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Evaluation of a commercial vacuum fly trap for controlling flies on organic dairy farms

M. J. Kienitz,* B. J. Heins,*[1] and R. D. Moon†
*Department of Animal Science, and
†Department of Entomology, University of Minnesota, St. Paul 55108

ABSTRACT

The objective of this study was to evaluate the efficacy of a commercial vacuum fly trap (CowVac, Spalding Laboratories, Reno, NV) in on-farm organic dairy production systems to control horn flies, stable flies, and face flies. As cows walk through the trap, flies are brushed off the face, flank, and back with hanging flaps and blown off the belly, udder, and legs from one side, and then vacuumed from the air into a chamber from vacuum inlets opposite the blower and above the cow. The study included 8 organic dairy farms during the summer of 2015 in Minnesota, and herds ranged from 30 to 350 cows in size. The farms were divided into pairs by location; during the first period of the summer (June to July), the trap was set up on 1 farm, whereas during the second period of the summer (August to September) the trap was sent to its paired farm. Farms were visited once per week to collect and count flies from the trap as well as count and record flies on cows. Bulk tank milk, fat, and protein production and somatic cell count were collected on farms during the entire study period. Data were analyzed using the GLM procedure of SAS (version 9.3, SAS Institute Inc., Cary, NC). Independent variables for analyses were the fixed effects of farm, trap presence, housing scenario, and summer period. Horn fly numbers on cows were lower by 44% on farm in the presence of a trap (11.4 vs. 20.5 flies/cow-side) compared with the absence of a trap. Stable fly (5.4 vs. 7.1 flies/leg) and face fly (1.0 vs. 1.0 flies/cow) numbers were similar on farm whether the trap was present or absent on farms, respectively. Milk production was similar for farms with the trap (15.5 kg/d) compared to without (15.3 kg/d) the trap. Bulk tank milk, milk components, and somatic cell count were statistically similar in the presence and absence of the trap, so potential benefits of the trap for those measures were not evident at low fly populations observed during the study. The presence of a trap on farm reduced horn fly population growth rates (−1.01 vs. 1.00 flies/d) compared with the absence of a trap. Cows on farms with no housing (100% pasture) tended to have reduced horn fly numbers (11.7 vs. 28.3 flies/cow-side) in the presence of a trap compared with the absence of a trap on farm. Cows on farms with housing had similar horn fly numbers (11.2 vs. 14.8 flies/cow-side) in the presence of a trap compared with the absence of a trap on farm. In summary, these results indicate the trap was effective in reducing horn fly numbers on cows and reduced horn fly growth rates during the pasture season in organic dairy production systems, but benefits in improved milk production were not evident likely because of relatively low fly populations.
Key words: organic dairy, CowVac, horn fly, stable fly

INTRODUCTION

The horn fly (*Haematobia irritans* L.) and the stable fly (*Stomoxys calcitrans* L.; Moon, 2002) are 2 biting and blood-feeding flies that attack organic grazing cattle in the upper Midwest. The horn fly develops exclusively in intact, fresh cattle manure in pastures and are pests of conventional and organically raised cattle. Unlike other kinds of flies that visit cattle for brief moments, adult horn flies reside on the host animals, making them especially vulnerable to control. Adequate horn fly control leads to increased milk production and calf growth (Jonsson and Mayer, 1999).

Stable flies are blood-feeding flies typically found on the legs of cattle, and were estimated to cause annual losses of $360 to $920 million to US dairy cattle between 2005 and 2009 (Taylor et al., 2012). Stable flies develop as maggots in a wide array of decomposing OM, including soiled animal bedding and soiled feed debris that accumulates wherever cattle are confined (Moon, 2002). Populations of stable flies build exponentially by continuous reproduction from spring to fall in northern temperate climates (Beresford and Sutcliffe, 2010; Taylor et al., 2012). Dairy farm surveys indicate that calf hutch bedding is a prominent source of stable

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[1]Corresponding author: hein0106@umn.edu

flies around dairies (Schmidtmann, 1988), and choice of bedding material can minimize stable fly production (Schmidtmann, 1991). Recently, feed debris and manure accumulated during winter feeding have been documented as favorable for development of stable flies, especially where debris piles remain intact into the following summer (Talley et al., 2009; Taylor and Berkebile, 2011).

The face fly (*Musca autumnalis* DeGeer) is a nonbiting fly that feeds on liquid secretions, typically around the eyes and muzzle of cattle. These flies cause irritation and they may be vectors for parasites and pathogens of the eye.

Observing that horn flies remained with the host, Bruce (1938) built a walk-through fly trap with 1-way fly-screen baffles on its otherwise translucent sides to remove and capture flies as the cattle passed through. That simple design is now known as the Bruce walk-through fly trap, and different versions (some using a passive trap and others with electric modification) have been studied for horn fly control in Missouri (Hall and Doisy, 1989), Florida (Tozer and Sutherst, 1996), North Carolina (Watson et al., 2002), and Ontario, Canada (Surgeoner et al., 1998). Those studies showed that walk-through traps can reduce horn fly burdens by 50 to 90%. Most recently, North Carolina State University replaced the side baffles with a system that included a blower and a vacuum (Denning et. al, 2014). Bruce traps and the newer vacuum traps are compatible with organic dairying and conventional dairy grazing, because a trap can be positioned at the entrance to or exit from a milking parlor, where cows come and go twice or 3 times per day.

Organic dairy farmers rely on botanical repellents and sticky tapes to alleviate fly problems, but success of these products is limited (Sorge et al., 2015). Because horn flies spread easily among adjacent pastures, efficacy for a whole herd is modeled as the difference between the rate at which traps can remove and kill flies on cattle and the rate at which they are produced naturally in pastures. Our hypothesis was that summer growth of horn fly populations from June to August would be lowest on commercial organic dairies where a commercial vacuum fly trap (CowVac, Spalding Laboratories, Reno, NV) was used and greatest where no trap was used. Therefore, the objective of our study was to determine removal rates of a commercial walk-through fly trap, measure natural fly reproduction rates in organic dairy pastures, and then evaluate herd-level control using the trap. Furthermore, an objective was to determine the effects of production (milk, fat, protein, SCC) on farms when the trap was present or absent.

MATERIALS AND METHODS

Experimental Design and Collection of Data

This study was conducted at the University of Minnesota West Central Research and Outreach Center organic dairy (Morris, MN) and 7 other organic dairy farms in Minnesota during the summer of 2015. The study period was from June 4 to September 30, 2015. All animal procedures involving animal care, management, and the client consent forms were approved by the University of Minnesota Institutional Animal Care and Use Committee (#1508–32966A).

The organic dairy farms included in our study spanned from southeast, to central, to northwestern Minnesota, and ranged in herd size from 30 to 350 cows. The West Central Research and Outreach Center organic dairy herd had 130 milking cows. All herds had cows that were of numerous breeds of cattle and consisted of pure Holstein, pure Jersey, and crossbreds of Holstein and Jersey and European dairy breeds. The 8 herds averaged in milk production from 7 to 23 kg/cow per day. Six herds milked cows in a milking parlor twice daily; however, 2 herds had a Lely Robotic Milking system (Lely, Maassluis, the Netherlands). For all herds and cows, at least 30% of their diet consisted of high-quality organic pasture during the grazing season, which is in accordance with USDA-NOP organic regulations (USDA-NOP, 2016).

Weather data were collected for 3 weather stations in Minnesota (Fosston, Morris, and Rochester) from Weather Underground (https://www.wunderground.com/). Mean temperature and total precipitation for the 3 weather stations for the months of the grazing season during 2015 were 17.8°C and 7.3 cm, 20.0°C, 32.0 cm, and 20.0°C, 32.2 cm for Fosston, Morris, and Rochester, respectively. The mean temperatures for the study were similar for the 30-yr average (1985–2015) of 18.7°C. Rainfall totals were similar to the 30-yr average in Morris, but 10 cm lower in Rochester and 25.3 for Fosston compared with the 30-yr average.

Four traps were acquired during the spring of 2015 from Spalding Laboratories (Reno, NV) for use in the experiment. The trap is a novel way to control pasture flies on dairy cows. It can be placed at the entry or exit of the milking parlor or barn. Figure 1 shows the trap positioned at the entrance to the milk parlor holding area in the cattle walkway at the University of Minnesota West Central Research and Outreach Center organic dairy. The trap has 1 vacuum and 1 blower opening, and the flies are brushed off the face, flank, and back with hanging flaps in the chute and blown off the belly, udder, and legs from one side into