United States Department of Agriculture
Animal and Plant Health Inspection Service
Program Aid No. 1794

Center for Plant Health Science and Technology National Programs

Molecular Diagnostics and Biotechnology

Who We Are

The Molecular Diagnostics and Biotechnology (MDBT) staff provides scientific support to the Plant Protection and Quarantine (PPQ) branch of the U.S. Department of Agriculture's (USDA) Animal and Plant Health Inspection Service (APHIS) on a broad range of issues related to molecular diagnostics and genetically modified organisms.

The MDBT program has three main focus areas. First, the team identifies, develops, or adapts appropriate cutting-edge technologies for molecular-based detection and identification of agents of interest to APHIS-PPQ. Molecular detection methods may be based on nucleic acids or proteins but may also utilize immunological or biochemical analyses. Second, MDBT's laboratories are also responsible for validating molecular assays that are destined for use by the regulatory community. Finally, the team provides scientific support for the development of genetically modified insects for the control of crop pests.

MDBT's activities are based upon a strong scientific foundation. The unit's vision is to identify and employ the best and most effective technologies available, thereby ensuring that PPQ delivers effective programs. MDBT develops robust, highly reproducible assays, ensuring that the deployment of genetically modified organisms is rooted in sound science.

Plum pox, a viral disease, can make stone fruits distended and unappealing. (APHIS file photo.)

What We Do

MDBT personnel evaluate technologies for their potential to improve APHIS–PPQ program management. Program activities include

- Obtaining, evaluating, or developing state-of-the-art technologies for molecular diagnostics of exotic pests.
- Validating molecular diagnostics.
- Providing training to personnel from other Federal or State laboratories on the use of specific molecular diagnostics.
- Providing quality assurance of accepted, validated molecular diagnostics.

For example, MDBT scientists are currently working on better ways to suppress populations of pink bollworm (PBW), one of the world's most destructive insect pests of cotton. Crop damage sustained from PBW infestations costs U.S. farmers more than $30 million annually. One of the key strategies PPQ employs to combat PBW infestations is the sterile-insect technique. CPHST technicians rear PBWs in specialized facilities and irradiate these insects, rendering them sterile. Upon mass-release, these sterile insects effectively suppress PBW populations, resulting in reduced production costs and increased efficiency. MDBT is also exploring the use of insects genetically modified to contain a mutated gene lethal to PBW in the wild.

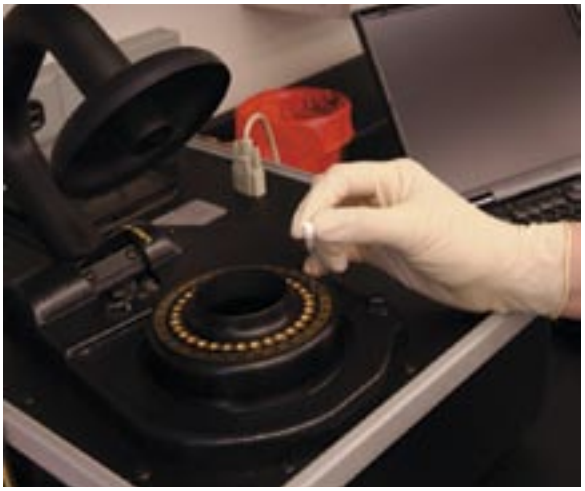
Plum pox virus also affects the leaves of susceptible plant species. (Agricultural Research Service photo by John Hammond.)

Where We Are Going

One of the primary functions of the MDBT program is to adapt and adopt new technologies, enabling APHIS-PPQ to meet its goals. Scientists at the National Plant Germplasm and Biotechnology Laboratory in Beltsville, MD, perform applied research and development of molecular diagnostics for regulated plant pests. Researchers at the lab use state-of-the-art technology to validate and improve existing diagnostic methods, and they develop methods when none exist. This facility also screens foreign germplasm introductions for exotic pests.

Other CPHST laboratories perform or develop molecular diagnostics for specific insects (e.g., Mediterranean and Mexican fruit flies) to support APHIS-PPQ regulatory programs. These activities provide key support for regional and State plant disease diagnostic laboratories, plant introductions, border inspections, and international trade. The MDBT group promotes ground-breaking control methods, such as its development and implementation of genetically modified insect pests as an alternative to chemical control strategies.

For more information, visit our Web site: <http://www.cphst.org>.



Real-time PCR assays for plant pathogen confirmation from emergency programs and national surveys. (USDA photo by R. Anson Eaglin.)

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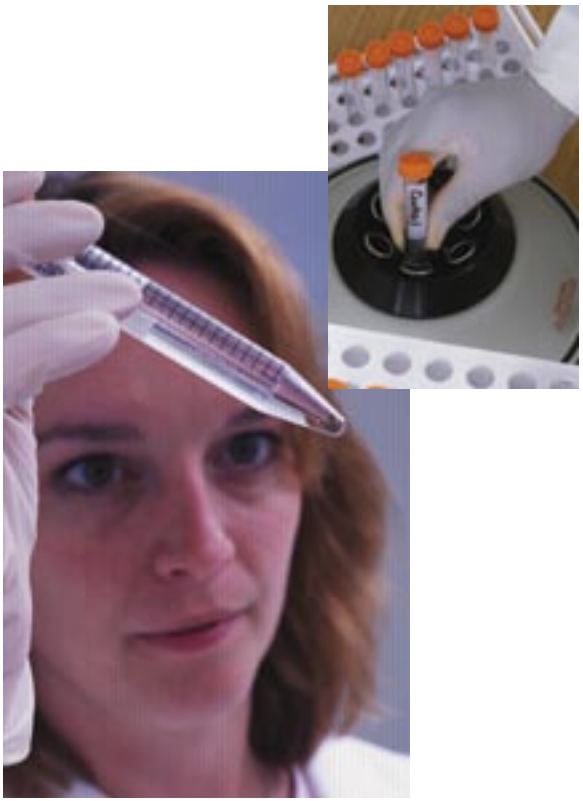

A PPQ scientist prepares a sample for genetic diagnostics using the polymerase chain reaction (PCR) test. (Agricultural Research Service photos by Scott Bauer.)

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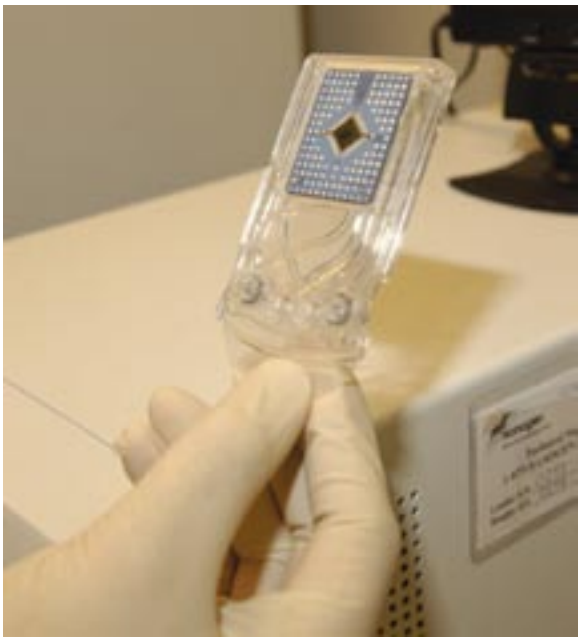

DNA (deoxyribonucleic acid) nanochip technology is under development to detect plant pests and pathogens. This technology can detect 100 targets simultaneously. (USDA photo by R. Anson Eaglin.)

Cover photo: The photo on the top shows pink bollworm larvae under normal white light. The image on the bottom shows the same larvae under ultraviolet light. Larvae 1, 3, and 4 (left to right) are expressors of the GFP transgene. *(APHIS file photo.)*

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