AGRICULTURAL SCIENCE

Research Community Swats Grasshopper Control Trial

As chemical pesticides have gained a bad reputation as indiscriminate killers of good and bad insects alike, agricultural scientists trying to protect crops have been pinning their hopes on biological controls—combating pests with pests of their own. The U.S. Department of Agriculture (USDA) is, however, about to exterminate plans to test one such method this year, fearing the cure may be worse than the disease. Pests brought in to do the killing, they worry, could wipe out not just the target insects but beneficial species as well—just the problem that has given chemical pesticides a bad name.

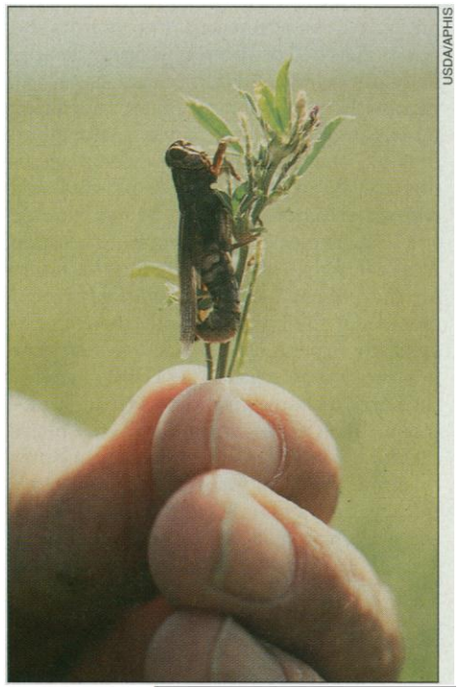
The target in this case is grasshoppers. Once or twice a decade on western U.S. rangelands, grasshopper populations boom, sometimes reaching 100 hoppers per square meter. Large areas of grazing land are nearly stripped bare, and what the grasshoppers eat, cattle cannot. So ranchers and government range managers usually turn to broad-spectrum pesticides such as malathion.

In 1987, after the worst hopper outbreak in 50 years (55 million acres infested; widespread crop and forage damage), USDA scientists realized that chemical control was not only environmentally unwise, but simply wasn't working. They began evaluating alternatives and eventually turned to some out-of-town help: The scientists imported two grasshopper enemies, a wasp and a fungus, from Australia.

The Australians do their dirty work in different ways. The fungus, *Entomophaga praxibuli*, lurks as spores among range grasses and latches onto a passing grasshopper. It then penetrates the insect's exoskeleton, where it grows rapidly, digesting the tissue of its unfortunate host and killing it. The wasp, on the other hand, is an egg parasite. *Scelio parvicornis* lays its eggs in buried grasshopper egg pods. The hungry wasp larvae hatch inside a grasshopper egg and ravenously devour the developing insect.

The fungus was released on small test plots in North Dakota and Alaska in 1989, 1990, and 1991. The initial results were promising, and in 1992 the USDA's Agricultural Research Service (ARS) planned to enlarge the fungus program with additional releases. But these plans got derailed when a dispute arose over a separate proposal to release the Australian wasps, bringing the whole notion of plaguing grasshoppers with imported pests under fresh scrutiny.

The fuss began in 1991 when Richard Dysart, a research entomologist with the ARS in Sidney, Montana, applied to the USDA's Animal and Plant Health Inspection Service (APHIS) for a permit to release the wasps onto test plots in three states. "The action, if successful, would reduce the amount of pesticides poured out on the habitat," says Dysart. But when University of Wyoming entomologist Jeffrey Lockwood learned of the planned release, he became alarmed. The wasp isn't particularly choosy about the grasshopper species it attacks. Yet only 10 to 15 of the more than 300 grasshopper species in the lower 48 states have the periodic population booms that turn them into real pests. The nontarget grasshoppers, Lockwood says, probably do no harm and in some cases may even do some good. For example, the species *Hesperotettix viridis* suppresses the poisonous snakeweed plant, which could spread unchecked if that particular grasshopper population plunged.



Death be not chemical. This grasshopper was killed not by chemicals, but by a fungus.

Lockwood and some colleagues took these objections to APHIS officials, prompting the service to do a more thorough assessment of both the wasp and fungus programs, beginning in 1992. The review, undertaken by a division of APHIS's Plant Protection and Quarantine section, has stalled the wasp release and halted further releases of the fungus. While results of the wasp assessment are not due until later this month, both Dysart and Gary Cunningham, the director of the ARS grasshopper control project, say the official in charge of the assessment told them 3 weeks ago that the wasp permit will be denied. The ARS entomologist in charge of the fungus program, Don Hostetter, has heard nothing about that evaluation, but since his funding is about to run out, even a positive reply will come too late. "I think this plan is dead in the water," he says.

ARS entomologist Raymond Carruthers, who helped initiate the fungus research, says that when the fungus was first released "there wasn't much concern about the impacts on nontarget species." Further research has shown that the fungus too has a fairly wide host range, encompassing not only some of the worst pests but many nontarget species as well. Both of these enemies do, however, appear to be restricted to grasshoppers, which makes them much more specific than chemical insecticides.

The fungus, Carruthers feels, as well as the wasp, have a built-in control mechanism that makes them safe to use: density dependence. They should only build up to large populations when there is a grasshopper outbreak. As the enemies cut short the outbreak, their own populations would crash. Rarer, nontarget grasshoppers would largely be spared from any attacks.

Lockwood, however, questions this logic. "Density dependence says that as the host declines, it becomes harder for an enemy to find," he says. "But if the enemy can switch hosts easily, it might continue to hammer away at the new host." He'd prefer the USDA to develop alternative techniques such as more specific native biological control agents and more surgical use of insecticides in baits.

Jerry Onsager, research leader of the USDA's Rangeland Insect Laboratory in Bozeman, Montana, agrees that it is impossible to predict all of the effects of a test release accurately. Yet he thinks the risks of harmful side effects from such a release are low and are worth it, because lab studies won't answer one crucial question: What wider environmental impacts will such a release have? "You either grit your teeth and take chances or spend the rest of your career doing cage studies, and in 30 years you won't necessarily know much," he says.

Lockwood, though, has a darker view. "Biological control agents are not bounded in space and time," he says. "Their impact will not decline as a function of time or distance from the release, if the releases are successful. If they're a bad idea, we can't get them back."

–Billy Goodman

Billy Goodman is a science writer based in Montclair, New Jersey.