Sticky Traps for Large Scale House Fly (Diptera: Muscidae) Trapping in New York Poultry Facilities[1]

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ABSTRACT Large sticky traps were evaluated under field conditions in two commercial high-rise, caged-layer poultry facilities in New York. To determine the longevity of trap efficacy in capturing house flies, *Musca domestica* L., we exposed varying lengths of adhesive coated ribbon to the flies, dust, and debris common in caged-layer poultry facilities. One side of each poultry facility received traps with 1.2 m of exposed adhesive, whereas traps with 2.4 m of exposed ribbon were placed on the opposite side. Significantly more house flies were captured using 2.4-m traps on 4 of the first 5 weeks when fly densities were highest. During all sampling weeks, traps exposed for 3- and 4-day intervals captured significantly more flies per day per meter of trap than the 7-day trap intervals. Furthermore, on 7 of the 10 weeks, 3-day trapping captured significantly more flies per meter per day than 4-day trapping, indicating a rapid deterioration in trap efficacy. Spot card data documented the reduction in fly densities at the bird level (upstairs) as the study progressed. The estimated number of house flies captured during this 10-wk study was greater than 9 million.

KEY WORDS *Musca domestica*, poultry, sticky traps, physical control

The house fly, *Musca domestica* L., is the primary pest in New York poultry facilities. The potential for fly outbreaks on farms combined with a highly mobile adult insect and the possibility of nuisance fly litigation intensify poultry producers' anxiety. Insecticide resistance (Scott et al. 2000) and loss of insecticides due to regulatory actions have reduced pesticide options available for fly control. Proven biological and cultural fly control options offer cost-effective alternatives to the use of insecticides (Legner 1975, Axtell & Rutz 1986, Meyer 1990). However, these methods often do not provide a reduction in adult house fly outbreaks that commonly occur 4–8 wk following repopulation or in fresh manure following a mid-year cleanout. An effective trapping device may allow for the capture of migrating flies before these flies leave the buildings.

Light-trapping of flies has been examined by several researchers (Tarry 1968, Skovmand & Mouvier 1986, Rutz et al. 1988, Pickens et al. 1994). However, little research has been conducted with alternative trapping devices in poultry facili-

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ties. Pickens et al. (1994) reported that light traps placed in darkened poultry manure pits captured 1% of the fly population per day and required cleaning every 30 days. Baited traps and pyramidal traps have been shown to capture large numbers of house flies on dairy farms (Pickens & Miller 1987).

A new sticky trap, the Spider Web™ (Atlantic Paste & Glue Co., Inc, Brooklyn, New York), captures large numbers of house flies when fly densities are high. However, like other sticky devices, effectiveness can be reduced under dusty conditions that are commonly found in poultry facilities. To determine the longevity of trap efficacy, we evaluated the Spider Web™ in two commercial high-rise, caged-layer poultry facilities in New York.

Materials and Methods

This study was conducted in two commercial, conventionally ventilated, high-rise, caged-layer poultry facilities located in Sullivan County, New York. Adult house fly densities were monitored using two sets of 10 spot cards (76 × 127 mm white file cards) that were positioned equidistant on each side of the facility on the bird level, 1.7 m above the floor (Axtell 1970). Each Friday, two cards were placed at each location. On the following Monday, one of the two cards was removed and a fresh card placed. This provided fly density data for the 3-, 4-, and 7-day time periods.

The Spider Web™ trap is a spooled ribbon, 30 cm wide by 7.3 m long, that when pulled exposes increasing lengths of adhesive coated ribbon. The attractiveness of the adhesive is enhanced by the addition of several house fly attractants. Spider Web™ traps were positioned horizontally, between the fluorescent lamps, 8 to 15 cm below the ceiling above the birds in the walkway (Fig. 1). Label directions for these traps suggest that 6.1 m (20 ft) of trap be placed for every 56 m^2 (600 ft^2) of building. Each facility was divided lengthwise providing three aisles per side. The outer aisle on each side was not included in the trial because of dust accumulation caused by close proximity to ventilation baffles. On one side, 1.2 m of each trap was exposed, whereas 2.4 m of each trap was exposed on the opposite side of the facility (2 aisles each). Facility 1 held 30,000 birds and contained 12, 2.4-m traps and 12, 1.2-m traps (6 traps per aisle). Twenty-four 2.4-m traps and 24, 1.2-m traps were placed in facility 2, which contained 60,000 birds (12 traps per aisle). This arrangement resulted in one-half the linear distance (i.e., total area) of trap being present on the 1.2-m sides of the facility on a given day. However, because the 1.2-m traps were stretched twice each week, an equal amount of "unexposed" trap was presented each week.

All traps were changed weekly (new trap placed or an additional 1.2 or 2.4 m exposed). In addition, 1.2 m traps were refreshed (by pulling an additional 1.2 m of ribbon) following a 3-day exposure, providing an alternating 3- and 4-day exposure, equaling the single "fresh" 2.4 m exposure per week. Traps were initially placed on 2 July 1999 and the study concluded on 10 September 1999 (10 wk).

Following exposure, all traps were removed from poultry facilities and the numbers of house flies estimated. To determine the numbers of flies captured, each trap was unrolled and hung vertically such that both the top and bottom of the trap could be observed from the side. Trap exposures were measured to de-

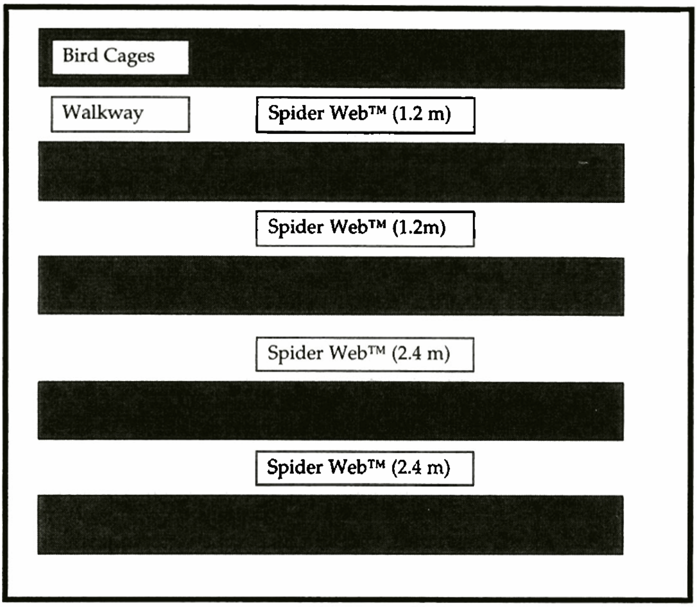

Fig. 1. Layout of poultry facility and positions of Spider Web™ trap placement.

termine the exact length presented at each time period. To estimate the numbers of flies on a trap, transparent acetates (7.6 × 28 cm) were positioned on opposite sides of the trap and flies observed through the acetate were counted. Acetates were positioned randomly on each trap with three and six areas counted on 1.2-m and 2.4-m traps, respectively. The numbers of flies per side of each trap were determined by multiplying the length of each trap (cm) by the average number of flies per cm per respective side.

To make comparisons as to the relative loss in effectiveness of the trap over time, we converted the trap catch data to a constant, based on the estimated number of flies captured per meter of trap per day. Analyses were conducted on the fly catch data to determine the impacts of linear distance exposed and to uncover a time-dependent reduction in effectiveness (accumulation of dust, feathers, etc.). To determine the impact of linear distance, the total numbers of flies captured on 3- and 4-day traps were summed and compared to the total fly catch on 7-day traps. This allowed for a comparison between an equal time exposure, with only 50% of the linear distance presented with the 3- and 4-day traps. A two-way analysis of variance was performed on these data with poultry facility and exposure length in the linear model (SAS 1996).

To determine the influence of time of exposure (duration) on trap efficiency, weekly fly catch data from the 3-, 4-, and 7-day traps were converted to a number of flies per meter of trap per day constant. Data were examined using a two-way analysis of variance with poultry facility and days of exposure in the linear model (SAS 1996). A Tukey's comparison was used to separate significant differences among treatment means. Spot card data from 7-day cards were log transformed and analyzed by week using a two-way analysis of variance with poultry facility and side of facility in the linear model (SAS 1996). Spot card data were reverse transformed, and the mean numbers of spots per card are presented. For each analysis presented, the lowest F-value that provided a significant difference over the 10-week study along with the associated degrees of freedom and *P*-value for that study week are provided in the text.

Results and Discussion

House fly populations in these poultry facilities were very high when traps were initially placed (Fig. 2). Insecticides were not applied to either facility and manure conditions were very favorable for house fly production throughout the study.

Significantly more flies were captured using 2.4-m traps on 4 of the first 5 weeks (Fig. 3) when fly densities were highest ($F = 5.86$, df = 139, $P < 0.0168$). During weeks 9 and 10, significantly more flies were captured on the 1.2-m traps ($F = 8.89$, df = 141, $P < 0.0034$). These study weeks also corresponded to weeks with lower fly catch rates and indicated that dust accumulation on traps may have reduced trap efficiency in as little as 7 days.

During all sampling weeks, both the 3- and 4-day traps captured significantly more flies per day than the 7-day traps ($F = 28.55$, df = 210, $P < 0.0001$) (Fig. 4). Furthermore, on 7 of the 10 weeks, 3-day traps captured significantly more flies per meter per day than 4-day traps, indicating a rapid deterioration in trap efficacy due to dust accumulation.

Although the trap was not as efficient after a few days, it was certainly not ineffective. The display of 2 or 3 m of trap has surface area advantages over shorter presentations, especially when fly populations are high. Placing and stretching traps was labor intensive. Although shorter traps captured significantly more flies per meter per day, the additional labor required to maximize catch rates would render frequent trap maintenance impractical. The incorporation of an automatic stretching device would provide poultry producers with a labor saving investment as well as improve trap effectiveness. However, following an initial 2- or 3-m exposure, the "refresh" or roll-up rate should be designed to offer a slow delivery. This would offer an excellent balance between trap effectiveness and economics.

The estimated total number of house flies captured on 3-day–exposed, 1.2-m traps was 2,167,046 flies, on 439 linear m of trap (equivalent to 60 traps). The estimated total number of house flies captured on 4-day–exposed, 1.2-m traps was 2,353,086 flies, on 439 linear m of trap (equivalent to 60 traps). The estimated total number of house flies captured on 7-day-exposed, 2.4-m. traps was 4,649,162 flies, on 878 linear m of trap (equivalent to 120 traps). The estimated total number of house flies captured during this 10 wk study was 9,169,294.

The use of electrocuting black light devices in poultry facilities was reported by Rutz et al. (1988) who noted that traps were more effective when placed in the manure pit. During an eight wk period when house fly densities were high, manure pit placed devices killed over 29,000 flies per device per week. When the electrocution device was combined with muscalure (Z-9-tricosene), a sex attractant, the efficacy of the device was increased up to 76%. Pickens et al. (1994) reported that a Hodge window trap fitted with a black light and placed in a

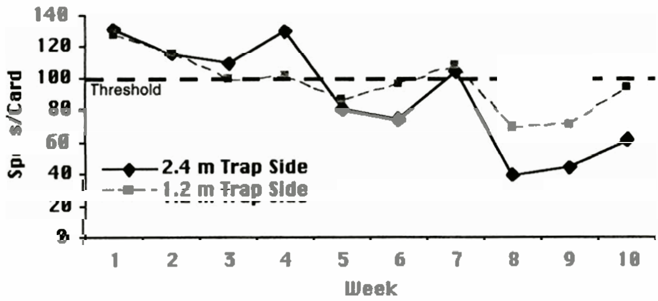

Fig. 2. Mean number of fly spots per card placed on opposite sides of two high-rise, caged-layer poultry facilities while Spider Web™ traps were present.

poultry manure pit captured 10,500 house flies per day, or 1% of the population. The Spider Web™ traps captured ca. 25,000 house flies per trap per week at the manufacture recommended rate (6.1 m of trap for every 56 m^2 area). These capture levels are comparable to those reported by Rutz et al. (1988) for electrocuting black light devices placed in manure pits; however, the Spider Web™ traps were positioned at the bird level.

Spot card data documented the reduction in fly densities at the bird level (upstairs) (Fig. 2). There were no significant differences between fly populations on either side of the facility. This is not surprising given the high mobility of adult house flies. As discussed earlier, trap catches also decreased as the study progressed, further demonstrating the effectiveness of the Spider Web™ in reducing fly populations (Figs. 2 and 3).

Cornell University Poultry Pest Management Recommendations suggest a treatment threshold of 100 spots per card (Kaufman et al. 2000). The numbers of spots per card in this study were above this threshold for the first 4 wks, and for 5 of the 10 wks of the study (Fig. 2). This suggests that house fly populations can be reduced; however, they cannot be satisfactorily managed using only trapping.

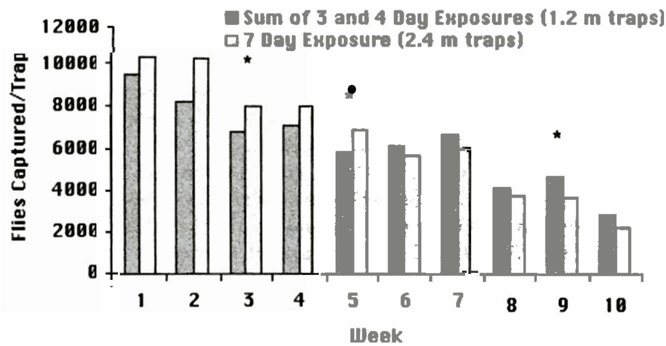

Fig. 3. Estimated number of house flies captured using the Spider Web™ in two high-rise, caged-layer poultry facilities in New York. (*Indicates significant differences between treatments, $\alpha = 0.05$)

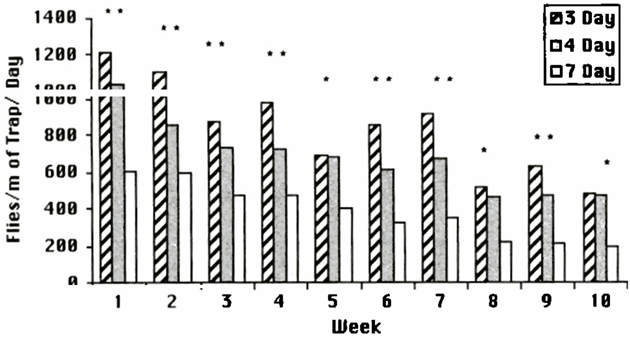

Fig. 4. Estimated number of house flies captured/meter of Spider Web™/day in two high-rise, caged-layer poultry facilities in New York. (**Indicates significant differences between all treatment means, *indicates significant differences between one treatment mean and remaining 2 treatment means, $\alpha = 0.05$)

Furthermore, use of the Spider Web™ would be most advantageous during house fly outbreaks when producers are most concerned about off-farm fly movement. The Spider Web™ provides an additional effective management tool to poultry producers facing severe fly outbreaks.

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