

Exploring Nectar Sources for Wasps That Kill Mole Crickets

Identifying nectar sources could help spread this biological control of mole crickets.

BY DAVID W. HELD AND C. M. ABRAHAM



An adult *Larra bicolor* wasp feeds on the white flowers of *Pentas lanceolata*.

OBJECTIVES:

- Determine the seasonal life history of *Larra bicolor* in the northern Gulf Coast.
- Determine the suitability of flowering plants as nectar sources for *Larra bicolor*.
- Determine if incorporating wildflowers on golf courses will facilitate the establishment of *Larra* wasps on those sites.

Start Date: 2006

Project Duration: Three years

Total Funding: \$29,232

L*arra bicolor*, an introduced parasitic wasp of mole crickets, has spread into the northern Gulf Region (Mississippi and Alabama) from where it was originally introduced in Florida.

This creates an opportunity for golf course superintendents in this area to utilize this biological control agent. This project is the first empirical research on *Larra bicolor* conducted outside of Florida, and it is necessary to determine the seasonal flight period in the extended range of this wasp.

From 2006 to 2008, wasps were monitored on four sites in south Mississippi. Across all sites, wasps were



The wasp egg hatches in about one week, after which the wasp larva feeds externally on the host mole cricket.

generally active during June through October, with an additional month of activity in fall 2007. This seasonal activity of *L. bicolor* is similar to that reported from the Florida panhandle (Gadsden Co.). Wasps were observed on flowers for about 13 hours (0700 to 1900 h CST) in August and 9 hours (0900 to 1700 h CST) in October. Sunrise, and not temperature, more likely triggers activity. Air temperatures in August when wasps became active were 81–82°F, whereas wasps were active when air temperatures were 65°F in October.

In August, a maximum of 14 females and 31 males were observed at once on flowers, compared to 3 and 25, respectively, in October. Males were almost always present on flowers during the hourly observations. Females, however, were observed on flowers for distinct periods (3 to 9 hours) each day. Females spend their time mainly hunting for hosts, only returning to flowers for nectar as needed.

In 2007 and 2008 we established a replicated garden of 16 plant taxa of flowering plants in 0.5m × 0.5m plots, arranged in a randomized complete

block design. Only two taxa, *Pentas* and *Spermacoce*, were visited by *L. bicolor*. White pentas was readily foraged upon by *L. bicolor*, and numbers of wasps were comparable to *Spermacoce*. Among pentas, white-flowered pentas was significantly different from either pink- or red-flowered pentas. White and yellow are common colors, attractive to day-active insects such as these wasps. However, there were several taxa in the garden with yellow and lighter-colored flowers that went unvisited by *L. bicolor*. Volatiles emitted from the plants likely determine wasp visitation to these flowers.

Attempts to trap or passively monitor this species previously have been unsuccessful. In fall 2008, an experiment was conducted using pan traps of various colors as attractants. Despite activity on adjacent flowers, wasps were not recorded in the traps. In 2009, trapping studies were conducted using phenylacetaldehyde (PAA) and floral extracts of *Spermacoce* and *Pentas* as lures. The objective was to verify the results of a previous study that demonstrated that *L. bicolor* could be trapped using PAA and floral vola-

tiles as a way to collect specimens for research or to passively monitor the continued spread of *L. bicolor*.

Field plots containing white-flowered pentas have been established on four holes at Grand National Golf Club, Opelika, Ala. These plants will serve as release points for *L. bicolor* on that course. Wasps will be collected from golf course sites in Mobile and Baldwin Counties in Alabama and released on the flowers at dusk.

SUMMARY POINTS

- *Larva bicolor* have a four- to five-month activity period in the northern Gulf region to parasitize mole crickets. Wasps are active mostly during daylight hours. Although the impact of insecticides on *L. bicolor* have not been evaluated, turf managers wanting to conserve these biological controls should consider making insecticide applications later in the day as numbers of foraging wasps wane.
- In two trials, pentas, particularly white pentas, recruited equivalent numbers of *L. bicolor* as flowering *Spermacoce verticillata*. Wasps don't appear to be visually attracted to flowers, and

CONNECTING THE DOTS

An interview with DR. DAVID HELD regarding his research on *Larra bicolor*, a parasitic wasp of mole crickets.

Q: Can you provide a brief history of *Larra bicolor*?

A: In the early 1980s, wasps were collected from Puerto Rico and introduced to five sites in Florida, but populations became established only near Ft. Lauderdale. In the late 1980s, wasps and parasitized mole crickets were collected from Bolivia and released to three sites around Gainesville, Fla. This release also was thought to be a failure until *Larra bicolor* was observed attacking a mole cricket and feeding on *Spermacoce verticillata* on the University of Florida – Gainesville campus in 1993.

Q: Given its current expanded range since introduction, do you think *L. bicolor* will eventually spread to all mole cricket areas in the United States?

A: I suspect the existing populations of *Larra bicolor* in North America can be sustained in the coastal areas where mole crickets are problematic. The range of mole crickets will be larger than that of the wasp, but most areas where mole crickets are problems (coastal areas) are likely to benefit from the incidental and intentional movement of *Larra bicolor*.

Q: Are wasps easily disturbed or could they become a nuisance for golfers?

A: The females on the turf are particularly skittish when people are around. However, most golfers won't ever notice or contact this wasp, even on sites where the wasps are abundant.

Q: Are there significant differences among nectar sources with regard to carbohydrate concentrations or nutritive value for foraging wasps? If so, how do pentas rank against the other plants included in your experiments?

A: Yes, there can be variation in composition, availability, and amount of nectar among various flowers. *Larra bicolor* has specific tastes in flowers, preferring pentas and a plant called *Spermacoce verticillata*, or false shrubby buttonweed. The basis for this preference is not yet known. Based on lab studies, wasp survival is comparable on both species, but I don't have data on specific nectar composition of these flowers.

Q: Can environmental factors such as soil and/or air temperatures be used to predict wasp activity?

A: We monitored air and soil temperatures during our experiments and found that both of these variables were significant predictor variables of wasp activity in August, but not in October. In August, wasps were active when air temperatures were around 81°F (27.2°C). Despite warm temperatures, wasps seem to "go home" just before dusk. Around dusk, wasps just fly off of the flowers where they have been feeding. We tried to follow them,

but it was nearly impossible to keep track of a dark-colored wasp at twilight. Wasps that don't leave before dusk won't leave the plant until morning, despite warm air temperatures.

Q: Do both wasp sexes have similar foraging activity? What time of day are female wasps most likely to parasitize mole crickets? How well is the parasitizing activity of *L. bicolor* matched to mole cricket activity in the United States on a seasonal basis?

A: Males and females have different flower feeding habits. Males, which don't attack mole crickets, are found on flowers almost all day long. Females come and go on flowers. Neither sex is active before sunrise, and activity, regardless of the time of year, continues until near dusk. Females hunt in the morning, which is likely tied to the fresh activity of the mole crickets, then hunting decreases. In the afternoon, females make more frequent returns to flowers to feed on nectar or possibly rest. Activity of *Larra bicolor* begins in late May or early June and continues through fall. In the spring, mole crickets complete their development and large nymphs and adults are available for parasitism. While the young nymphs are active (July through mid-August), populations of wasps decline slightly. By fall, there are large nymphs and *Larra bicolor* will attack them until October or later in some years.

Q: Based on your work, are you recommending that southern golf courses grow pentas or other members of the Rubiaceae plant family to attract *L. bicolor*?

A: If you know that *Larra bicolor* are present on the golf course, planting flowers is one way to supplement their diet and increase their longevity. I am hesitant to recommend other members of the Rubiaceae family because some, like *Spermacoce verticillata*, can reseed and become weedy. Ornamental annuals such as pentas are a non-weedy alternative. Pentas also are used extensively in butterfly gardens, and additional nectar sources adjacent to areas that are perennially infested with mole crickets may bolster *L. bicolor* populations.

Q: What information is necessary to demonstrate that this strategy of using parasitizing wasps for mole cricket control is successful? Are you convinced that this approach will prove successful?

A: The missing piece of the puzzle is a successful field test. It is difficult to manipulate parasitism under natural conditions. However, based on my observations, *Larra bicolor* are territorial. Once you have wasps recruited to flowers, they will come back throughout the season and year after year unless the flowers are removed or they are inadvertently killed. This suggests that a localized population of wasps may have a significant impact on mole crickets in the vicinity.

JEFF NUS, PH.D., manager, Green Section Research.

experiments using volatile attractants are being conducted.

- One paper summarizing this research is in review with *Applied Turfgrass Science*, and a thesis on this research has been published. This thesis research has been nationally recognized through a graduate student awards program sponsored by the Entomological Society of America.

RELATED INFORMATION

<http://turf.lib.msu.edu/ressum/2008/9.pdf>

<http://turf.lib.msu.edu/ressum/2007/12.pdf>

<http://turf.lib.msu.edu/ressum/2006/16.pdf>

<http://turf.lib.msu.edu/tero/v01/n08.pdf>

<http://www.plantmanagementnetwork.org/pub/ats/research/2008/wasps/>

http://www.midsouthentomologist.org.msstate.edu/Volume1/Vol1_2.html_files/vol1-2_002.html

http://midsouthentomologist.org.msstate.edu/pdfs/Vol1_2/vol1-2_002.pdf

DAVID W. HELD, PH.D., assistant professor, Department of Entomology and Plant Pathology, Auburn University, Auburn, Ala.; and CHERI M. ABRAHAM, graduate student, Department of Entomology, University of Georgia, Athens, Ga.