowns	4885	2775	2775
Totals	6710	4588	11298

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Acknowledgements: The authors wish to thank cooperating farmers Kevin Engelbert and Matthew Mix and Cornell Veterinary Entomology assistance provided by Colleen Strong, and summer assistants Joy Tomlinson, Meaghan Pimsler, Kay Russo, and Sarah Seehaver.

Funded by a grant from the New York State Integrated Pest Management Program