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Insect Management and Molecular Diagnostics Laboratory - Arizona

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The IMMDL Phoenix Station's mission is to develop, adapt, and implement area-wide control technologies for program pests.

Current work includes developing control tools, methods, equipment, and support for rangeland grasshoppers and Mormon crickets, and navel orangeworm (NOW). Technologies currently in development include biological control methods using fungal pathogens, sterile insect technique, novel pheromones, more environmentally friendly insecticides, enhancement of ground and aerial delivery systems (e.g., using Unmanned Aircraft Systems or UAS), and geographic information system applications. The lab's scientists conduct extensive laboratory and field studies, at both smaller and operational scale to test and validate materials, methods, and equipment.

The primary mission of the lab's Rangeland Grasshopper and Mormon Cricket Management Team is to comply with Section 7717 of the Plant Protection Act and protect the health of rangelands (wildlife habitats and where domestic livestock graze) against economically damaging cyclical outbreaks of native grasshoppers and Mormon crickets in the 17 contiguous western states of the United States by testing and developing better, cheaper, and greener management methods on behalf of the APHIS Grasshopper and Mormon Cricket Suppression Program and its federal, state,

tribal, and private stakeholders. New methods are continuously identified and evaluated in order to maintain state-of-the-art status. Current work on navel orangeworm includes developing mass-rearing and sterile insect technique methods to be integrated in an area-wide management program to combat the pest in pistachio and almond production systems, primarily in California.

Recent Accomplishments

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Rangeland Unit

- Provided support, consultation, and review for the program's new Environmental Impact Statement (EIS), which was implemented in late 2019. This version includes chlorantraniliprole, an insecticide that was tested on both grasshoppers and Mormon crickets. Stakeholders have welcomed it to the program's toolkit as an alternative product that is especially useful for late-season programs on adult outbreaks, but it can be used on both adults and nymphs. Demonstrated the efficacy of 2% carbaryl bait on both grasshoppers and Mormon crickets at the rate of 5 lbs/acre, far lower than the recommended label rate. This rate also provides statistically similar mortality to higher rates, thereby decreasing costs, and is more environmentally friendly.
- Biopesticide work with selected *Metarhizium spp.* isolates is promising and ongoing using replicated lab and field cage studies with both grasshoppers and Mormon crickets, with optimization of pathogen persistence and mortality induction abilities being the primary focus.
- Unmanned Aircraft Systems (UAS) are under investigation to potentially enhance multiple program functions. Two such functions are enhancing survey and detection to more rapidly locate and treat population hotspots, plus enable safer and more targeted applications of bait and liquid insecticides.
- Collaborating continuously with the Global Locust Initiative to share methodology with others focused on similar grasshopper/locust management issues worldwide.
- Partnering with Arizona State University to rear a colony of *Melanoplus sanguinipes* (migratory grasshopper), one of the most widespread and

economically damaging grasshopper species in the U.S. Colony specimens are used year-round in many mission-oriented projects, both by Rangeland Unit and its many cooperators.

Navel Orangeworm

- Developed diet improvements for navel orangeworm (NOW) and transitioned to a formulation that is much easier to handle resulting in a reduction in labor.
- Made improvements to the moisture control system. New equipment was developed, tested, and incorporated in daily protocols. Timing of water addition was tested and adjusted to maximize production.
- Continued methods development testing for more efficient rearing techniques, including balancing the quantity of diet per rearing tray and egg density to produce the maximum number of moths per unit of floor space in the rearing facility.
- Facilitated mass production of adult moths for the NOW Pilot Project. 750,000 sterile moths per day were produced and released on tree nuts in California in 2019.
- Tested additional sterilizing irradiation dosages lower than the currently used dose.
- Testing additional genetic lines of NOW to produce moths that perform better in the field.
- Improved temperature control protocols during shipping. Made significant reduction in heat accumulation inside the aircraft release magazine.
- Conducted testing of lab quality control tests and release recapture tests in field cages to develop quality control tests that reflect field performance of moths.

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