Biology

An Aussie fungus among us

An Australian fungus that kills crop-destroying grasshoppers shows promise as a natural pesticide in the United States, according to scientists performing field trials in North Dakota. The fungus, *Entomophaga grylli,* produces a cocktail of enzymes capable of penetrating a grasshopper's tough outer skeleton. Having gotten through this protective barrier, the fungus circulates in the insect's blood, attacking body tissues and fat reserves. The grasshopper dies within a week, but the fungus lives on, producing spores that spread in the environment and attack other grasshoppers in the area.

Laboratory studies indicate the Australian fungus, like its U.S. relatives, does not harm other insects. Field studies, begun last month in outdoor cages containing carefully censused insect populations, so far confirm that the fungus affects only grasshoppers, reports Ray Carruthers of the U.S. Department of Agriculture's Plant Protection Research Laboratory in Ithaca, N.Y. The Australian variety kills a wider spectrum of harmful hoppers, spreads more efficiently to new hoppers and appears more heat resistant than U.S. strains of *E. grylli,* Carruthers adds. Some grasshoppers survive exposure to the U.S. fungus by "sunning" themselves for a few hours and raising their body temperature to about 100°F – a level comfortable for a grasshopper but lethal to the American fungus.

Once the U.S. scientists confirm the Aussie fungus' safety, they hope to infect batches of grasshoppers in laboratories, then release them in crop areas plagued by the voracious pests.

First field test of engineered virus

Researchers plan to begin the United States' first open-field test of a genetically engineered virus, starting in late July. Scientists from the Boyce Thompson Institute for Plant Research and Cornell University will spray genetically weakened viruses onto cabbage plants at Cornell's agricultural experiment station in Geneva, N.Y. They expect the viruses to infect and kill cabbage looper caterpillars. The Environmental Protection Agency approved the test June 12.

Scientists want to weaken the virus because a potent viral insecticide would be unsafe if it persisted in the environment.

To weaken the virus – one of a group of insect parasites called baculoviruses – the researchers removed a gene coding for a protein called polyhedrin, which shields the microorganisms against environmental damage. Early in an infection, baculoviruses replicate and spread from cell to cell as single particles. The polyhedrin gene normally switches on late in the infection, forcing the host cell to produce large quantities of polyhedrin. New virus particles become embedded in masses of polyhedrin, like raisins in raisin bread. Eventually the cell becomes engorged with polyhedrin capsules and bursts. After several days, the insect dies and the capsules disperse. The cycle begins again when a looper eats encapsulated viruses along with its cabbage.

Laboratory tests show that without the protective protein, "this virus doesn't have a prayer," says H. Alan Wood, project leader at Boyce Thompson in Ithaca, N.Y.

Wood first infects insect cells *in vitro* with a mixture of normal and altered viruses. Both end up embedded in polyhedrin produced by normal virus. After spraying the virus capsules on the cabbage, the scientists will monitor the rate at which altered viruses disappear. Wood predicts their levels will drop to undetectable amounts within two years. Some altered viruses in the lab appear to have regained the ability to trigger polyhedrin production, but the researchers are unable to detect such recombinants after several generations, he says.

If removing the gene debilitates the virus, says Wood, the finding could pave the way for making a faster-acting but still short-lived baculovirus – a melting magic bullet.

Food Science

A grain to weather climate change

Over the past 30 years, the world's "breadbasket" nations have helped feed an ever-growing number of mouths by using crop genetics, fertilizers and modern agricultural techniques such as soil drainage and pesticides. But the dramatic crop increases stemming from these measures "seem to be reaching their limits," according to a new report by the National Research Council in Washington, D.C. The planet's expanding population is moving onto former croplands, while crop soils themselves are eroding, salting out and acidifying (SN: 8/20/83, p.127; 10/6/84, p.212; 11/10/84, p.298; 9/24/88, p.204). Moreover, signs of a greenhouse warming point to greater climate variability in the future.

"Because of the limits to intensive agriculture and the probable climate changes," the report says, "arable cropping will have to expand onto increasingly marginal lands." And the best cereal for meeting this challenge, says the council's board on science and technology for international development, is a wheat-rye hybrid called triticale (trit-i-KAY-lee).

Though plant breeders hybridized this grain more than 100 years ago, it went generally unrecognized – and unused – until about the 1960s. By that time, cereal scientists had conquered its seed sterility and much of its disease vulnerability. Subsequent wide-scale testing and commercial introductions identified new problems: a tendency for low yields, shriveled grain, poor adaptability to new geographic conditions, premature sprouting, late maturity (often after killing frosts) and poor baking quality (dough from triticale flour didn't rise well).

Further development though the '80s has improved the grain considerably, the new report says. Today, triticale appears "notably more resistant" than wheat to a number of major cereal scourges – including leaf blotch, powdery mildew, smuts, bunts and other fungal infections. Tough outer seed husks and bristles discourage bird predation. Yields match wheat's on good soil and can outperform the best wheats by 20 to 30 percent on marginal soils. Researchers have developed varieties that mature over a range of season and day lengths. But triticale's biggest advantage may lie in its ability to thrive where most cereals founder – on soils that contain otherwise toxic levels of boron or are saline, sandy, acidic, alkaline, cold, infertile, dry or mineral-deficient.

Although much of the triticale currently under cultivation goes for livestock feed or testing, this crop ultimately "could become a major staple" in kitchens throughout the world, the new report says. Researchers have already developed new lines that produce doughs that rise as well as those made from wheat flour.

How food restriction affects immunity

Chronically underfed animals live longer than their heavily fed counterparts (SN: 8/27/88, p.142). They also tend to suffer fewer illnesses, including autoimmune diseases (SN: 10/8/88, p.228) – an observation that may help explain their longevity. But researchers have been hard-pressed to explain why diet restriction works.

Robert A. Good of the University of South Florida in St. Petersburg and his co-workers now report what they consider to be several potentially important clues. First, they showed that mice prone to autoimmune disease naturally produce two to seven times the normal amount of Ly-1$^+$ B-cells – a type of white blood cell involved in the production of autoantibodies, which attack the body's own substances. They also demonstrated that chronically restricting the diets of the autoimmune-prone mice to 60 percent of normal reduces the number of these potentially detrimental B-cells to a normal level.

The researchers report their findings in the June PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES (Vol.86, No.11).