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Plant Protection Today: How PPQ’s Science & Technology Lab Identifies Pests Using Molecular Diagnostics

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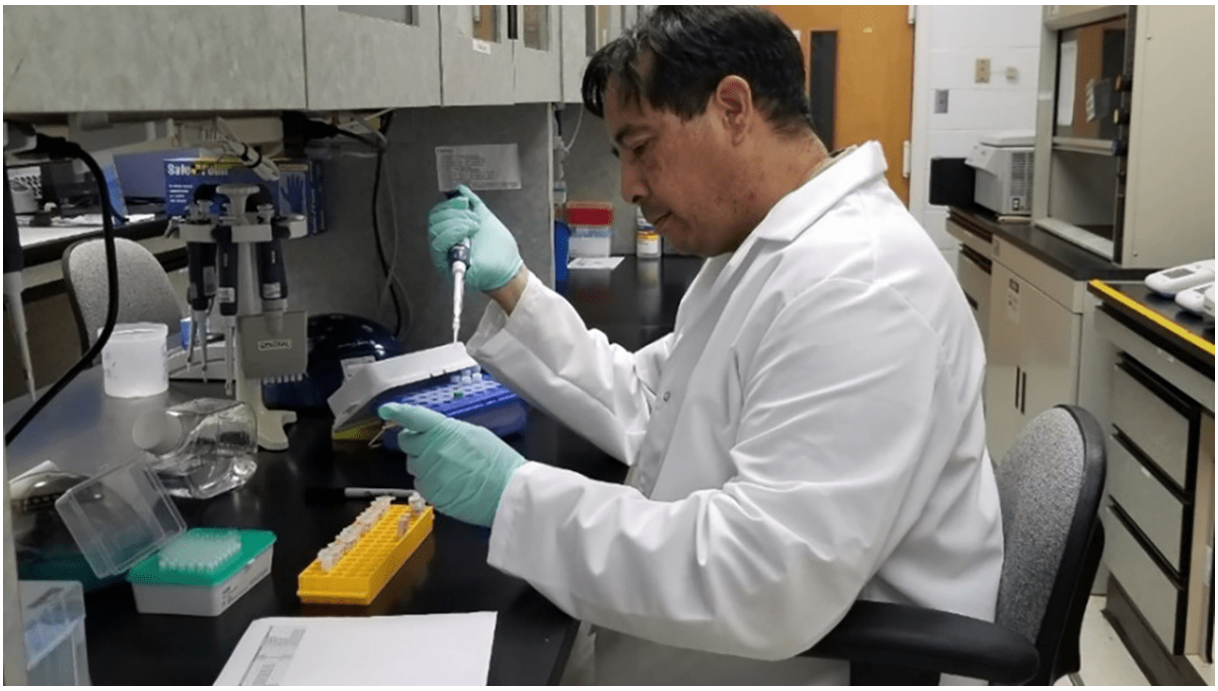


[Biological Scientist Terrance Todd performs a Polymerase chain reaction (PCR) on DNA extracted from captured tephritid flies. Amplified DNA will then be sequenced to determine the species.]

By April Dawson

Identifying Pests Can Be a Challenge, But Not With This Lab's Cutting-Edge Tools

Typically, identifying a fruit fly is routine work for the expert eyes of a USDA Plant Protection and Quarantine (PPQ) pest identifier, who carefully examines the pest's size, shape, and structure to determine the species. But when the insect specimen is highly degraded, making those characteristics unclear, PPQ needs some advanced technology to make the ID. That's where our PPQ Science and Technology comes in.

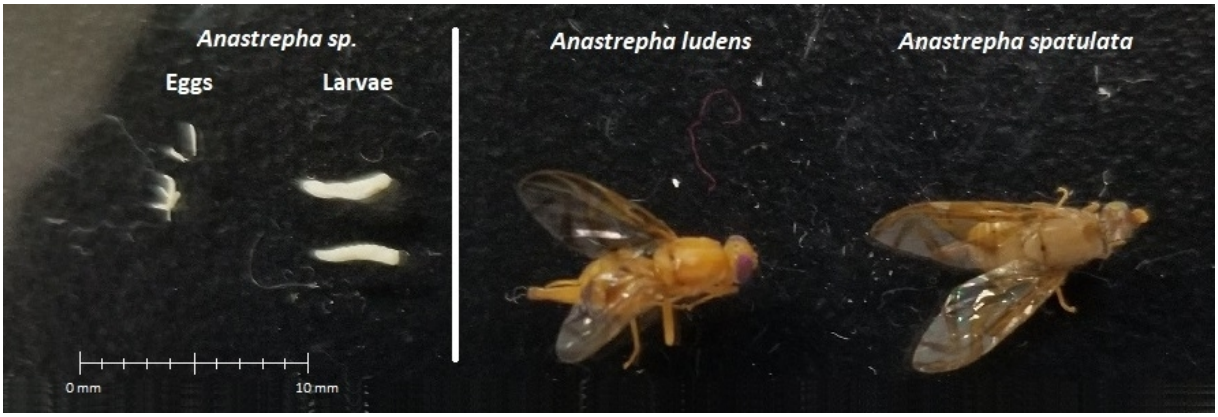
This scenario played out last month, when PPQ Science and Technology received an unusually decayed specimen of an adult tephritid fruit fly collected in Cameron County, TX. PPQ Science and Technology scientists turned to molecular diagnostic methods and successfully extracted, amplified, and sequenced DNA from this fly, and identified the insect to be a Mexican fruit fly (*Anastrepha ludens*). Exact results like this give PPQ a timely and accurate identification, which helps improve eradication efforts.

"This capture was an example where molecular diagnostics resolved a species-level question," said Terrance Todd, a Biological Scientist with PPQ Science and Technology. "Several species of fruit fly have a similar appearance to the Mexican fruit fly. Without the DNA analysis, PPQ would not have been able to confirm which of these pests was actually present. In this case, DNA sequencing confirmed the fly was of the same species that triggered this particular quarantine and was not evidence of an additional pest species in the region."

Another problem with insect identification occurs when early life stages of the pest are found. Most methods for identification are based on visual examination of the adult stage. The immature life stages of two species can look nearly identical. Because the DNA of an insect is the same throughout its life, molecular diagnostics can also be used to identify fruit flies when recently hatched as larvae and as eggs found inside the fruits. To ensure that these different life stages can be reliably identified, PPQ Science and Technology has developed enhanced extraction techniques for isolating high-quality DNA from these types of specimens

“In May of this year, we received an egg that was initially thought to be the egg of another *Anastrepha* species,” Todd said. “After testing using an optimized DNA extraction technique developed to isolate DNA from *Anastrepha* species eggs, it was identified as a Mexican fruit fly. This capture was located between two established quarantine zones, leading program managers to bridge the two areas to enhance eradication efforts. These examples show how molecular techniques can be used to enhance and support program activities.”

The Mexican fruit fly (Anastrepha ludens) is a pest of economic importance that APHIS attempts to control. Illustrated here are examples of various life stages for Anastrepha species that have been detected in the Lower Rio Grande Valley. DNA can even be isolated from a single egg, as shown to scale.



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PPQ Science and Technology supports PPQ’s programs by developing pest detection and management methods, mitigation strategies, and molecular diagnostic tools for insects and invertebrate pests.

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