Component II: Protection of Agricultural and Horticultural Crops

2h. Tropical / Subtropical Crops (U.S. Value 2007: $0.6 billion) (avocado, banana, cocoa, coffee, date, kiwi, macadamia nut, olive, papaya, pineapple)

***Problem Statement*:** Expansion of tropical / subtropical crops is limited by quarantine restrictions, market factors, and maximum yields due to the following pests:

- Mediterranean Fruit Fly, Oriental Fruit Fly, Melon Fly, Malaysian Fruit Fly, Olive Fruit Fly, Peach Fruit Fly, Mexican Fruit Fly (Hawaii, California, Florida, and Texas) and Other Fruit Flies (Hawaii, California, Florida, and Texas).
- Light Brown Apple Moth (California), Banana Moth, Nettle Caterpillar and Other Invasive Moths
- Coffee berry borer (Puerto Rico)
- Other Insect Pests: Cocoa Pod Borer (Micronesia), Coffee Berry Borer, (worldwide) Red Palm Mite (Florida), Macadamia Borer (Hawaii), Sweet Potato Weevil (Hawaii), Pink Hibiscus Mealybug (Florida), Glassy-winged Sharpshooter (Florida and California)

***Research Needs*:**

1. **Fruit Flies** *(Please see the Fresh Commodities section for coverage of this important group of pests).*

2. **Light Brown Apple Moth, Banana Moth, Nettle Caterpillar and Other Invasive Moths**

   Importance: Moths, such as light brown apple moth (LBAM) (*Epiphyas postvittana*), banana moth (*Opogona sacchari*), and nettle caterpillar (*Darna pallivitta*), are pests of various tropical /subtropical crops, limiting production, and may severely disrupt trade if not detected and allowed to become established in primary growing areas. LBAM also attacks temperate crops and has recently been identified in California as a new invasive species. Because LBAM threatens a multibillion dollar industry in California, alone, CDFA and APHIS, have asked ARS scientists to help develop methods for LBAM control.

   Research Gaps: Effective management of moth pests of tropical /subtropical crops requires the development of: 1) user-friendly, economical, and environmentally acceptable technologies; 2) area-wide integrated pest management (IPM) systems for moth suppression; and 3) systems approaches to prevent pest movement on export commodities.

   Actions: ARS will:

   Basic Biology

- Conduct studies of population dynamics and moth interactions with their natural enemies, host plants, and other pests in Hawaii and other ecosystems.

- Provide baseline information for development of low prevalence and/or moth-free zones, detection, control, containment, suppression, and eradication technologies for use on the United States mainland.

Surveillance, Detection and Monitoring

- Identify attractants from host and non-host plants, and determine physiological and environmental factors affecting or modulating moth behavior.
- Improve lure and trapping systems for surveillance, detection, and control of moths.

Control, Biological

- Assess the efficacy of sterile insect technology for control of moths and determine factors limiting its effectiveness.
- Evaluate field behavior of sterile moths.
- Improve quality of laboratory-reared insects compared to wild counterparts.

Areawide IPM Systems

- Develop areawide IPM approaches to reduce the economic impact of moths.

Commodity Movement

- Develop systems approaches for movement of commodities infested with moths. *Also see Subcomponent 4a: Fresh Commodities*

3. **Coffee Berry Borer**

Importance: The insect feeds solely on the coffee seed and causes worldwide losses estimated at more than $500 million on a yearly basis. It was detected in Puerto Rico in August of 2008, and has quickly spread throughout coffee plantations in the island.

Research Gaps: Due to the cryptic nature of the insect inside the coffee berry, it is imperative to develop user-friendly, economical, and environmentally acceptable technologies that can be effectively implemented throughout extensive areas. These include the use of traps, cultural practices, natural enemies, and fungal biocontrol agents.

Actions: ARS will:

Basic Biology

- Search for new natural enemies of the coffee berry borer in its endemic areas in Africa

4. **Other Insect Pests**

Importance: Cocoa pod borer (Micronesia), red palm mite (Florida), mirids (Africa), the macadamia borer (Hawaii), sweet potato weevil (Hawaii), pink hibiscus mealybug (Florida), glassy-winged sharpshooter (Florida and California) and a variety of other invasive insects can severely limit tropical/subtropical crop production, may severely disrupt trade, and if not detected become established in primary growing areas. Effective prevention and management strategies are needed to reduce their economic impacts.

Research Gaps: Expansion of the markets for tropical/subtropical crops necessitates development of effective pest management strategies that provide: 1) novel environmentally sound chemicals for pest control; 2) user-friendly, economical, and environmentally acceptable surveillance, detection and monitoring techniques; 3) sustainable economical area-wide integrated pest management systems for pest suppression; and 4) systems approaches for movement of export commodities.

Actions: ARS will:

Basic Biology

- Conduct studies of population dynamics and pest interactions with their natural enemies, host plants, and other pests in Hawaii and other ecosystems.
- Provide baseline information for development of low prevalence and/or insect-free zones, detection, control, containment, suppression, and eradication technologies for use in Hawaii and the United States mainland.

Surveillance, Detection and Monitoring

- Identify attractants from host and non-host plants and determine physiological and environmental factors affecting or modulating pest behavior.
- Improve lure and trapping systems for surveillance, detection, and control.

***Anticipated Products*:**

- Increased knowledge of the biology, ecology, behavior, genetics, and biological control of pests and their biological controls and of plant traits conferring pest resistance.
- Discovery, characterization, and synthesis of insect attractants, repellents, and disruptants.
- Identification and release of new biological control agents.
- Identification of plant traits that might be used to develop pest-resistant plants and development of plants with pest resistance.
- Novel methods of reducing the impacts of insect pests of tropical/subtropical fruits, vegetables, and ornamental plants including the use of trap crops for pest management.
- New or improved methods for pest sampling, detection, and mating disruption.

- Novel and environmentally friendly insecticides

***Potential Benefits (Outcomes)*:**

- New and/or improved tools for use in the detection, delimitation, control/eradication, and quarantine treatments for these pests that will allow for trade to continue.
- New attractants and formulations, knowledge of SIT and mating disruption, specific mitigations that could be included into systems approaches to quarantine.
- IPM tactics that are ecologically sound.
- Strategies for improved IPM of subtropical insect pests.
- Economical and sustainable area-wide IPM systems.
- Reductions in crop losses to insect pests of specialty crops and the plant diseases they transmit.
- Reductions in expenditures to manage insect pests.

***USDA ARS Resources*:**

- Postharvest Tropical Commodities Research Unit, Hilo, Hawaii
- Subtropical Insects Research, Fort Pierce, Florida
- Sustainable Perennial Crops Laboratory, Beltsville, Maryland
- Tropical Plants Pest Research Unit, Hilo, Hawaii
- San Joaquin Valley Agricultural Sciences Center, Parlier, California;
- Kiki de la Garza Research Center, Weslaco, Texas;
- Center for Medical, Agricultural, and Veterinary Entomology, Gainesville, Florida