Golfdom'S PRACTICAL RESEARCH DIGEST FOR TURF MANAGERS

TURFGRASS TRENDS

GRUB CONTROL

Drubbing Grubs, Naturally

Tiphia parasitic wasps take on Japanese and Oriental Beetle grubs *By Ana Legrand*

The Japanese beetle, *Popillia japonica*, was first detected in Riverton, N.J., in 1916. It's believed this insect was accidentally introduced in infested nursery stock from Japan. Since then it has expanded its range, continuing to be a pest of ornamentals and turfgrass.

In 2008, surveys were completed to determine the extent of spring Tiphia parasitism on Japanese and Oriental beetle grubs. Collections were made at 12 sites that included public parks and golf courses in Connecticut.

Tiphia has been known as a parasitic wasp for decades. During the 1920s and early 1930s, U.S. Department of Agriculture entomologists imported *Tiphia vernalis* Rohwer (Hymenoptera: Tiphiidae) from Korea as a biological control agent against the Japanese beetle. C.P. Clausen and J.L. King, who spent several years in Japan and other parts of Asia searching for natural enemies of the Japanese beetle, led the effort.

T. vernalis, also known as the spring Tiphia, is a parasitic wasp that attacks Japanese and Oriental beetle grubs. The small insect is not harmful to people, and it's not known to attack any native beetle species (Ladd and McCabe 1966). With its help, populations of Japanese beetles are reduced in number from what potentially could be more severe infestations.

The USDA has made numerous wasp releases throughout the Northeast. *T. vernalis* was released in most of Connecticut's counties between 1936 and 1949. But since 1950, little information was available on the status of this wasp in the Northeast, and it was considered to be rare. However, a survey in Connecticut indicated that spring Tiphia wasps were widely distributed in the state (Ramoutar and Legrand 2007). Populations of the spring Tiphia have also been documented in Kentucky, Missouri, Ohio and Tennessee.

Tiphia wasps feed on extra-floral nectar from Peony Big Ben.

Spring Tiphia females are about a half-inch long and the males are about three-eighths of an inch long. These shiny black wasps are solitary. They don't live in nests or swarms, and they

Continued on page 50

IN THIS ISSUE

OUR SPONSORS

Continued from page 49

have only one generation per year. Male wasps emerge first and females emerge three to four days later. In Connecticut, spring Tiphia wasps are active from the first week of May to mid-June with a peak in numbers observed around the last week of May. Adult wasps feed on honeydew produced by insects like aphids, and they are seen on the foliage of maple and cherry. Tulip trees are reported as being one of their preferred plants for seeking honeydew.

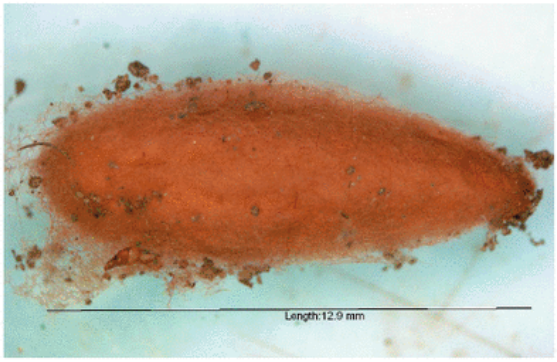
After mating, female wasps burrow into the soil discreetly and search for grubs. When a grub is found, the wasp stings it and paralyzes it momentarily while the wasp attaches one egg on the ventral groove between the third thoracic and first abdominal segments. When the wasp egg hatches, the resulting parasitic larva begins feeding on the grub. The parasitic larva securely attaches itself outside the host and feeds on the grub until the host grub dies.

The parasitic larva grows rapidly and the full-grown larva spins a papery, water-resistant, silken cocoon. Within the cocoon, it completes its development and transforms into an adult wasp. It passes the winter in this stage within the cocoon until the next spring when wasps emerge to start the cycle again.

Tiphia females live for about a month and may lay 40 to 50 eggs on as many different grubs. The female wasps seek out the Japanese beetle grubs in May to early June when the grubs are feeding before pupation.

Samples at the 12 sites were taken throughout June. Larvae collected during the survey were from European chafers, Asiatic garden beetles, Japanese and Oriental beetles. As expected, only the Japanese and Oriental beetle larvae were parasitized by the spring Tiphia. Previous research had shown the range of parasitism rates of this parasitoid to be 19 percent to 61 percent on Japanese beetle grubs (King and Parker 1950). In our survey, we found a range of 61 percent to 100 percent parasitism on the Japanese beetle grubs (see table on page 52). In addition, the spring Tiphia is also inflicting mortality on Oriental beetle populations with a parasitism rate ranging from 7 percent to 33 percent in low-density Oriental beetle populations. Reding and Klein (2001) found in an Ohio nursery the rate of *T. vernalis* parasitism on Oriental beetles ranged from 6 percent to 23 percent.

On average, parasitism of Oriental beetle was less than that found on Japanese beetle larvae, and we will continue work to determine possible reasons for this. Nevertheless, the spring Tiphia can be a significant source of mortality for the Japanese beetle, and it should be integrated with other management tactics.



(Above) The parasitic larva securely attaches itself outside the host and feeds on the grub. (Bottom) The full-grown larva spins a silken cocoon.

Summer Tiphia

While the focus of this article has been the spring Tiphia, there is another beneficial wasp by the name of *Tiphia popilliavora* Rohwer that was released as part of the biological control effort against the Japanese beetle. This wasp is commonly referred to as the summer Tiphia. It behaves in a similar manner as the spring Tiphia with the exception of the time when it is active and where it places its egg on the host grub.

We did not have much information on this wasp, but surveys done in 2008 showed it was

Continued on page 52

PHOTOS COURTESY: ANA LEGRAND

PARASITISM CHART

Percent parasitism of *Tiphia vernalis* on Oriental and Japanese beetle grubs from 2008 surveys in Connecticut.

Town	Oriental Beetle grubs/square feet	Percent Parasitism	Japanese Beetle Grubs/square feet	Percent Parasitism
Vernon	0		0.2	100
Manchester (a)	0.3	33	0.3	0
Manchester (b)	0		0.3	0
Farmington	0.4	0	0	
Meriden	1.9	0	0.5	67
Mansfield	0.3	33	0	
Thompson (a)	0		0	
Thompson (b)	0.3	33	0	
Pomfret	1.7	23	0.1	100
Coventry	3.1	7	0	
Tolland	0.2	0	0	
UConn,Storrs			0.8	61

Continued from page 50

present in Connecticut. The wasp is active from August to early September, and the collected wasps readily oviposited on Japanese and Oriental beetle larvae. The summer Tiphia attacks grubs in older stages of development (second or third instars) during late summer. The specific egg location for this wasp is in the crease between the fifth and sixth abdominal segments (Clausen et al. 1927). Future work will assess the parasitism rates of *T. popilliavora* on the Japanese and Oriental beetles.

One of the important questions to ask is how to conserve these naturally occurring wasps in order to benefit the most from them. The Tiphia species described here have been observed using nectar resources to supplement their diet. By providing nectar resources to the wasp, we could enhance their survival, spread and their efficiency in attacking grubs. Potential plants that harbor aphids for honeydew or produce nectar have been suggested in an effort to enhance populations of this beneficial insect. Research by Rogers and Potter (2004) in Kentucky examined the potential to recruit more Tiphia vernalis and Tiphia pygidialis using sugar water sprays and flowering plants. Peonies in their third year of planting were found to significantly attract more *T. vernalis*, and parasitism on Japanese beetle was increased from 1 percent to 3 percent in areas without peonies to about 24 percent in areas with the peonies.

In Connecticut, we're studying which peony cultivars are suitable for attracting the spring Tiphia in addition to finding other perennial plants that could be used to attract the spring and summer Tiphia without attracting or providing food plants to the pest beetles. In the future, we would like to suggest to the public the use of certain ornamental plants to enhance the activity of these beneficial insects as part of integrated pest management for Japanese and Oriental beetle grubs.

Ana Legrand is an assistant extension professor with the IPM Program in the University of Connecticut's Department of Plant Science.

REFERENCES

Clausen, C. P., J. L. King, and C. Teranishi. 1927. The parasites of Popillia japonica in Japan and Korea and their introduction into the United States. USDA, Dept. Bull. 1429.

King, J.L. and L. B. Parker. 1950. The Spring Tiphia, an imported enemy of the Japanese beetle. USDA, Agricultural Research Administration, Bureau of Entomology and Plant Quarantine, E-799, April 1950.

Ladd, T.L. and P.J. McCabe. 1966. The status of Tiphia vernalis Rohwer, a parasite of the Japanese beetle, in southern New Jersey and southern Pennsylvania in 1963. J. Econ. Entomol. 59:480.

Ramoutar, D. and A. Legrand. 2007. Survey of Tiphia vernalis (Hymenoptera:Tiphiidae) a parasitoid wasp of Popillia japonica (Coleoptera: Scarabaeidae) in Connecticut. Florida Entomologist 90(4): 780-2. http://www.fcla.edu/FlaEnt/fe90p780.pdf

Reding, M. and M. Klein. 2001. Tiphia vernalis (Hymenoptera: Tiphiidae) parasitizing Oriental beetle, Anomala orientalis (Coleoptera: Scarabaeidae) in a nursery. Great Lakes Entomologist 34: 67 - 8.

Rogers, M.E. and D. A. Potter. 2004. Potential for sugar sprays and flowering plants to increase parasitism of white grubs (Coleoptera:Scarabaeidae) by Tiphiid wasps