Tamarixia wasp (*Tamarixia radiata*)

Let's not forget about our friends.

By Lukasz Stelinski

Tamarixia radiata (Fig. 1) is a small wasp that parasitizes Asian citrus psyllid (ACP) and, in the process of using it as a food source for its larval development, kills ACP nymphs. The adult wasp lays an egg into the psyllid nymph, and the larval wasp feeds on the psyllid's "blood," essentially eating it inside-out. A single female wasp can lay up to 300 eggs. The adult wasp eventually emerges from the empty psyllid cadaver, leaving a distinct emergence hole (Fig. 2).

Because it kills its host, it is referred to scientifically as a "parasitoid" rather than a true parasite. True parasites feed on/within or otherwise exploit their hosts, but do not kill them. Recently, this little wasp has received a lot of attention in the press because of its release in California by University of California entomologists. The purpose of such planned introductions of otherwise exotic biological control agents, which is called "classical biological control," is to establish populations of parasitoids or predators of an introduced pest in order to regulate the pest's populations. This can be a very effective pest management tactic for exotic pests, which are typically introduced without their associated natural enemies.

Fig. 1 (left). *Adult Tamarixia radiata*
Fig. 2 (above). *Emergence hole on psyllid nymph cadaver left by Tamarixia parasitoid*

The *Tamarixia* wasp is native to

northwestern India. Release of the *T. radiata* wasp is credited with reviving the citrus industry in Reunion Island after its introduction from India in 1978, and the parasitoid caused substantial decline in ACP populations in Guadeloupe Island within one year of release. Presently, the parasitoid is found in Brazil, China, Guadeloupe, Indonesia, Mauritius, Mexico, Pakistan, Philippines, Nepal, Taiwan, Vietnam, Puerto Rico and the United States.

Classical biological control of ACP in Florida was initiated in 1999. Colonies of *T. radiata* and another wasp species were imported from Taiwan and Vietnam. The wasps were released in Florida in 1999, 2000 and 2001. The *Tamarixia* parasitoid became established throughout the major citrus-growing regions of the state. Currently, the parasitoid is also found in Texas and Puerto Rico, where it was not released intentionally.

While *T. radiata* reproduces at a very high rate, its effectiveness in suppressing psyllid populations under field conditions has been variable in Florida and other adjoining regions. Parasitism rates have averaged less than 20 percent during spring and summer and increase to 39 percent to 56 percent in the fall. Although these mortality rates are a positive contribution to reducing psyllid population densities in Florida in general, the action of this natural enemy alone has not regulated populations of ACP in Florida sufficiently to reduce the need for other tools, such as insecticides, or to reduce the spread of HLB.

One issue that complicates control of the psyllid with natural enemies is that ACP transmits a disease pathogen, and a single psyllid is capable of infecting a tree. In order for a classical biological control program to function robustly, a population of the pest is necessary to sustain the parasitoid or predator population. In other words, if the prey (pest) is killed off, the specialized parasitoids also die off because their food source disappears.

Maintaining a small population of a pest to sustain populations of natural enemies is often possible in crops that can withstand a certain low pest injury level below an economic threshold that causes reduced yield or crop quality. The issue with controlling a vector of a disease pathogen is that a pest threshold for preventing spread of disease is exceedingly low. Therefore, the equilibrium psyllid density that would be maintained under the action of biological control alone in Florida is likely higher than we can afford.

A compounding issue is that intense psyllid control with insecticides, which is believed to be effective in slowing the spread of HLB, is to a large degree incompatible with relying on Tamarixia, because these wasps are just as or more susceptible to the same toxins that kill psyllids.

However, there is a place for Tamarixia in an integrated control program for psyllids and HLB, and the added benefit of the wasps in reducing existing populations of psyllids may sometimes go unnoticed. It is possible that the action of biological control agents, like Tamarixia, may sufficiently reduce psyllid populations during certain times of the year that an insecticide spray may not be necessary.

Also, another type of biological control, called "augmentation," may prove useful for psyllid control and is being investigated by several growers and scientists in Florida and elsewhere. Augmentation is the mass rearing and periodic release of large numbers of natural enemies for short-term control of pests in small areas. In this case, one does not rely on an established population of the natural enemy and does not have to maintain a population of the pest, like in a classical biological control program. Also, such periodic releases can be specifically timed and "sandwiched" in between pesticide sprays so as to maximize complementary utility of both pest control methods.

Scientists continue to search for new populations of parasitoid wasps in areas of the Asian origin of ACP, with the goal of possibly finding more aggressive or otherwise effective strains of this natural enemy than those we appear to have currently. Although we can't at this point solely rely on these little wasps for management of psyllids in Florida, it's possible these barely visible, tiny wasps are eating some of your psyllids from the inside out.

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