Parasitic wasps keep on ticking

With chemical pesticides becoming increasingly regulated in the developed world – and prohibitively expensive in poorer countries – a tiny wasp is gaining a big reputation for its value as a "biological control." Each year, more than a million billion parasitic *Trichogramma* wasps are reared and released by farmers in the Soviet Union, China, the United States and Canada. Released at the peak of pregnancy, female *Trichogramma* seek the perfect place to lay their eggs: directly into the eggs of such agricultural pests as the cotton bollworm and the European corn borer. Consuming the host egg, the developing parasites grow to adulthood and fly away, leaving cotton and corn unblemished by would-be bollworms and borers.

Because of its usefulness as a biological control, *Trichogramma* has become the focus of considerable research. A study reported in the Aug. 21 SCIENCE now demonstrates that it is a much more complex critter than its size would suggest. Jonathan M. Schmidt and J. J. Berry Smith of the University of Toronto report that the wasp has a highly refined internal clock capable of measuring extremely short intervals of time. What's more, it can "calculate" spatial volumes based on temporal clues. Although the research may have no immediate effect on scientists' attempts to raise the wasps more efficiently, it serves as a reminder of how intricate even the tiniest animals can be.

"They are incredibly complex," Smith says of the wasps. "The whole insect is about the size of a protozoan – it could sort of hide on top of a period on a printed page. And yet they're quite sophisticated insects."

The sophisticated behavior that has baffled the Toronto researchers involves the method by which *Trichogramma* measures host-egg volume. Based on that measure, the wasp decides how many of its own eggs to inject into the host's egg. The measure is a critical one: If too many eggs are laid in a host egg, the developing wasp larvae compete to the death for limited nutrients and space. If too few eggs are laid, unconsumed portions of the parasitized egg begin to rot, killing the *Trichogramma* larvae.

Previous research excluded the possibility that *Trichogramma* uses visual or chemical clues to calculate host-egg size, so the researchers turned to the wasp's sense of touch. They knew that when an adult *Trichogramma* encounters a host egg, it engages in a complex series of meanderings on top of the egg. The researchers kept track of such variables as the number of transits over the egg, the number of contacts with the surface upon which the egg was resting, the longest and shortest intervals between such contacts and a number of other behavioral patterns. Only one behavior correlated with the number of eggs subsequently laid: the length of time of the wasp's initial walk over the "equator" of the egg.

To confirm the role of that initial transit, the researchers placed a tiny plastic shield over part of the host egg during the wasp's first transit. After the wasp had hit the shield, turned away and continued to wander the host-egg surface, they removed the shield so that subsequent transits covered the entire perimeter. The number of eggs laid was still proportional to the initial, shortened walk. Moreover, the measure was not a function of the number of "footsteps" taken – since wasps of varying size (and stride) take a different number of steps to cover a given distance. Rather, the crucial measure was time itself.

"If the wasp maintains a constant walking speed," the researchers conclude in their paper, "the duration of initial transit could give information about the exposed area of the host." But one question remained: Do large and small *Trichogramma* actually walk the same speed? Observing the little critters through microscopes with measuring devices, the researchers found that indeed they do.

"When just walking on a leaf, normal walking speed does seem to be faster in larger *Trichogramma*," Smith told SCIENCE NEWS. But when they bump into a host egg, he says, "they slow down, instantaneously, to about one-tenth their normal speed. And when they slow down, they seem to all slow down to the same speed, so something inside is compensating in a totally unknown and mysterious way for the body size of the insect."

He calculates that *Trichogramma* is capable of accurately measuring durations from less than half a second to more than 8 seconds. "How it works," Smith says, "is pure speculation." But if the mechanism is similar to the better-studied 24-hour clocks in other insects, it is probably "temperature compensated" as well – accurate despite extreme changes in temperature and metabolic rates. Not bad, he says, for a bug that "comes up to about the knee of a fruit fly." *– R. Weiss*

Punching holes in a sticky defense

Some insects have evolved a method of carefully draining a plant's latex-carrying vein system as a way to avoid contact with the gummy substance, say researchers studying "vein-cutting behavior" among insects.

Intrigued by a series of observations begun a century ago that suggest that plants use the sticky, toxic latex to protect themselves from insect attack, David E. Dussourd and Thomas Eisner of Cornell University exposed some of these so-called laticiferous plants to a variety of insects in their laboratory. As reported in the Aug. 21 SCIENCE, they confirmed that the clipping of leaf veins among certain groups of insects is not serendipitous eating, but a calculated attempt to render a plant defenseless by eliminating its latex.

Better known as a tropical source of natural rubber, latex also flows through more common plants like milkweed, dandelion and lettuce. Dussourd, now studying the chemical composition of latex at the University of Maryland in College Park, told SCIENCE NEWS that each of these plants is associated with specific vein-cutting insects. The insects themselves seem to display customized cutting behavior. Some insects studied at Cornell make simple cuts across the midrib of a leaf, while others cut circular trenches and then eat the latex-less center, say the authors. One type of caterpillar handles the intricate, looping vein system of the papaya leaf by chewing across the length of the leaf.

Dussourd, who believes latex contains a chemical that stimulates vein-cutting behavior, says the cutting may take an hour to complete. But the process apparently is efficient in emptying leaves of their latex, making them more palatable to insects normally repelled by latex's defense. While some insects included in the study avoided the sticky milk by deliberately draining a leaf's supply with a well-placed cut, the authors found that other freeloading insects apparently took advantage of leaves with latex supply-lines already severed by the vein-cutters. *– D.D. Edwards*

Eisner/Dussourd

A katydid called Amblycorypha rotundifolia *enjoys a lunch of Indian hemp after draining globules of unappetizing latex away from the leaf tip.*