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Good Bug, Bad Bug Identification Using Team Teaching and Live Video Demonstration

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Arthropods play an important role in production; they may be crucial for pollination or devastating to production, depending on the situation. To help farmers tell the difference, the 2012 Small Farms and Alternative Enterprises Conference featured a "Good Bug, Bad Bug ID" session where 50 farmers got hands-on experience with common pest and beneficial arthropods for vegetables and ornamentals. Microscope stations allowed farmers to look closely at pests and consider commercially available biological controls. Two Extension Specialists simultaneously presented reference information and live images of arthropods under microscope. The session featured an electronic before and after quiz to digitally capture responses. Results of the quiz show twice as many participants were able to identify three of nine beneficial and pest arthropods following the session. More than three-quarters of respondents were able to identify two additional pests and beneficial arthropods than they could before the session. Identifying arthropods is an important skill and the basis for decisions regarding the need for and proper selection of pesticides. Learning about commercially available biological control agents may increase their use.

Identification of common pest and beneficial arthropods is a learned skill and forms the basis for the proper application of pesticides. An interactive session conducted at the 2012 Small Farms and Alternative Enterprises Conference increased the ability of participants to identify pest and beneficial arthropods and improved their awareness of resources to identify insects and make pest management decisions. The conference routinely draws 700–800 people and 50 attended the "Good Bug, Bad Bug ID" held 29 July 2012, at Osceola Heritage Park in Kissimmee, FL. The specific objectives were that three out of four participants would be able to identify at least two more pest and beneficial arthropods than they could before the session and they would also be able to identify resources for insect identification and pest management decisions for future reference.

Teaching Methods

The 3-h session began by engaging participants with an electronic pre-test using remote response cards, receiver, and software (Turningpoint Technology, Youngstown, OH). The test consisted of 10 multiple choice questions asking participants to identify pictures of pest and beneficial arthropods. Responses were recorded digitally for comparison with the identical post-test.

Interactive lecture was used to present basic arthropod identification, scouting, chemical control and biological control concepts, and examples from tomato production were used to demonstrate concepts. Printed, online, and service resources for identification were reviewed. Chemical control decision making was demonstrated using the Vegetable Production Handbook for Florida. Concepts such as mode of action and organic approved materials were discussed in addition to pesticide resistance and residues as they pertain to chemical and biological control selection. Biological control concepts were introduced and illustrated with specific examples corresponding to live samples.

Co-presenting Technique

A unique feature of this session was the use of co-presentation with live images and reference information on two separate screens (Fig. 1). Two Extension Specialists concurrently provided

Fig. 1. Co-presenting background information and live specimens on two screens.

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Table 1. List of pest and beneficial arthropods included in the session.

Pests	Beneficials
Thrips (Order Thysanoptera)	Predatory mites *Neoseiulus californicus* (McGregor) *Amblyseius swirskii* (Athias-Henriot)
Twospotted Spider Mite *Tetranychus urticae* (Koch) (Arachnida: Acari: Tetranychidae)	*Phytoseiulus persimilis* (Athias-Henriot, 1957)
Aphids (Order Hemiptera)	Ladybird beetles, *Diomus* sp. and *Delphastus* sp. Order Coleoptera, Family Coccinellidae
Whitefly, *Bemisia tabaci* (Gennadius) or *Bemisia argentifolii* Bellows & Perring (Insecta: Hemiptera: Aleyrodidae)	Whitefly parasitoids: *Encarsia formosa* (Gahan), *E. sofia* (Girault and Dodd)
Generalist	Minute pirate bugs, *Orius* spp. Predatory gall midge, *Feltiella acarisuga* (Vallot) (Insecta: Diptera: Cecidomyiidae) Syrphid fly larva, Order: Diptera, Family: Syrphidae

complementary presentations featuring background information on one screen and live images of the featured arthropod as it was manipulated under a microscope on a second screen. The prepared information oriented participants to notable characteristics while the live feed allowed participants to watch the behaviors of the arthropod(s) and gain a sense of practical experience with identification. Specimens featured were chosen based on the likelihood that participants would encounter them in vegetable or ornamental plant production as well as the availability of the specimens in the field and lab. See Table 1 for a list of included arthropods. Short video clips of beneficials in action were also incorporated where available.

The final hour used hands-on identification of specimens under microscopes in stations around the perimeter of the room, followed by the post test and question and answer period. Participants received a hand lens, a copy of the latest Vegetable Production Handbook for Florida, biological control catalogs, and a prepared list of biological control producers.

Results: Pre and Post Test Comparisons

Comparison of the pre and post test results show that twice as many participants were able to properly identify three of the featured arthropods following the session. The change in correct responses improved by as much as 55% (Table 2). One question was removed due to an error in the post test. Overall conference evaluations showed 84% (n = 44) of respondents reported they could identify at least two more pest insects than before the session. More than three out of four respondents (79%, n = 42) reported they could 1) identify at least two more beneficial insects than before the session and 2) identify resources for insect identification and pest control information as a result of this session (86%, n = 42). An online article written by a participant from the Bahamas spoke highly of the overall conference and specifically referenced the hands-on interactivity of the "Good Bug, Bad Bug ID" session.

Table 2. Improvement in participants' ability to properly identify featured arthropods.

Arthropod	Pre	Post	Change
Ladybird beetle larvae	47%	92%	55%
Two spotted spider mite	18%	47%	29%
Predatory mites	24%	42%	18%
Flower thrips	56%	89%	33%
Predatory midge larvae	35%	39%	4%
Minute pirate bug	51%	97%	46%
Whitefly parasitoid	16%	46%	30%
Whitefly	76%	89%	13%
Healthy and parasitized whitefly nymph	56%	83%	27%

Impacts

The teaching methods employed effectively improved the ability of participants to identify pest and beneficial arthropods as well as available resources for identification and integrated pest management information. Proper identification is essential for the proper use of pesticides, and as such, these small farmers will be better prepared to properly apply pesticides in the future. Increased awareness of beneficial arthropods and ability to identify them will enable growers to monitor the activity of predators and parasitoids in their crops and reduce sprays accordingly if beneficial arthropods are observed to be helping suppress pests. In addition, increased awareness of commercially available biological control agents may increase their use and reduce the use of pesticides, ultimately reducing the risks for people and the environment.

Suggestions and Appreciation

The interactive nature of this session required extensive planning and coordination. Those considering conducting a similar session should consider their access to microscopes, projectors, and a camera with the ability to connect to a projector and a microscope. The quality of the session was largely a function of the available samples, and the cooperating entomology labs and staff were essential to the preparation and execution of this session. The authors are also grateful to Bob Hochmuth of the University of Florida's Research and Education Center in Live Oak for providing a set of microscopes and supporting equipment. In addition, the students of the Doctor of Plant Medicine Program,

University of Florida, Gainesville, greatly contributed by helping participants to use microscopes. The authors appreciate the excellent venue for teaching and learning provided by the organizers of the Small Farms and Alternative Enterprises Conference. A similar format will be used for a Vegetable Diagnostics 101 session to be conducted at the 2013 Small Farms and Alternative Enterprises Conference.

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