A pair of star-crossed love bugs

USDA/Agricultural Research Service

Cotton bollworm larva (left) penetrates a soybean pod while tobacco budworm adults (right) mate on a cotton leaf. Both crops are favorite foods of these pest insects.

Romeo and Juliet are perhaps the most famous, but certainly not the only, pair of ill-fated lovers whose union was doomed by unsuitable lineage. In nature, such mis-matches—between species, that is—are avoided by special safeguards, called isolating mechanisms, that ensure a member of one species won't be attracted to a member of another. A team of U.S. Department of Agriculture researchers, however, found a way to fool Mother Nature and induced copulations between two species of insects. These pairings, they say, which proved fatal to both partners, may offer a new approach to biological control of two serious crop pests.

Don Hendricks, Juan D. Lopez and Ted Shaver of the USDA's Agricultural Research Service in Brownsville and College Station, Tex., tricked male cotton bollworms *(Heliothis zea)* into believing that female tobacco budworms *(Heliothis virescens)* were their own kind by confusing the males' sensory systems with synthetic sex pheromones. Pheromones are species-specific chemicals of communication. Once united, the moths became "mechanically locked," says Hendricks, because their genitalia did not fit together correctly. Eventually, the insects died.

Larvae of these moths are among the most serious of U.S. agricultural pests. According to the USDA, they cost farmers nearly $1 billion in cotton, corn and soybean losses each year. Current control consists almost entirely of insecticides, but "these substances are not very selective," Lopez told SCIENCE NEWS. They often result in the death of other species, including those that prey on *Heliothis*. Thus, the USDA has recently focused more on biological control of these pests. The most promising approach so far has been release of synthetic sex pheromones either to trap or confuse males looking for females. Sex pheromones, unique to each species, are among the isolating mechanisms that provide recognition of the right sexual partner.

When the researchers were testing various components of the tobacco budworm's sex pheromone to see which would be most potent in disrupting mating within that species, they found one compound, Z-9-tetradecenal, which was particularly effective. More surprising, they found it also made male cotton bollworms try to mate with female budworms.

The two species' pheromones share at least four compounds. "We think that Z-9-tetradecenal is a critical component of the tobacco budworm's pheromone—one that allows cotton bollworms to distinguish it from their own," says Lopez. The high concentrations of Z-9-tetradecenal probably blocked the bollworm's sensory systems so that they believed the pheromones — and the females — were their own. Once they copulated they could not withdraw, says Hendricks, "because genitalia in the insect world varies considerably and must be matched exactly for everything to work."

In addition to this lock-and-key fit and species-specific pheromones, there is a third isolating mechanism—separation in time and season of mating—that protects against inter-specific mating, and could limit the broad applicability of this technique, says Lopez. "But there are still some overlaps in these species," he says, "and these would be the times this kind of approach might work." *—L. Tangley*

EPA's lead rule—not everyone is happy

New lead-in-gasoline regulations, formally proposed by the Environmental Protection Agency last Monday, are expected to reduce automotive lead emissions 31 percent over the next 7 years when compared to what existing rules would have permitted. This new proposal represents a compromise to the many parties who have fought over it in recent months. And as such, no group is unconditionally pleased. But it is safe to say that the proposal has elicited general kudos from environmentalists and grumbling from the gasoline industry.

When the proposal first surfaced (SN: 8/7/82, p. 85), environmental leaders expressed reserved approval of its strengthening controls over leaded gasoline — the leading contributor of airborne lead, a health hazard (SN: 2/6/82, p. 88). Since then, the Office of Management and Budget has gotten involved in resolving what it had seen as an inequity in a timetable for ending preferential treatment to small refiners. The rules gave those in business on September 1976 an advantage over those who incorporated later. Interestingly, true refiners and environmentalists alike are happy with the outcome of OMB's action.

Unhappy (to put it mildly), is a segment of the gasoline industry known as blenders. Most blenders emerged only after 1977 amendments to the Clean Air Act allowed these firms to call themselves refiners. In fact, they are not refiners; they merely buy inexpensive refined raw materials, and blend them with lead to make leaded gasoline. By staying small, blenders qualified for special exemptions in the lead-phase-down timetable (permitting a more gradual introduction of the costly changes needed to make unleaded gasoline).

But beginning Nov. 1, 1982, the new rules take away those small-refiner exemptions from firms incorporated after Oct. 1, 1976 —a group almost exclusively composed of blenders. And only the smallest of the refiners left will be allowed a waiver of the new ceiling limiting lead in gasoline to 1.1 grams per gallon. (The small-refiner waiver permits use of up to 2.5 g/gal lead.)

"We're pleased with this equity," says Urvan Sternfels, president of the National Petroleum Refiners Association. "Cutting blenders out of the preferential treatment" given small refiners "takes into account the intent of Congress in 1977 to only permit real refiners—albeit small ones—any kind of advantage."

But, Sternfels adds, even true refiners are not totally pleased with EPA's proposal. The law currently allows refiners to use a total of 0.5 g/gal lead, based on their total — leaded and unleaded — production of gasoline. The new proposal calls for a limit of 1.1 g/gal averaged only across leaded grades. EPA figured that since refiners nationally produce about 55 percent unleaded gasoline, the 0.5 g/gal averaged across all grades was equal to 1.1 g/gal averaged across only leaded grades.

Not so, says Sternfels. "That number would probably be 1.2 or 1.3 g/gal if you took the situation that everybody is predicting for the end of the year when this rule becomes effective. And those extra tenths," he says, "will mean a big difference to refiners. It's about a 10 percent increase." *—J. Raloff*