MICROBIAL CONTROL OF INSECT PESTS

While many insects are important to agriculture and society, some are serious pests that harm crops, livestock, humans, and the environment. The damage they inflict and resources to control them cost the U.S. over $120 billion each year.

Heavy reliance on chemical pest control has led to problems including health and safety risks, environmental contamination, unintended harm to other animals, and pests that are resistant to the chemicals. In light of these concerns, safe, cost-effective alternatives are needed. Land-grant university researchers are working with USDA and industry partners to advance the use of microbes to infect and kill insect pests without harming humans, the environment, or other organisms. By providing effective pest control and reducing the use of chemical pesticides, microbial control could enhance the safety, sustainability, and productivity of U.S. agriculture and natural and urban areas.

Working together, scientists have been able to test many different types of bacteria, viruses, fungi, protozoa, and parasitic worms against a variety of agricultural pests in a wide range of crops and climates. Researchers also explored control options for bed bugs, ticks, flies, mosquitoes, ants, termites, grubs, and weevils that impact homes, businesses, recreation, and human health.

Recent studies have shed light on how microbes are transmitted to, infect, and kill host insects. Scientists also tested the effects of management practices on microbe abundance, diversity, and persistence. Other scientists determined how environmental factors influence the effectiveness of microbial control strategies.

Over the past five years, the group has filed multiple patents and worked with industry to make new microbial control products available. To help users select the best products and use them correctly, Extension offices are sharing information through workshops, conferences, fact sheets, and websites.

This group's research has shown that microbes can provide effective pest control for conventional crops and offer useful alternatives for organic crops and pests that are resistant to chemical control. Because other countries often have stricter limits for chemical pesticide residues on produce, microbial control can make U.S. crops more competitive internationally. In these ways, microbial control could play an important role in agricultural sustainability and ensuring food and economic security.

The fungal pathogen Isaria fumosorosea can be used to infect and kill Asian citrus psyllid, an insect pest that spreads costly citrus greening disease.

RESEARCH HIGHLIGHTS

Soil characteristics impact the diversity and abundance of microscopic worms that are parasites of insect pests. *University of Arizona*

In studies, parasitic worms were more abundant, but not as diverse, in soils from cultivated fields. Other studies suggest *Beauveria* spp. fungi are more common in natural habitats, whereas *Metarhizium* spp. fungi are more tolerant of disturbance. *Penn State University, Rutgers University*

In field tests, *B. bassiana* fungi were more persistent after using poultry manure or planting cover crops, but were less abundant in fields with manure build up. *Penn State University, USDA-ARS*

Beetles carrying fungi that control hemlock woolly adelgid pests are impaired by cold weather, whereas warmer temperatures reduce the ability of *M. anisopliae* fungus to control bugs in cotton crops. *Cornell University, University of Illinois, US Forest Service*

UV radiation can reduce microbe persistence, so applying treatments earlier in the spring may work best. *Cornell University*

Researchers designed new ways to bring pests into contact with pathogens. These include coating seeds with microbes, irrigation systems that deliver pathogens through the water, surface treatments that make it easier for parasitic worms to infect insects, treated mulch, oil sprays, bug vacuums, and traps.

Researchers are using pheromones to attract pests to tree trunks banded with fungus that infests and kills the insects. *Cornell University*

Researchers are using natural yeast strains to make bait that will better attract fruit flies to traps. *Michigan State University*

In a new "trap tree" strategy, growers apply attractant to trees along the perimeter of an apple tree grove and spray dropped fruit below the trees with a solution containing microscopic worms that will infect any insects attracted to the trees. *USDA-ARS*

Another newly designed trap uses bait to attract European red ants to stations covered in a fungus that kills the ants. *University of Maine*

To develop better insect traps, researchers are studying how microbes in the guts of fruit flies affect their feeding preferences. Research insights could also make it possible to control fruit flies by manipulating the microbes in their guts. *University of Florida*

Used together, resistant sugar beet varieties and fungi granules control root maggots, meaning growers could sustain production if chemical pesticides are not available in the future. *North Dakota State University, USDA-ARS*

B. bassiana fungus has played a role in the decline of problematic kudzu bugs across the Southeast. This fungus can also help control root aphids in organic celery fields, ambrosia beetles in avocado groves, and burrower bugs on peanut farms, helping growers maintain production. *Auburn University, University of California Cooperative Extension, University of Florida, Fort Valley State University, USDA-ARS*

Dipping tomato roots in a bacteria mixture worked as well as chemicals and helped California tomato growers control root knot nematodes. *UC-Davis*

Photorhabdus and *Xenorhabdus* bacteria species can control insects that spread pecan and peach diseases. *USDA-ARS*

A strain of *M. robertsii* fungi can control wireworms in corn polenta and millet granules and improve spring wheat yields in Montana. *Montana State University, USDA-ARS.*

Fungi can provide 50-80% control of thrips on roses in Florida, which have developed resistance to chemical insecticides. *University of Florida*

In trials at 50 sites, high-volume spray applications of *M. anisopliae* fungus along the property edges led to 20% tick mortality. *US Environmental Protection Agency, Novozymes Biologicals*

O. popilliae fungi can infect and kill Japanese beetles on golf courses and cargo airports where the beetles are serious pests. *Michigan State University*

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