THE SECRET LIFE OF SAP BEETLES

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The strawberry sap beetle (SSB) is a pest of growing concern among New York strawberry growers. The beetles are widespread throughout New York, being present in all of 37 fields across 14 farms included in a 2002 statewide sampling for SSB, and are considered the number one arthropod threat to strawberries by New York Berry Growers Association members. The two pyrethroid insecticides labeled for use have variable effectiveness in the field and are broad spectrum, potentially interfering with IPM practices such as maintenance of predatory mite populations for spider mite control. SSB is not considered to be an economically important pest in crops such as apples, raspberries, blackberries, blueberries, cherries, pumpkins, melons, and various vegetables, however crop residues potentially attract SSB and enable the insect to reproduce until late in the growing season. While reports of SSB feeding on a variety of crops are numerous (Blackmer and Phelan 1992), no conclusive information is available as to which crops the beetles are capable of reproducing on other than strawberries.

The long-term objective is to determine where the beetles are going after strawberries are no longer available. A first step in understanding this critical between-crop movement is determining what crops SSB can survive and reproduce on and roughly how far adult SSB are capable of moving. The potential of a crop to support additional generations of SSB depends on food source quality, ability of the insect to access the food source, and proximity of the residue to the SSB population. Adult SSB may visit certain crops to feed, but not oviposit because the food source will not last long enough for the larvae to develop or is of insufficient nutrient value. A thick outer layer on fruit such as apples or melons may deter SSB from feeding on an otherwise suitable food source unless the fruit is damaged. At present, it is unclear just how mobile adult SSB are in the field. By studying adult SSB movement in the relatively homogenous environment of a strawberry planting, we can develop methods of quantifying sap beetle movement that can be applied to larger scale movement between crops.

Objectives and Methods

Objective 1: Identify crops the strawberry sap beetle feeds and reproduces on

Egg production for a cohort of similar aged adult strawberry sap beetle was evaluated on 6 different foods: apple, blueberry, corn, melon, raspberry, strawberry, tart cherry, and strawberry sap beetle diet. Two male and 2 female adult SSB were placed in a 163 mL plastic container on 26 July 2003 with a food source and a moist paper towel as an oviposition substrate. An excess of food was supplied in each container: one-tenth of an apple, 3 blueberries, one-sixth of a corn ear, approximately 22 g melon, 2 raspberries, 1 large strawberry, 2 tart cherries, or approximately 2.5 g SSB diet. Muslin cloth was placed over the opening of the container and secured with rubber bands to allow adequate ventilation. Containers were arranged in a completely randomized design with 10 replications of each food source in an controlled environment chamber set at 27^{o}C and 60% relative humidity with a 16 h day/ 8 h night cycle. A small amount of water was used to moisten the paper towel in each container daily. The number of eggs on the paper towel was counted every two days for 12 days and a new paper towel was placed in the container. If any beetle was found dead, the sex of the dead individual was noted and it was removed from the container. The number of eggs per living female was calculated for each time interval.

Objective 2: Determine if strawberry sap beetles are overwintering in strawberry fields and when colonization of strawberries in the spring occurs

Four to 6 transects were placed 15 m apart in each of 5 strawberry fields bordered by wooded edges on 14 April 2003. Traps were placed at four locations along each transect: edge of wooded area, edge of strawberry field, 27.6 m into the field, and 40.8 m into field. The nitidulid inventory traps were modified from those used by Williams et al. (1994). A 0.95L polypropylene deli container was baited with approximately 30g of whole wheat bread dough wrapped in nylon fusible knit interfacing material and secured with a rubber band. The opening of the container was screened (7 holes/cm) to exclude larger species of arthropods. A golf course cup cutter was used to create a hole in which the top of the trap was placed at soil level (Williams et al. 1994). A 30.5 x 30.5 cm piece of roofing shingle served as a rain shield and was placed over the trap and held in place with either rocks or soil. Traps were checked daily for SSB adults from 15 April to 29 May 2003, after which traps were checked every 3 days. Bait was exchanged at 3 day intervals. Traps remained in the field until 22 June. The number of male and female adults per trap were counted. All females in a trap were dissected to determine presence of eggs until 7 June when a maximum of 5 females per trap were dissected.

Results and Discussion

Objective 1: Identify crops the strawberry sap beetle feeds and reproduces on

Female SSB oviposited while feeding on all eight food sources (Figure 1). In general, there was an increasing trend in number of eggs per female until about day 8. The exception to this was apple where very few eggs were produced before day 8 and the mean number of eggs was still increasing when the study was ended on day 12. A similar trend in delayed egg production when feeding on apple was seen in picnic beetle by Peng and Williams (1991) and could indicate that apple is a lower quality food source for nitidulids. It is obvious that SSB are willing to feed on and capable of reproducing on a wide range of crops, including many that are frequently planted adjacent to strawberry fields in New York. The extent that the beetle population is using these crops in the field will require further investigation. Crops on which SSB survival is high and the beetles are able to reproduce should be the focus of efforts to reduce the size of the overwintering SSB population. Possibilities of management strategies include a more thorough removal of crop residue near strawberry plantings or relocation of crops when possible such that strawberries are planted further away from alternate food sources, making residue in other crops unavailable to SSB.

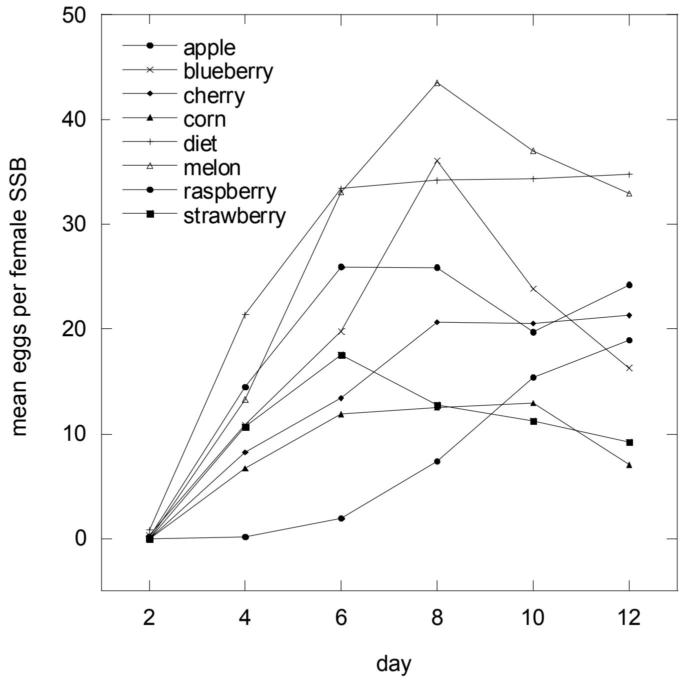

Figure 1. Mean number of eggs oviposited per female SSB over two day intervals. A cohort of 2 male and 2 female beetles were placed on one of eight food sources on day 0. Eggs were oviposited onto a moist paper towel included in a ventilated cup containing an excess of a particular food source. n=10 containers per food source.

Objective 2: Determine if strawberry sap beetles are overwintering in strawberry fields and when colonization of strawberries in the spring occurs

SSB were caught in traps in woods bordering strawberry fields about 1.5 weeks earlier than in the strawberries and a steady progression of beetles from the woods into the fields was seen in at least two of the fields, indicating that the beetles do not overwinter in the strawberry field to any significant extent (Figure 2). A drop in the number of SSB caught was seen after application of a pyrethroid on day 61 of the sampling. Similar trends were seen in other fields. However, this drop only lasted 2 to 3 days before trap counts returned to the previous or higher levels. A large part of the reason for the drop in SSB capture may have been a decrease in minimum temperature associated with the decreased trap counts rather than insecticide application. Even if the insecticide was the cause of the decreased trap counts, any benefits were not long-term and likely had little impact on damage to the fruit. The movement of the beetles into the field may offer and opportunity to intercept the SSB population as it colonizes strawberry fields in the spring using attract and kill traps along wooded edges. It is fairly certain that the male beetles produce an aggregation pheromone that both male and female beetles would be responsive to. If this pheromone could be ioslated it may be possible to reduce the SSB population in early spring by baiting the attract and kill traps with this pheromone and bread dough, with the combination attracting greater numbers of beetles than is possible to catch with bread dough alone.

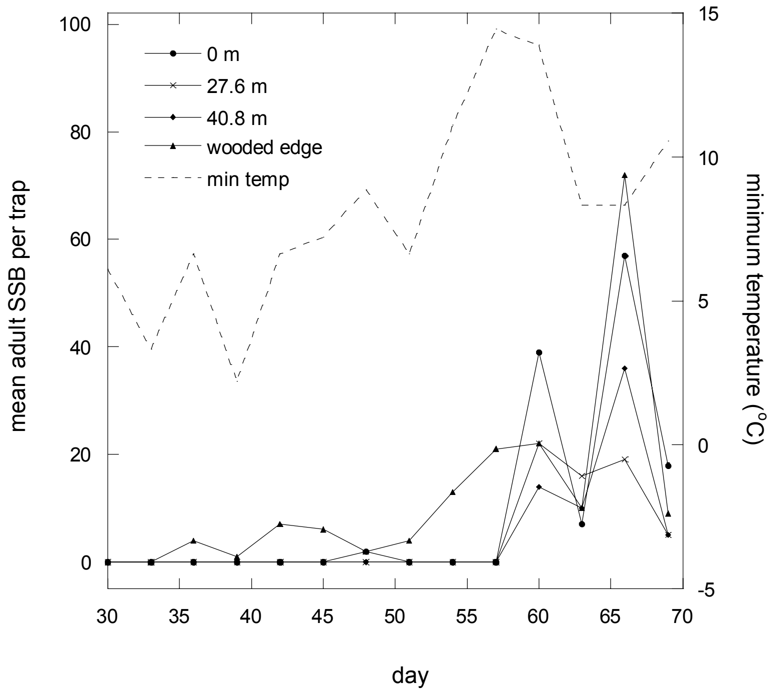

Figure 2. Mean number of strawberry sap beetle caught in traps baited with whole wheat bread dough at one of three distances along a transect into a strawberry planting or in the edge of a wooded area adjacent to the planting. One of five fields sampled is shown. Means are shown beginning 14 May 2003 and ending 22 June 2003. Four to six traps were placed at each distance or wooded edge in each field. A pyrethroid insecticide was applied on day 61.

Literature Cited

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