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Insect Management and Molecular Diagnostics Laboratory - Texas

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The Insect Management and Molecular Diagnostics Laboratory (IMMDL, formerly Mission) supports PPQ's programs by developing pest detection and management methods, mitigation strategies, and molecular diagnostic tools for insects and invertebrate pests.

The laboratory identifies, develops, and provides technology transfer of a wide range of scientific methods to PPQ and State departments of agriculture. In addition to these core functions, the laboratory cooperates with stakeholders and researchers to provide expertise to PPQ regarding geographic information systems, biological control, area-wide pest management, and sterile insect technology (SIT) support for the Mexican fruit fly eradication program. In addition, the laboratory leads the agency’s Unmanned Aircraft Systems (UAS) initiative to develop methods for the successful incorporation of new UAS technologies into PPQ programs.

The laboratory is responsible for developing and validating technologies used to detect and diagnose plant pests. The focus of the laboratory’s diagnostic work is on insects that cause damage directly to plants or that serve as vectors of plant disease, but molecular biological methods are also used to support production of beneficial insects through detection of insect pathogens in rearing populations. Methods developed at the laboratory include cutting-edge molecular approaches to

study nucleic acids such as High Throughput Sequencing, real-time PCR, isothermal amplification, and microfluidic genotyping. These have been used to complete confirmatory identifications, to track high-risk pathways of invasive species, and screening of insect genomes for new molecular tools. In addition, the laboratory is examining how recent advances in methods such as CRISPR and nanotechnology can be used in treatment of plant pathogens.

Recent Accomplishments

Expand All

Asian Citrus Psyllid/ Citrus Greening

- The IMMDL has developed methods to produce large numbers of beneficial insects for the biological control of the Asian citrus psyllid (ACP), and those methods have been transferred to state, federal and industry cooperators.
- Since 2011 a cumulative total of over 12 million biological control agents have been mass produced at the IMMDL for field releases in Texas (5.9 M), Louisiana (1.1 M), Tamaulipas (2.2 M), and Baja California (2.9 M).
- Field evaluations of ACP populations in South Texas indicate that psyllid populations have been reduced by more than 92% since releases first began in 2011, supporting the idea that augmentative releases of beneficial insects continue to have an effective impact on management of ACP densities.
- IMMDL scientists screened the impact of 13 selected commercial entomopathogenic fungi (EPF) in a total of 20 preparations which led to the selection of NoFly*Isaria*strain Ifr 9901 and Bioceres*Beauveria*strain ANT03 as the two-best performing mycoinsecticides for field trials. Field testing of these two strains are currently underway in the MAB citrus research grove.

Unmanned Aircraft Systems

- Three IMMDL personnel have been FAA qualified and trained as remote pilots to support the Unmanned Aircraft Systems (UAS) initiative within PPQ. The

addition of a methods development engineer has greatly increased our ability to customize UAS airframes, release and application devices to meet a wide range of programmatic needs for detecting crop diseases and damage, as well as developing methods to combat plant pests.
- Field trials testing the application of insecticidal baits for red imported fire ant has been completed, and applications for grasshopper and Mormon cricket are in the planning stage.
- Field trials of applications of ultralow volumes of spinosad with UAS for Mexican fruit fly control have been completed and have shown to be effective.

Mexican Fruit Fly Sterile Insect Technique

- Evaluated the use of an unmanned aircraft system (UAS) for release of sterile Mexican fruit flies. The study was designed to determine swath width of release flies, effect of a multiple UAS unit SWARM release, and evaluated fly dispersal across the 140 acre citrus groves using fly re-capture data.
- Developed backup Mexican fruit fly strain from Cameron County obtained from infested fruit collected around wild larval finds in 2019-20 in the Lower Rio Grande Valley of Texas.
- Provided assistance to PPQ canine handlers from Newnan, Georgia in training detector dogs for locating Mexican fruit fly larvae in citrus fruit.
- Provided training and technical transfer to Florida and Texas identifiers on the Ventral Receptacle Compression Technique. This method provides increased level of classifying the female mated status eliminating false positive mating which can affect determination of quarantines.
- An APHIS Science Fellow is investigating X-ray and E-beam as alternative means of sterilization of Mexican fruit fly. The X-ray irradiator meets required dose rate and penetration level, and E-beam evaluations are ongoing.

Molecular Diagnostics

- Developed and applied diagnostic methods for the identification of wild and commercial cotton variants of *Anthonomus grandis* to support the Boll Weevil eradication program.

- Developed and applied diagnostic methods to detect *Helicoverpa armigera* (the old world bollworm) in pathways entering the United States.
- Developed and applied molecular methods to identify the European cherry fruit fly, *Rhagoletis cerasi*, a pest that has recently been introduced into Niagara County, New York
- Developed and applied molecular diagnostics for fruit fly detections in California, Texas, and Florida from domestic trapping programs including the Mexican fruit fly, *Anastrtepha ludens*, Oriental fruit fly,*Bactrocera dorsalis*, and Mediterranean fruit fly, *Ceratitis capitata*
- Developed a molecular diagnostic protocol for detection of *Candidatus* Liberibacter asiaticus bacteria, the causal agent of citrus greening disease, from roots of citrus trees to support early detection.

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