Squash Bug, Squash Vine Borer, and Striped Cucumber Beetle on Butternut Squash and Muskmelon

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Introduction

Alternative agricultural schemes are gaining attention as the demand for organic and sustainable products continues to grow. Pest insects pose a sizeable challenge to agricultural production because their activities reduce crop fitness and productivity. Effective management of pest-insects is, therefore, crucial for successful management, and increasingly entails a multi-dimensional approach.

The squash vine borer moth (*Melittia cucuritae*), squash bug (*Anasa tristis*), and striped cucumber beetle (*Acalymma vittatum*) are major pests of cucurbit crops. Aside from their roles as vectors of disease, feeding by larvae and adults of these insects is damaging to fruit and roots, stunts growth and can lead to substantial losses if measures to control their populations are not implemented at the appropriate time. Phenological research is necessary to develop models that enable growers to predict the arrival of different pest species, and thus more accurately direct efforts to control pest populations before they grow beyond manageable levels.

Research conducted in the summer of 2011 at the Iowa State University Horticulture Research Station in Ames, Iowa was year two of a collaborative effort with scientists at Iowa State University, Pennsylvania State University and the University of Kentucky, to develop degree-day models for squash vine borer, squash bug, and striped cucumber beetles. The USDA Organic Research and Extension Initiative (OREI) program is funding the project.

Materials and Methods

Trap flats. One trap flat containing 2-week-old squash seedlings (*cv*. Blue Hubbard) was deployed in each of ten random locations at the ISU Horticulture Research Station to collect squash bug and striped cucumber beetle emergence data beginning the week of April 18, 2011. Flats were sampled passively with adjacent sticky cards (Gemplers RSTRIP) and actively sampled via visual inspection three times per week for five weeks, and discontinued with the establishment of phenology plots on May 17.

Phenology plots. The plots consisted of two adjacent 50-ft-long rows of butternut squash (*cv*. Betternut) and muskmelon (*cv*. Strike), from which, ten plants of each cultivar were randomly selected and inspected for the presence of squash bug adults, eggs, and nymphs, as well as adult striped cucumber beetles. Insects were actively sampled bi-weekly via vacuum aspiration until harvest.

Monitoring for squash vine borer was done using pheromone lures suspended from Hartstack (Heliothis) traps. Two traps were placed near the south phenology plot and checked bi-weekly for adult moths beginning May 26 through August 12. Moths found in the traps were removed to prevent their recapture.

Results and Discussion

Early-season trap flats produced little information regarding the timing of emergence of squash bug and cucumber beetle adults from overwintering. Neither taxa was observed during the five weeks of monitoring with trap-flats; beetles were finally encountered on May 31 as flats were being gathered for disposal. Having not collected any prior to this time, a single flat was left in the location and beetles aspirated from it during scouts until phenology plots were fully established (Figure 1).

Specimens collected on May 31 included seven male and four female striped cucumber beetles (SCB). Subsequent samples were taken on June 2, 3, and 8, with the greatest number of beetles collected on June 10 (37 male and 12 female). A total of 105 beetles were collected from May 31 to June 10, consisting of 75 males and 30 females. Presumably, these were among the first host-seeking individuals of the season, having emerged from overwintering earlier in May.

Host-seeking by adult SCB occurs when temperatures rise to between 54°F-65°F. Males first colonize a host plant and begin to feed. Male feeding results in the release of volatile cues (by male beetles and host-plants), which in turn, recruits conspecifics to the site. The greater number of male than female beetles collected from the trap is likely a reflection of this tendency in *A. vittatum.*

Squash vine borer (SVB) (*Melittia cucurbitae*) monitoring with pheromone traps demonstrated one clear population increase preceded by a 3-week period during which no individuals were captured. The moth population peaked around July 7 with the capture of 21 individuals, and began to fall through July 21. The number of moths captured increased slightly by July 25 and again dropped to zero by August 7. After this point, no individuals were captured for the remainder of the season (Figure 2). It is unclear if the arrival of the overwintering population of moths was captured in the data. Next season, traps should be deployed earlier and monitoring continued later into the season to gather data that better depicts the activity of SVB populations in Iowa.

Squash bug (*Anasa tristis*) activity in the phenology plots was greater in squash than in muskmelon cultivars. The first adult squash bug was observed in the melon crop of the north phenology plot, approximately two weeks before the first individuals were observed in the squash crop of the same plot (June 24 vs. July 6, respectively).

A single egg mass was recorded in the north phenology melon crop on July 28. However, nymphs were never observed in the melon crop of either the north or south phenology plots. Neither eggs nor adults were ever found in the south phenology melon crop (Table 1).

Adult squash bugs were first observed in the north phenology squash crop on July 6 (after the vines of the plants began to “run”), with the first egg masses appearing July 12, about one week after the first adults were observed. Nymphs began to hatch on July 18, approximately one week after the first egg masses were recorded. All life stages were present in the squash crop of both plots by July 25. After July 21, immature life stages were inordinately represented in squash bug population data (Figure 3).

Striped cucumber beetles (SCB) were first observed in phenology melon and squash plots on July 12, despite that the melon plots were established more than three weeks earlier than the squash plots (Table 1). The overall population of beetles, in terms of the average number of beetles counted per plant and date, was greater in squash than melon. The data show a single, late-season population peak in both crops, likely corresponding to the arrival of the second generation of beetles (Figure 4).

The apparent late arrival of these insects may be owing, in part, to low early-season temperatures. However, it is possible that heavy machinery might have contributed if their use in the removal of declining conifer trees from areas near our experimental plots earlier that spring was destructive to the insects' overwintering sites.

Future phenological research would benefit by establishing a protocol for dealing with the different developmental stages of the immature squash bug. Early instars are easily identified, but begin to appear more and more like the adult with each molt. Particular attention should be paid to late- and final-instar nymphs, which look very similar to the adult, but differ in that they do not yet have fully developed wings.

The accuracy of beetle counts could be improved if phenology scouts were performed early in the morning when beetles are less likely to take flight. By early afternoon, the beetles' high activity level makes them difficult to follow and increases the likelihood of some individuals to be counted repeatedly. First removing the beetles from a plant via vacuum aspiration, and then counting them as they are released, also helps to minimize this error.

Implementing timed counts could reduce the chaos of trying to keep accurate tallies of each group once they are so abundant that they cannot all be counted. This approach would also help minimize between-sample differences when the insects are distributed in "patches" throughout a plot.

Emergence data collection on trap flats could also be improved by allowing the flats to remain in the field after phenology plots have been established. This would permit more comprehensive surveillance of overwintering populations in the case that there is a survival differential for insects overwintering in different locations.

Acknowledgements

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Table 1. Summary of important dates and activities of the 2011 growing season.

				Date of first appearance				
	Date planted/ deployed	Date of initial scout	Date of final scout	Squash Bug			Striped cucumber beetles	Squash vine borer
				Adults	Eggs	Nymphs		
Butternut squash	10-Jun	10-Jun	30-Aug	6-Jul	12-Jul	18-Jul	12-Jul	–
Muskmelon	17-May	23-May	28-Jul	24-Jun	28-Jul	–	12-Jul	–
Pheromone traps	23-May	26-May	12-Aug	N/A	N/A	N/A	N/A	17-Jun

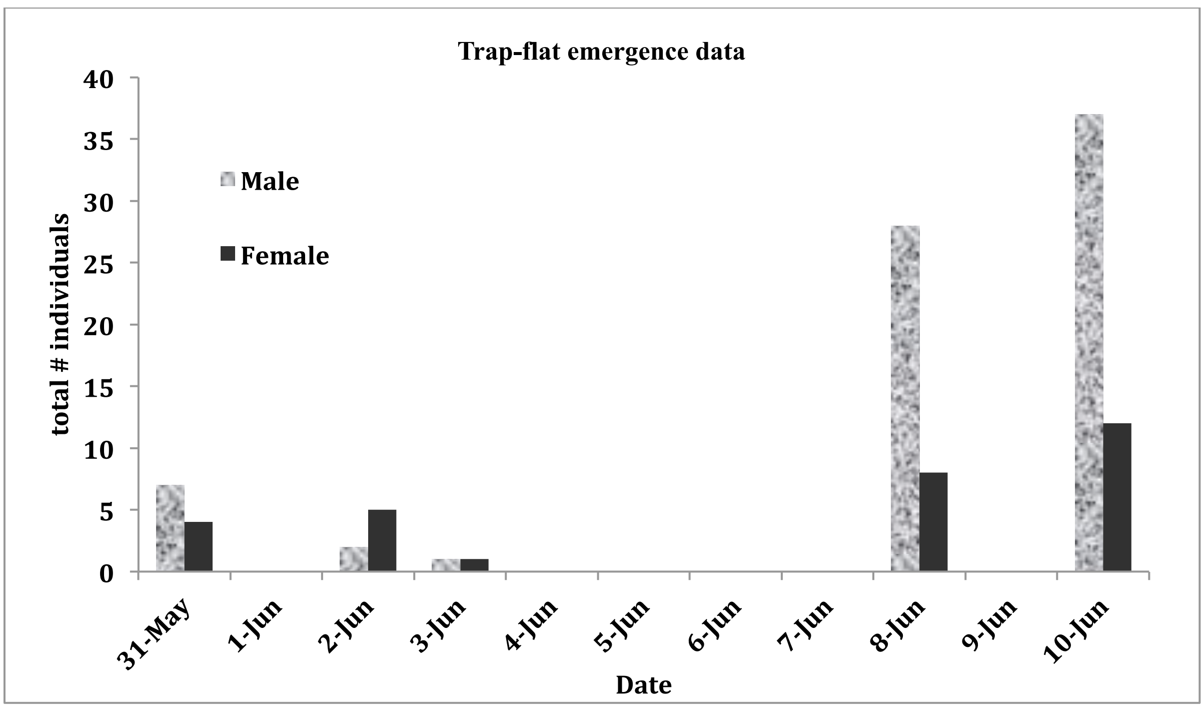

Figure 1. Striped cucumber beetle (SCB) emergence data collected on trap flats, beetles first collected May 31, 2011. Of the 105 beetles captured, most were male.

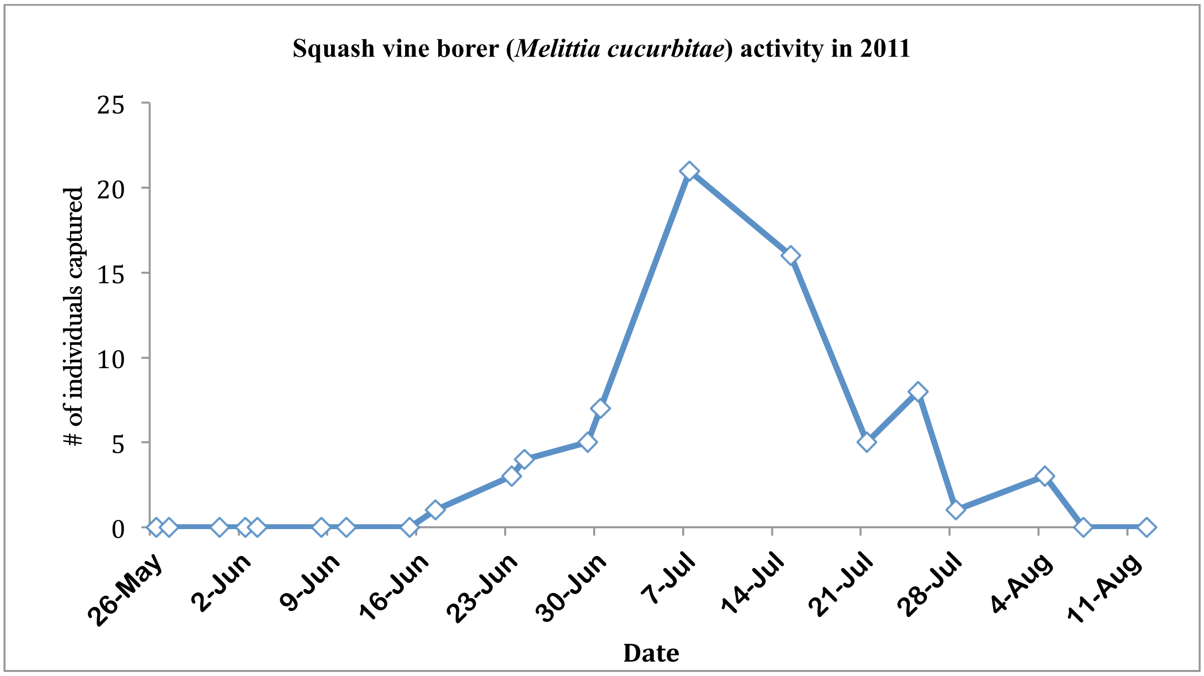

Figure 2. Squash vine borer activity in 2011. Moths captured via Hartstack pheromone traps.

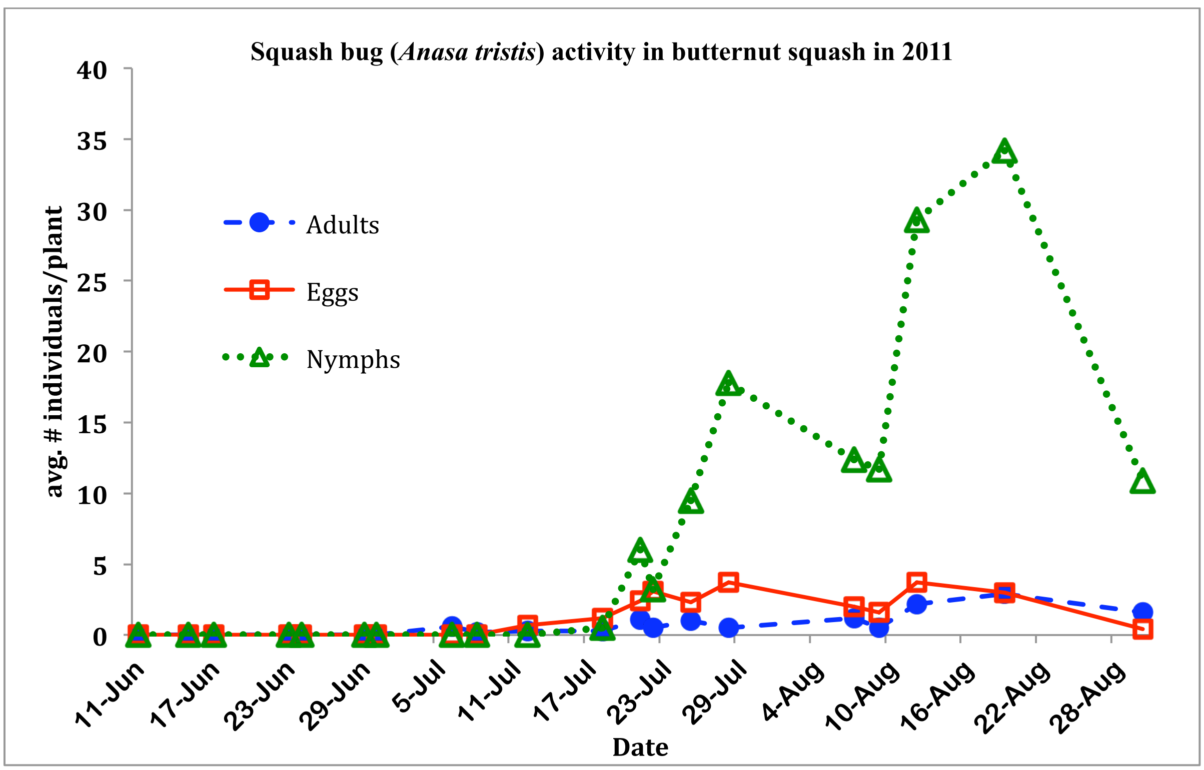

Figure 3. Squash bug activity in phenology plot butternut squash. Shown above, the average number of adult bugs, egg masses, and nymphs observed per plant and date in 2011.

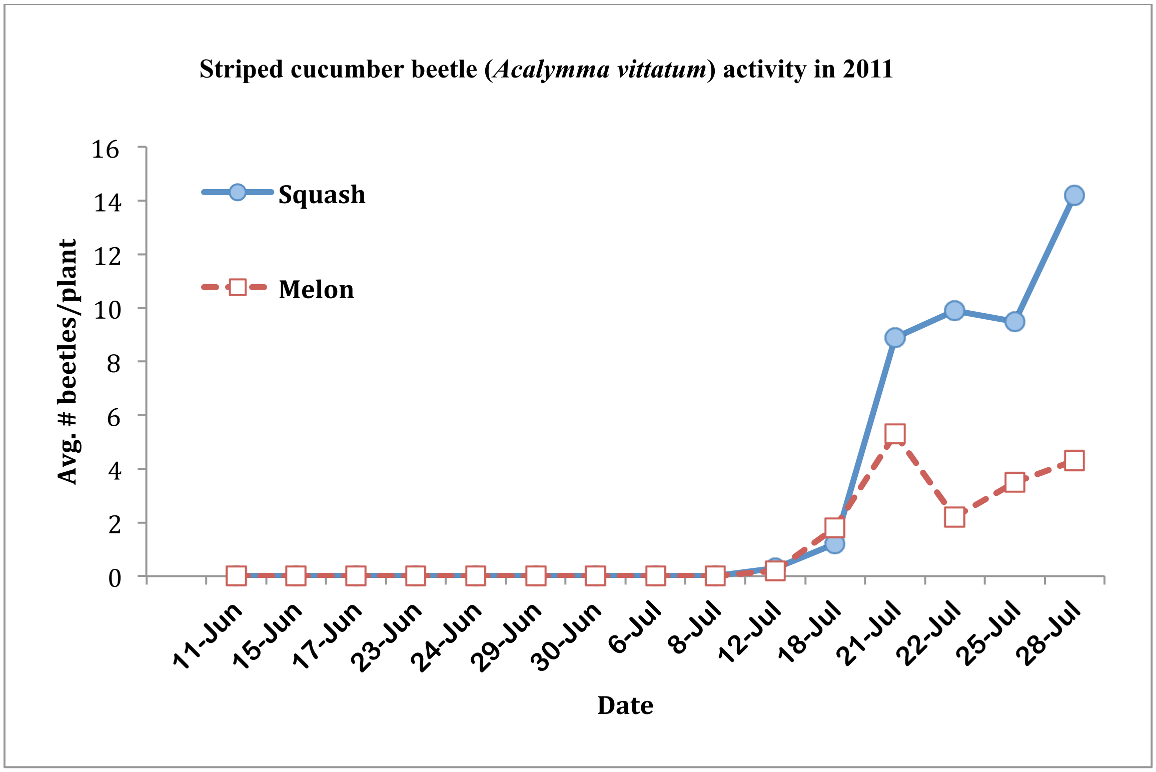

Figure 4. Striped cucumber beetle activity in phenology plot squash and muskmelon cultivars. Shown above, the average number of adult beetles observed per plant and date in 2011. Adult beetles that emerged earlier that spring were apparently absent from phenology plots; however, the new generation of beetles was captured by the survey.