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A MIGRATION STUDY OF *STELIDOTA GEMINATA* (COLEOPTERA: NITIDULIDAE)

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ABSTRACT

The strawberry sap beetle, *Stelidota geminata* (Say), is a major pest of strawberries in the northeastern United States. Further knowledge of the migratory habits of this insect pest can enhance the effectiveness of pest management strategies. This nitidulid was shown to migrate from its overwintering sites to one of its primary reproductive sites, strawberry fields, in late May. The beetle population peaked in the third week in July, 1993 in the strawberry field and then gradually declined. In 1994, the peak, as well as the total population, was much greater than in 1993. Furthermore, *S. geminata* was concentrated in the transition areas surrounding the strawberry fields prior to the ripening of the fruit.

The strawberry sap beetle, *Stelidota geminata* (Say), is a major pest of strawberry fruit in the northeastern United States. The economic losses due to this pest can be devastating. Strawberry growers in Michigan were reported to have lost $3 million in 1966 due to the damage of this beetle (Jantz et al. 1967).

Chemical control of this pest can be complicated by the following factors: (1) the migration of *S. geminata* into strawberry fields occurs while the fruit is ripening; however, spraying at this time, in many cases, is not feasible due to harvest restrictions; (2) the dense leaf cover of strawberries that prevents pesticides from reaching targeted berries where beetles feed; and (3) the EPA regulations that govern the use of pesticides on specific crops such as strawberries to prevent excessive residues in foods (Gertz 1968).

Knowledge of the migration habits of *S. geminata* can enhance the effectiveness of pest management strategies. Miller and Williams (1982) conducted a preliminary study in which the number of *S. geminata* in four different habitats during the beetle's breeding season was investigated. Nitidulid Inventory Technique (NIT) traps (Williams et al. 1993) were placed on the perimeters of strawberry, corn, and raspberry fields, and also in nearby wooded areas in Wayne County, Ohio. The traps were run from May to October. The first beetles in this study were caught in the wooded areas in late May. Peak captures of *S. geminata* in the strawberry fields were during the first week of August, 3-5 weeks after the peak of the strawberry season. They concluded that *S. geminata* does not overwinter in strawberry plantings, but rather in woodlots or protected thickets in order to escape the harsh winter weather. These wood-

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lots are the site of emergence for adult beetles in the spring. Gertz (1968) and Weiss (1979) performed similar studies and also have data which support the theory that *S. geminata* has an extensive spring migration.

MATERIALS AND METHODS

These investigations were conducted over a period of 20 weeks in both 1993 and 1994. The field portion of the study was conducted at the Moreland Fruit Farm in Moreland, Ohio, approximately 8 miles south of Wooster. The laboratory phase of the study was conducted at the Ohio Agricultural Research and Development Center in Wooster, Ohio. In 1993, traps were set out on 10 May, and run until 28 September. Similarly, in 1994, traps were set out on 11 May, and removed on 28 September.

During both years, NIT traps were used to collect beetles. These traps consisted of wide-mouthed, pint canning jars containing a food attractant. A masonite rain shield was attached to the lid of the jar to prevent excessive water from entering the trap and to prevent bait desication. Hardware cloth was inserted in the lid of the canning jar to prevent animals such as raccoons from removing the bait. A tapered, plastic drinking cup, with its bottom removed, was placed in the mouth of the jar to act as a restraining device for captured beetles (Williams et al. 1992). A golf-course, cup-cutter was used to excavate holes in the soil where the traps were placed. Jars were set upright, with their tops even with the ground surface, in order to allow easy access.

Whole-wheat, bread-dough was used as bait for the entire study. Approximately 30 g of dough was wrapped in fiberglass screen to prevent *S. geminata* and other nitidulids from becoming embedded in the dough. This facilitated removal of the beetles.

The study site was composed of three habitats surrounding, and including, a commercial strawberry, *Fragaria* × *ananassa* Duch., planting. The first habitat was a woodlot which bordered the fruit farm. The woodlot was composed of many species of trees, shrubs, and vines dominated by white oak, *Quercus alba* L., and red maple, *Acer rubrum* L. The floor of the woodlot was covered with leaf litter and fallen trees. The second habitat was a transition area between the woodlot and the strawberry patch. This transition area was composed of orchard grass, *Dactylis glomerata* L., apple trees, *Malus domestica* Borkhauser, and a raspberry, *Rubus idaeus* L., planting. The third habitat was a strawberry field, approximately 0.4 hectares in size. The strawberry planting was located approximately 260 meters away from the nearest woodlot.

In 1993, three traps were placed in the woodlot, 8 were placed in the transition area, and 7 were placed in the strawberry planting. In 1994, the arrangement was modified slightly placing 4 traps in the woods, and 6 traps each in the transition area and strawberry field. All traps were collected weekly and replaced with clean jars with fresh bait. The traps were taken to the laboratory where they were frozen until they could be processed. The trapped insects were later separated, identified, and counted.

RESULTS AND DISCUSSION

During both years of the study, the *S. geminata* populations followed the same basic trend. We were able to confirm the early spring migration from the woodlot into its early season reproductive habitat, strawberry plantings, which was reported by Miller and Williams (1982). The 1993 and 1994 results shown in Figures 1 and 2, respectively, seem to confirm the findings of Gertz (1968) that the migration is accomplished by a series of short flights or even

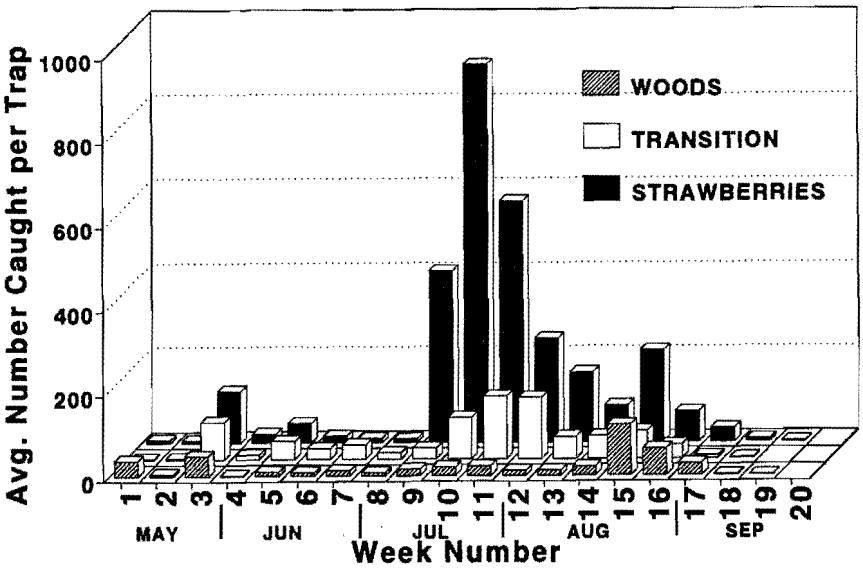

Figure 1. *Stelidota geminata* migration at the Moreland Fruit Farm, Moreland, Ohio in 1993.

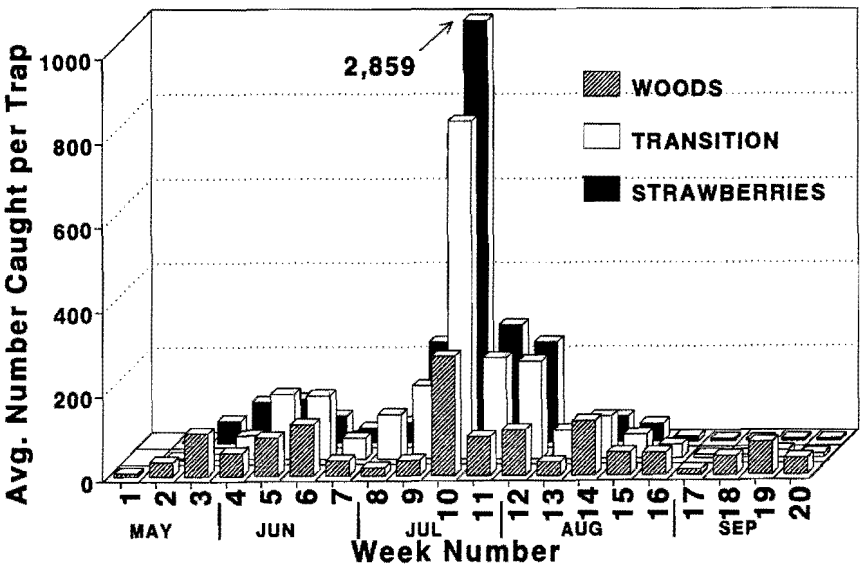

Figure 2. *Stelidota geminata* migration at the Moreland Fruit Farm, Moreland, Ohio in 1994.

by ground movement rather than by one long migratory flight. During a 1991 study which included trap height data, aerial NIT traps captured 10 times fewer *S. geminata* than NIT traps at ground level (Williams et al. 1993). Furthermore, aerial NIT traps utilized during this study caught 80 times fewer strawberry sap beetles than the respective ground traps.

The difference in the number of traps in each area over this two year study was unavoidable due to changes in crops and their locations on the farm during this period. The numbers collected were averaged, however, for each of the three areas (woods, transition, and strawberries) to compensate for this difference. For purposes of comparison, Figure 2 was scaled down to the same level of Figure 1 (max. 9000). However, it should be noted that the peak of 17,155 beetles in week 10 has been truncated in order to keep both figures on the same scale.

The results of this study support results in previous studies. During the initial trapping week, the majority of beetles were taken in the wooded areas. Next, a gradual increase through weeks 3 to 5 occurs in all three areas. During the third week in July (week 10), in both years, a major population explosion occured in the strawberries. This peak was nearly a 100-fold increase over the total for week 8 in both years. Furthermore, the population peak occured approximately 5 weeks after peak strawberry production, the length of time required for *S. geminata* to complete its life cycle (Weber and Connell 1975). We speculate that the peak in week 10 is the result of reproduction in the strawberry patch and represents adult movement as they emerge. The raspberries in the transition area, although unlikely, could be a secondary breeding site (Miller and Willams 1982); however, our observations suggest that *S. geminata* will aggregate in raspberries in relatively small numbers unless extensive amounts of fruit are left to rot on the ground.

The data indicate that the captures in late May and early June are the migration of adult *S. geminata* from their overwintering site to their reproductive site. The first peaks in the strawberry plantings were around 3 to 5 weeks after ripe berries were present in the field. This time period between migration and the first new adult generation reflects findings by Gertz (1968) which claimed that *S. geminata* development time was between 2 and 4 weeks.

There were some differences between the populations of the two years. The biggest change was the *S. geminata* population increased dramatically to 43,862 in 1994 over the 28,559 caught in 1993. Through this drastic increase, however, the percentage of *S. geminata* in relation to the total nitidulids captured per year remained nearly constant (62% in 1993 and 59% in 1994). This suggests that, presumably due to either favorable climate or an abundant food supply, 1994 was simply a good year for sap beetles in this particular area. An additional variation occurred in the magnitude of the smaller peaks. In 1993, during the last week in May and the third week of August, minor peaks were observed. In 1994, however, this trend was not detectable with the higher population. Finally, the transition area peak during week 10 of 1994 was much greater proportionally than its respective peak in 1993. One possibility for this difference was the addition of another strawberry patch approximately 100 meters south of the study patch but within 10 meters of two of the transition area traps.

In conclusion, this study gives further support to the hypothesis that *S. geminata* has a spring migration from its overwintering sites to its primary reproductive site. The migration is accomplished by a series of short flights or walks. Migration occurs in mid to late May. There is a period of time, prior to the ripening of the berries, when *S. geminata* are concentrated in areas surrounding the strawberry plantings. A basic understanding of the movement and migration of the strawberry sap beetle facilitates pest management

strategies such as biological or cultural control methods, or the use of toxic baits. Concentrating properly timed control measures on the transition areas where the migration occurs will reduce the damage to ripening fruit caused by this pest and reduce chemical residues on the fruit. A post harvest application of an appropriate insecticide, targeted at the newly emerging beetles, will reduce carry over of this pest to crops that mature later in the season. This would also help to reduce the population in subsequent years. This practice of disrupting the migration of *S. geminata* may prove helpful in the control of other pest insects as well.

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