Development Of Grasshopper Biocontrol Agents A Lengthy Process

By Lois Kerr

According to surveys done by APHIS (Animal Plant Health Inspection Service) in the fall, Montana could see a major grasshopper outbreak this summer, with 48 million acres affected by these pests. Because the public has voiced concerns about the use of pesticides to control grasshoppers, scientists have spent a lot of time looking for safe, natural methods to control grasshopper numbers.

One of these scientists, Stefan Jaronski, USDA/ARS Northern Plains Agricultural Research Lab research entomologist, Sidney, has spent nearly 34 years investigating the use of fungi to control various insect pests, and for the past five years he has worked on developing new fungi for use in grasshopper control. Jaronski, who has joined forces with scientists from APHIS to work on this grasshopper problem, believes that several strains of fungi show great promise. "There is a continual environmental need to find ways other than pesticides to control grasshoppers," Jaronski remarks. "There are currently two registered fungal controls but neither one is very effective on grasshoppers and they are cost-prohibitive for use on rangeland."

He continues, "There is a push to develop new fungal treatments. APHIS is very interested and in 2004 I began collaborating with a scientific team from APHIS on field trialing new fungi. We use 10-acre plots per trial, so this work can't be done with a backpack sprayer. Having help from the APHIS team has really opened up field trial capabilities."

Jaronski points out that the development of new fungi follows one of two paths. Researchers can find and develop domestic fungi, or they can go through the lengthy process of obtaining approval to import foreign fungi. Jaronski has opted to explore both routes. He began the process three years ago to import a fungus developed and commercialized in Africa that does a good job in controlling African locusts. "We've spent three years working on the regulatory process that will allow us to import and field trial a fungus from Africa, and we hope to have the permits later this year," says Jaronski. "This fungus is specific to grasshoppers, which makes it very environmentally safe. Based on field work in Africa, this fungus works very well to keep locust populations in check. There is another strain of the same fungus that is a commercial grasshopper control in Australia, but we are focusing on the African fungus."

Jaronski also researches in the lab and has tested in the field several strains of fungi discovered by Utah. "I'm also working on native fungi found in the U.S. Utah has over 1000 isolates of the two most important fungi that could be a source of good grasshopper control. We will field test some promising fungi beginning this summer in the Miles City area."

Jaronski and his collaborators have already tested some of these native fungi on Mormon crickets, insects that pose a serious threat in Utah, Wyoming and Nevada. Because Mormon crickets travel great distances in the course of a day, researchers had to cage test Mormon crickets to study the effects of the promising fungi. "Mormon crickets can travel up to a mile a day, usually in a straight line, and they are cannibalistic, so we had to devise a workable way to test the fungi on these insects outdoors, under natural conditions," Jaronski explains. "My colleagues from APHIS have a device that simulates aerial spraying on rangeland but sprays in a small diameter circle. We sprayed a small circle of ground, put down a cage, and inserted one cricket per cage. They were confined to treated ground so

A crew member applies the fungus under study to a 10-acre test plot.

Above: A grasshopper killed by fungus.

Left: Harvesting fungus for use in field trials.

we could monitor the cages, noting how quickly they died. We used 600 cages for one field test."

This summer, Jaronski will use 10-acre plots at Miles City and test the same fungi on grasshopper populations. This field trial will mark the first time scientists have tested fungi efficacy in this manner. "In June and July, we'll evaluate several of these native fungi against grasshopper populations," Jaronski notes. "Grasshoppers move around, but not like Mormon crickets do. We'll treat 10-acre plots with fungi and look at how the grasshopper population changes over a three-week period. We'll also collect samples of vegetation and expose grasshoppers to these samples to determine how much of the infectious fungi remains after three days and after three weeks."

He adds, "We'll also bring grasshoppers back to the lab and incubate them under conditions that fungi thrive in and compare those results with what we see in the field."

Jaronski explains that researchers compare grasshoppers in field studies with grasshoppers treated in the lab because a fungus may work very well in the lab under ideal conditions but fail utterly in the field because of environmental factors. "We're trying to understand the ecological limitations," Jaronski remarks. "Environment can affect the effectiveness of the fungus because grasshoppers and Mormon crickets can actively control their body temperature by basking in the sunshine. At night it gets cold and grasshopper body temperature may go from 98º at mid day to 35º at night, so a fungus has to deal with extreme body temperature fluctuations during a 24-hour period. Different fungi have different tolerances to high and low temperatures."

He continues, "We're trying to identify good fungi that work despite temperature fluctuations. We can get a feeling about a fungus in the lab, but we must see how it works in the field. This information will help us learn when we need to spray these fungi and how temperature affects them. Under lab conditions, grasshoppers die, but in the field they may not die, depending on temperature. That's why we compare grasshoppers in the field trials to grasshoppers treated under lab conditions. With a good fungus, there will be no difference in effectiveness."

Jaronski explains that as with chemical applications, microbial controls are used only in places where grasshoppers have become a serious economic threat. Once a population builds to a critical number, control mechanisms come into play. "We just want to drop the numbers down to a level where there is no economic impact," Jaronski remarks. "Fifteen grasshoppers per square yard is considered the economic threshold."

Rangeland provides a home to many insect species, unlike crop land that generally supports crop specific insects. Researchers therefore take extra care to ensure the health of the land. The object remains to keep a healthy balance of insects, not the total destruction of a particular species. "Rangeland is natural habitat and it contains a lot of different organisms that all have a role to play," Jaronski concludes. "Even grasshoppers contribute to nutrient recycling, and they are also food for the birds. We don't want to knock them out, we just want to keep them under enough control so ranchers can still economically use rangeland for their cattle."