Vegetable Section

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Collaborative, Rapid-Response Research and Extension Efforts for Management of an Invasive Thrips Species, *Megalurothrips usitatus* (Bagnall)

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Florida snapbean production ranks first in the United States, contributing to more than one-third of the national production. In January 2020, *Megalurothrips usitatus* (Bagnall) (Thysanoptera: Thripidae), Asian bean thrips, was first detected in Homestead, FL by Glades Crop Care, Inc. and identified by FDACS as a new pest to the continental U.S. Impacted snapbean growers in Miami-Dade County reported 30% losses (estimated at $1,620 per acre), which could total more than $33 million with similar losses across southern Florida. As a pest of other legumes, *M. usitatus* has the potential to negatively impact growers across the southeastern U.S. A rapid-response extension program led by University ofFlorida/IFAS (UF/IFAS) faculty and extension agents was developed in partnership with commercial crop consultants and growers. Meetings were organized to train growers, scouts, and extension agents, and to foster information sharing across farms and production areas. A regional scouting effort was initiated that covered 25 farms in Palm Beach, Hendry, and Collier Counties to monitor population level dynamics, detect potential alternative hosts, and identify effective grower management practices during the 2020-2021 season. Lab and field pesticide efficacy trials began. A website was developed to provide timely insights from research efforts along with weekly updates of *M. usitatus* population levels throughout the scouted region. This presentation will highlight knowledge gained from the first year of the rapid-response effort. Discussion will include the successes and challenges faced, expansion and improvements to be made for the upcoming season, and takeaways for future collaborative, rapid-response efforts.

Florida ranks #1 in the U.S. for snapbean production, producing nearly half of total national production (Zhang et al., 2017). Florida has about 28,000 acres of snapbeans, with about 7500 acres in Miami-Dade County, 6670 in Palm Beach County, and 7270 acres in Southwest Florida (Hendry, Glades, Collier, and Lee Counties) (USDA-NASS, 2017). Average Florida snapbean yields are approximately 180 thirty-pound bushels/acre (Zhang et al., 2017). At $30 per bushel, growers can gross about $5,400 per acre. Production costs are $4,000 to $4,700 per acre (Olson et al., 2011), with a net return of $700 to $1,400 per acre.

In Jan. 2020, significant damage was reported in a young snapbean field near Homestead, FL, in Miami-Dade County. Field scouts from Glades Crop Care, Inc. noted large black thrips feeding on the young plants. Samples were sent to UF/IFAS entomologist and thrips specialist, Joseph E. Funderburk and Florida Department of Agriculture and Consumer Services Division of Plant Industry (FDACS-DPI) taxonomist Felipe Soto-Adames. Based on its morphology, the new pest was identified as *Megalurothrips usitatus*, Asian bean thrips (ABT). This was later confirmed by DNA molecular analyses. This was the first record in the continental U.S. A PEST ALERT describing this pest was published by FDACS-DPI (Soto-Adames, 2020).

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Female ABT are large (nearly 2 mm long), black thrips with two white bands on their wings. Antennae are black except for a white, 3rd antennal segment. Light-colored forelegs are also characteristic of *Megalurothrips*. Males are smaller than females (1 mm long), slender, and are lighter in color. Male color patterns are the same as females', but less distinct. Young larvae are pale yellow like other thrips species, but later instar larvae are orange to red in color (Soto-Adames 2020).

During the 2019–2020 production season, snapbean growers in Miami-Dade County reported losses of 30%. This amounts to a reduction of $1,620 per acre, resulting in net losses. By the end of the 2019–2020 growing season, ABT were also confirmed in Palm Beach and Collier Counties. The potential negative impact of the ABT is great. If 30% losses were realized across South Florida snapbean production, this could amount to $35.3 million dollars of losses to Florida growers.

Response

The University of Florida, Institute of of Food and Agricultural Sciences (UF/IFAS) Extension initiated a collaborative effort between growers, scouts, state and private taxonomists, university researchers, and university extension specialists. The goal was to provide timely information to assist stakeholders in identifying ABT, understanding population dynamics, and implementing effective management practices.

During the 2020–2021 growing season, a survey effort began to document ABT population dynamics in Palm Beach, Martin, Hendry, Glades, and Collier Counties (subsequently referred to as the "survey region"). Up to 57 locations on 12 farms were monitored weekly by an UF/IFAS extension agent. Information was compiled along with weekly data from four professional scouts. Weekly updates were distributed to a listserv of 1560 subscribers that conveyed population levels throughout the scouting area. UF/IFAS research faculty began pesticide efficacy trials, both in the lab and in the field. The information gathered from the survey and trials were posted on the ABT website <https://mailchi.mp/da4e89b0186f/south-florida-growers-meeting-asian-bean-thrips>. Weekly reports were often re-distributed as Specialty Crop Industry <https://specialtycropindustry.com> news articles.

Results

Survey results during the 2020–2021 growing season indicated ABT were first identified in the survey region at the end of Oct. 2020 and became widespread by early Dec.2020. Population levels spiked in Feb. 2021 and losses were reported in some locations. With a year of surveying and a better understanding of pest thresholds and population dynamics, data are now available for year-by-year comparison in subsequent seasons. Insecticide applications are not needed during the first cropping cycle (September through December) with the exception of Homestead. This scouting effort has enabled producers to eliminate 1–2 preventative insecticide sprays during the first crop cycle, potentially saving up to $1.70 million ($60/acre × 2 sprays × 14,200 acres in scouting region).

Through weekly scouting, preliminary management recommendations have also been developed. Weed hosts and pseudo-hosts of ABT were identified. Wild cowpea (*Vigna luteola*), phasey bean (*Macroptilium lathyroides*), and multiple crotalaria species have all been reported as having ABT adults and larvae on blooms. Wild cowpea appears to be a primary alternative host which has been reported from ditch banks on most snapbean farms. Locations where ABT populations reached crop damaging levels all had large areas of wild cowpea nearby. The reproductive ability of ABT has not yet been evaluated on these weeds.

On 9 Mar. 2021, a population gradient of ABT was identified on a 500-acre planting of snapbeans in Hendry County. Data were collected to correlate ABT counts per bloom to percent damage on pods caused by thrips feeding. Scouting at bloom stage at six locations across the planting was done on two different dates (9 Mar. and 12 Mar.). Ten blooms were sampled at each location for each sample date. Harvest occurred on 26 Mar. 2021, with 10 plants were sampled; all beans over 3.5 inches were counted and graded. Grading consisted of marketable, unmarketable due to thrips, and unmarketable due to other reasons. Beans were considered marketable if thrips injury was found only on the bloom tip of a pod and overall damage was < 0.25 inches long. It was included in the other category if the damage was 0.25–0.5" long. If the damage was ≥ 0.5", the bean pod was considered unmarketable. Commercial harvest occurred on 26 Mar. 2021, although yield data are not available. Results are summarized in Table 1. Examples of ABT damage on pods can be seen in Fig. 1.

Damage increased as the ABT population increased. At high populations, total yield was reduced, confirming reports of flower abortion from growers and scouts in Homestead. No damage was seen on bean pods with populations of 0.4 ABT adult per bloom; and low damage identified at 1.4 ABT adult per bloom may be tolerable. If pod damage is identified using stricter standards than are described above, slightly more damage would be included in the "other" category. More data are needed to better correlate ABT populations and damage at lower population levels to begin developing an economic threshold. Edge effects were also apparent and should be considered when developing thresholds.

Laboratory insecticide efficacy trials were done using eleven pesticides with ten different active ingredients. Adult ABT were collected from 13 different locations and evaluated separately. For each population, 10 ABT were placed in a petri dish and fed bean seedlings that had been treated with the maximum labeled rate of the respective insecticide. Survival was recorded after 72 hours. Methomyl (Lannate®), spinetoram (Radiant®), acetamiprid (Assail), and cyantraniliprole (Exirel®) were the most effective against adults under laboratory conditions. Abamectin (Agri-Mek) was effective, although was only included in a few bioassays. Pyrethroids were not effective and are not recommended for management of ABT. There was greater variation in the larval study, with spirotetramat (Movento®) and novaluron (Rimon) causing the highest mortality. These results are consistent with anecdotal reports from scout and grower field experience.

A field trial was conducted in Palm Beach County to evaluate insecticide efficacy. It was initiated at early bloom stage, when ADT adult numbers were still very low. Four insecticides with five active ingredients were evaluated along with a control. Treatments were applied twice, 7 days apart. Adult numbers in insecticide treated plots were not different from non-treated plots, perhaps due to the very low initial population numbers. Trends indicated that pyrethroids had a negative effect, with higher average ABT detected after treatment than in the control. For larvae control, there was a trend toward lower numbers in spinetoram- and

Table 1. Scouting and damage data from Asian bean thrips across various population levels.

		Yield (g)						
			Non-marketable pods (g)					
Location	Asian bean thrips adult/bloom (no.)	Marketable pods (g)	Due to thrips feeding	Other reasons	Total (g)	Loss (%)[z]	Grower harvested	Other notes
SE	0.43	610	0	4.5	614.5	0.00%	yes	slightly younger planting
NE	1.4	689	58	230	977	5.90%	yes	
NC	2.2	740	175.5	103.5	1019	17.20%	yes[y]	
NW	4.4	453	327	205	985	33.20%	no	
SC	7.15	135	132.5	110.5	378	35.10%	no	slightly younger planting
SW	12.55	86	330.5	136	552.5	59.80%	no	

[z]Based on non-marketable pod weight due thrips feeding.
[y]Skipped 40 ft edge effect.

Fig. 1. Asian bean thrips feeding damage to snapbean pods (Photo: Craig Frey).

methomyl-treated plots, but total populations were quite low and variability was high.

Discussion

There were both opportunities and challenges in developing a collaborative scouting network. Extension agents have vehicles and county operating budgets, and are themselves labor to enable fast responses to new pest and disease situations. Scout and grower collaborations are essential because they greatly expand the area being monitored and substantially increase the amount of information an extension agent can provide to the industry. It is critical for county extension agents to partner with UF/IFAS research specialists to conduct trials to identify potential management strategies. The grower-extension-researcher collaboration fosters greater dialogue regarding the questions that need to be answered and help ensure research is applicable to the different growing systems around the state.

A collaboration is challenging as well. Research is not free and the time lag for writing and obtaining grants is often too slow for the agricultural community, which needs immediate answers to solve urgent problems. Extension agents have the potential to assist by engaging in practical research. Effective researchers are able to leverage similar research projects and industry support to provide timely management recommendations. Additionally, scout and grower partners are busy with full time jobs and regular contributions require additional work. Sometimes it is difficult to track down data to keep information up to date. In order to increase the efficacy of the work, it is important to combine scouting and research efforts with grower data, and this is often a challenge.

Conclusion

While grower trust takes time to develop, stakeholder involvement multiplies extension efforts and ensures grower cooperation in research initiatives. Season-long surveying efforts enable year-by-year comparisons that reduce unneeded pesticide applications, increasing grower savings. Research efforts closely associated with extension efforts have provided clear recommendations to manage new pests. They also identify specific active ingredients that can make a situation worse. Extension and research faculty relationships have been critical for the success of this rapid-response initiative, and will be important for the success of similar initiatives in the future.

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