The Effects of Parasitoid Behavior

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CONTROLLING IMPORTED FIRE ANTS

For over 60 years now, black imported fire ants (*Solenopsis richteri*) and the even more aggressive red imported fire ants (*Solenopsis invicta*) have been spreading through the American South. It was while surveying the ant species of Alabama as a high school student that Harvard University professor and myrmecologist E. O. Wilson first discovered the invasion of fire ants from South America.

Scientists at two research centers, Brackenridge Field Laboratory in Austin, Texas, and the USDA-ARS Center for Medical, Agricultural, and Veterinary Entomology in Gainesville, Florida, have looked to the ants' native ecosystems for the key to controlling them in the United States. In Argentina and Brazil, the researchers have found over a dozen species of phorid fly parasitoids that attack the native South American fire ants. Female flies inject worker ants with eggs that develop inside the ants and ultimately decapitate them, while male flies harass the ants, eliciting an alarm response and disrupting ant productivity.

Both Sanford Porter's group in Florida and Lawrence Gilbert's group at the University of Texas–Austin have imported several species of phorids and studied them for their potential in the biocontrol of imported fire ants. The first phorid species released, *Pseudacteon tricuspis,* is one of the more generalized phorid species; it attacks medium and medium-large imported fire ants but leaves the native US species of fire ant unscathed. *P. tricuspis* was released in Florida in 1997 and in Texas in 1999.

Initially released in several locations in central Texas, *P. tricuspis* has spread 3 to 10 miles per year from the initial release sites to an area encompassing over 4 million acres in central and southeastern Texas. Gilbert refers to the establishment of *P. tricuspis* in Texas as "getting to first base." This phorid species has not been able to adapt to some areas, such as southern Texas, and the consensus is that "the entire complementary suite of phorid species may be required to reduce the pest status of red imported fire ants," he says.

Three other phorid species have been released within the last few years: *Pseudacteon curvatus,* which parasitizes small ants and hybrids; *Pseudacteon litoralis,* which attacks medium-large to large ants; and *Pseudacteon obtusus,* the females of which can develop in a wide size range of ants (the sex determination of other phorid species depends on host head size, with larger heads required to produce females). Ant studies in South America show that it takes five to six phorid species to keep a fire ant species in check in its native habitat. "It is notoriously difficult to understand ant population dynamics," says Gilbert, and "other factors like climate are involved in complicated ways." (For more on imported fire ants, see *http://uts.cc.utexas.edu/~gilbert/research/fireants/.*)

QUIETING HAWAIIAN CRICKETS

In Hawaii, an introduced species of field cricket (*Teleogryllus oceanicus*) has encountered a species of parasitoid that is acoustically oriented to the mating calls of male crickets. The parasitoid fly (*Ormia ochracea*) co-occurs with the cricket populations of three islands: Kauai, Oahu, and Hawaii.

Marlene Zuk, John Rotenberry, and Robin Tinghitella, biologists from the University of California–Riverside, have been studying the impact of parasitoids on the cricket populations of the three islands. On their field trips to Kauai, where the tachinid fly's prevalence has been the highest, the researchers heard fewer male crickets calling each year from 1991 on, and by 2001 they had difficulty finding any crickets.

Although no cricket calls were heard on their visit in 2003, the scientists found a healthy—but silent—population of field crickets. Zuk's team discovered that, in under 20 generations, the cricket population on Kauai had undergone a startling adaptive response to the parasitoid: 90 percent of males have a wing mutation ("flatwing") preventing them from making a sound. The mutation has not been found in the cricket populations on the other islands.

The researchers performed experiments to determine how males with the flatwing mutation manage to mate when they can't signal to females where to find them. When the courtship song was played over a speaker in an area cleared of crickets, flatwing males responded more quickly and drew closer to the speaker than did normal-winged males. Females were observed mating with the flatwings in the experiments, suggesting that females either don't require the courtship song to mate or have become less choosy.

For now, the small number of normal-winged males still present in the Kauai population is calling for the whole population, and crickets of both sexes are drawn to the calling males to mate. (To read the study, see the 19 September issue of *Biology Letters.*)

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