Yellowjacket Trapping Efficacy Trials, NYS IPM Program, 2014 - 2016

Project Leaders: Lynn Braband, Matt Frye, Joellen Lampman, Debra Marvin, Ryan Parker

Cooperators: Jim Engel (White Oak Nursery), Cornell Cooperative Extension of Albany Co., Westchester Co. Parks, Town of Cortlandt, Indian Ladder Farm, Noreen Leonard-Inglis, Doug and Joyce Cullum, Robert and Carol Giblin, Fran and Connie Frye, Kevin and Lisa Frye, Mike Goldstein (Woodstream Corporation), Cornell Statistical Consulting Unit

Abstract: Container traps baited with a food attractant are often promoted as a technique to reduce yellowjacket populations without the use of pesticides. There has been little or no work on whether the traps reduce the risk of being stung. Continuing on work initiated in 2006, we tested the premise that trapping around a periphery of a plot will reduce the number of yellowjackets in the center of the plot. The assumption was made that the fewer the yellowjackets, the less the risk of being stung. During 2015, we also tested if adding a surfactant to the bait increased captures. The results in 2014 through 2016 were more variable than the 2006 study. In seeking to better understand this, we collected weather and landscape data on all sites and years that we have been conducting the study. Analysis of this data set is continuing and will hopefully provide insights on the best use of container traps. Although not conclusive, we have evidence that adding a surfactant improved the ability of the traps to retain yellowjackets.

Background and Justification: Although generally beneficial as predators of other insects, wasps can pose significant health risks based on their ability to sting. Stinging insects, especially yellowjackets (*Vespula* and *Dolichovespula* spp.), are among the most frequent and persistent pest problems at schools, parks, and similar locations (Murray 2000, Braband 2014). Yellowjackets are also common hazards at late summer and early fall outdoor events.

One approach to reducing the risk of yellowjacket stings is the use of container traps baited with a food attractant (Figure 1). Traps are often promoted to the public as an effective technique that does not use pesticides. A common use is to set traps near or encircling the area that is to be protected. Large numbers of yellowjackets can be caught in such traps. However, entomologists and pest management professionals are frequently skeptical about the ability of trapping to actually reduce the risk of being stung. Additionally, trapping is labor intensive. Most research on container traps has focused on what are the best lures/baits (Wegner and Jordan 2005) or comparing trap types (Kovacs et al. 2005). There has been little or no work on whether the traps actually reduce the risk of stings. The New York State IPM Program has been testing experimentally

Figure 1. Yellowjacket trap

whether trap use decreases yellowjacket numbers. Work completed in 2006 (Braband 2007), funded by the Pest Management Foundation, provided evidence that when a yellowjacket food attractant (such as a concession stand) exists, use of the traps can reduce yellowjacket numbers at the attractant. However, our work also pointed toward a tendency for the traps to attract (and not merely to intercept) yellowjackets.

Objectives:

1. Test the premise that trapping around a periphery of a plot will reduce the number of yellowjackets in the center of the plot (the assumption was made that the fewer the yellowjackets, the less the risk of being stung).
2. Test if adding a surfactant to the bait increased captures (2015 only).

Procedures: We used paired plots where we trapped the periphery of one plot but not the second. Our study design consisted of two plots one hundred yards or more apart from each other in open fields. Each plot was a square 100 feet by 100 feet (Figure 2). Trapping stations were established at twenty-foot intervals around the perimeter of each plot. Each station consisted of a 10-foot length of 3/4-inch conduit pipe driven two feet into the ground. Yellowjacket container traps were attached to the top of these poles at six to eight feet off the ground. Each plot also had a triplet of trap stations in the center. This triplet represented or mimicked a "protected" site such as a concession stand. The traps used were Victor® Yellow Jacket Trap Model M365 (Figure 1). Because we were primarily interested in testing whether perimeter trapping reduced yellowjacket numbers in the center of a plot, we kept other factors (trap and lure type) constant.

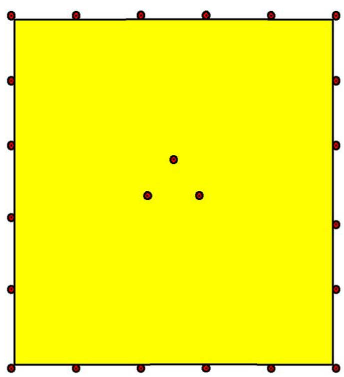

FIGURE 2. Location of trapping stations (red circles) on yellowjacket trapping efficacy plots.

During a two-week long testing trial, traps were maintained on all poles (periphery and center) on one plot but only on the center poles in the second plot. Perimeter traps were alternated from trial to trial. In other words, in the first trial, Plot A had traps on both the periphery and center while Plot B had traps only in the center. In the second trial, Plot A had traps only in the center while Plot B was trapped on both the periphery and center. In the third trial, the plots were switched again and so on for a total of four or five trials per year. Trapping started in August or September and ended in October. During 2014, we had 6 pairs of plots in New York, which were located in Geneva (2 pairs), Canandaigua (1 pair), Ithaca (1 pair), Albany (1 pair), and Katonah (1 pair). During 2015 and 2016, we had 4 pairs of plots, located in Geneva (2 pairs), Canandaigua (1 pair), and Bergen (1 pair). In 2016, a several-day break was included between trials for each pair of plots to reduce "carry over" effects.

Also during 2016, we gathered data on weather parameters and landscapes at all locations and years when the study has been conducted. Weather data was obtained from the nearest weather-recording station to each site. (A site is defined as the location of a pair of plots.) Weather parameters collected were temperature (daily average, minimum, maximum), humidity (daily average, high, low), wind speed (daily average, high, low), and daily rainfall. For each site, landscape analysis was done by circumscribing on GoogleEarth aerials ¾-mile radius circles centered midway between the plots. Habitat patches within each circle were classified by type (woodland, old field, annual crop, pasture, orchard, tract homes, etc.), and the percentage of the circle.

During 2015, a separate study was begun testing if adding a surfactant to traps increased the rate of yellowjacket capture. The status of this effort is included later in this report.

Results and Discussion: A more detailed analysis is pending, but the results were more variable than the previous study. The overall mean average capture was lower for center traps with peripheral trapping than for center traps without peripheral trapping all three years (6.5 to 8.3 in 2014; 7.8 to 13.0 in 2015; 4.2 to 5.4 in 2016). Student's T-test analysis did not show a statistically significant difference in the 2014 data (T score = -1.524, cumulative probability = 0.660, degrees of freedom = 69) and 2016 data (T score = 1.364, cumulative probability = 0.175, degrees of freedom = 50) but did for the 2015 data (T score = -2.628, cumulative probability = 0.0067, degrees of freedom = 30). Looking at individual plot pairs (Table 1), the mean captures were lower in center traps with peripheral trapping than in center traps without peripheral trapping in 4 of the 6 sites in 2014, 2 of 4 sites in 2015, and all sites in 2016.

Table 1. Overall mean yellowjacket captures for center traps

Site (Pair of Plots)	Center with Periphery Traps	Center without Periphery Traps
2014		
Geneva A	16.8	12.4
Geneva B	4.2	9.4
Canandaigua	3.5	5.0
Ithaca	4.4	4.5
Albany	6.1	7.8
Katonah	4.2	10.6
2015		
Geneva A	8.8	19.8
Geneva B	4.3	4.3
Canandaigua	4.1	4.7
Bergen	12.2	18.2
2016		
Geneva A	7.6	9.0
Geneva B	2.3	2.8
Canandaigua	1.7	2.3
Bergen	5.2	7.8

We are interacting with the Cornell Statistical Consulting Unit on the multi-level analysis of the influence of the weather and landscape parameters on yellowjacket captures. Analysis of this data set is continuing and will hopefully provide insights on the best use of container traps.

2015 STUDY OF IMPACT OF ADDING A SURFACTANT TO TRAPS

Background and Justification: In 2014, a replicated experiment at four locations in New York State was established to determine if perimeter trapping could reduce the incidence of yellowjackets and other stinging insects at the center of a square plot. During the experiment, it was noted that some yellowjackets would enter the trap (Victor Yellowjacket Traps Model # BM365), land on the surface of the liquid bait, then subsequently escape. Not only does this represent a problem for trap efficacy, but it can also lead to recruitment of additional yellowjackets by provisioning them with resources that benefit the colony (Overmyer & Jeanne, 1998), therefore exacerbating stinging insect problems.

Based on this observation, it was hypothesized that the addition of a surfactant to the bait would reduce the ability of yellowjackets to escape traps. Surfactants, or surface active agents, lower the surface tension between two liquids or between a solid and a liquid. As a result, insects that can normally float on the surface of a liquid will sink. Surfactants are common components of detergents, foaming agents and soaps, making them readily available. A small experiment conducted in 2014 demonstrated that the addition of two drops of fragrant shampoo (a surfactant) improve yellowjacket catch in liquid-baited traps.

Procedures: In 2015, a replicated experiment was undertaken to evaluate the role of surfactants in increasing yellowjacket trap efficacy. The experiment was conducted in both Westchester and Albany counties, and took place at a total of eight sites. This included three sites in Albany County (a residential site, an office location with abundant floral resources, and an apple orchard and farm store that contains a restaurant and cider processing center) and five sites in Westchester County (three residential and two public sites with an existing snack stand). Pairs of traps were installed at the top of an eight-foot piece of conduit (Figure 3), sunk two feet into the ground such that traps were approximately six feet above ground (Figure 4). A total of 19 paired traps were set up in early fall. All traps were baited with dilute fruit punch, and two drops of Dawn Dish Soap were added to the bait in "surfactant" treatment. This soap was selected because of its accessibility. Traps were checked weekly, yellowjackets were counted and bait/surfactant was replenished.

Figure 3: Side by side surfactant and control traps

Figure 4: Side by side surfactant and control traps on 8′ conduit

Results and discussion: Compared to 2014, in which yellowjacket populations were high across New York State, a paucity of insects were collected from Westchester in 2015. Combining trap catches from all five sites, a total of 20 yellowjackets were collected over a 10-week period from August to October, with no other stinging insects recorded. In comparison, a total of 1435 yellowjackets were collected from three sites in Albany County during a 7-week period from September to November. Collections also included ten paper wasps and three bald-faced hornets.

Trap catch totals for the entire season at each site are presented in Table 2. Raw data is included to highlight the variability in the number of yellowjackets caught, and the direction of the relationship between the surfactant and control trap catches.

Table 2. Yellowjacket trap catch data for the 2015 season by site.

Site*	# of Traps	Surfactant	Control	G-Test for Goodness of Fit**
A1	3	780	284	*G = 240.4; DF = 1; P < 0.001*
A2	1	52	74	G = 3.9; DF = 1; P = 0.049
A3	3	105	140	*G = 5.0; DF = 1; P = 0.025*
W1	2	0	0	N/A
W2	2	0	0	N/A
W3	2	3	1	G = 1.0; DF = 1; P = 0.306
W4	4	5	11	G = 2.306; DF = 1; P = 0.129
W5	2	0	0	N/A

*Sites labeled A are from Albany County; W sites are Westchester County.
**A G-Test for Goodness of Fit compares the ratio of observed values/data to a ratio expected based on theory. In this case, a ratio of 1:1 was selected as the null hypothesis, interpreted to mean that there is no difference in trap catch. The null hypothesis is rejected at $P \leq 0.05$, meaning that trap catches are not equal.

When data for all sites are combined, adding a surfactant improved the ability of yellowjacket traps to retain stinging insects ($G = 132.1$; $DF = 1$; $P < 0.001$). However, the raw data suggests that one trap in particular at site A1 was responsible for this result (Figure 5). Furthermore, results from Sites A2 and A3 alone indicate that control traps were better at catching yellowjackets. Proximity of traps to yellowjacket foraging sites and the use of Dawn Dish Soap might explain these results.

Figure 5. Paired traps at an apple orchard. The trap on the left contains a surfactant and hundreds of yellowjackets.

Site A1 was located at an apple orchard, with one trap pair located adjacent to the apple cider production and a kitchen. The predictability and abundance of food sources in this area would have attracted large numbers of yellowjackets, leading to high catches in the fall.

In 2015, Dawn Dish Soap was selected for use because it is easy to find in many local retailers. However, this product has a "soapy" smell, which might have deterred yellowjackets that rely on odors to identify food sources while foraging (Rust and Su, 2012). This is in contrast to the fragrant shampoo utilized in the small 2014 trial, in which fragrant shampoo could have increased the attractiveness of the fruit-punch baited trap containing a surfactant.

Future plans regarding this project include further analysis of the data to determine if stinging insect captures change over time, and to identify a better method of examining trap catch data. For instance, the current analysis does not take into account the replication of paired traps at several sites.

Resources developed:
YouTube stinging insect video: www.youtube.com/watch?v=kFaEG86BV_o

References:

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