

New World Screwworm Overview

New World screwworms (NWS), *Cochliomyia hominivorax*, are fly larvae (maggots) that infest living tissue of warm-blooded animals, causing a condition known as myiasis. Female NWS flies lay their eggs at the edges of wounds or on mucous membranes. The eggs hatch into larvae, burrow into the tissue, and continue to feed and grow. Infestations of NWS can be fatal if untreated. NWS is currently known to exist in parts of every country in South America except Chile, and in five countries in the Caribbean—Cuba, Jamaica, Haiti, the Dominican Republic, and Trinidad and Tobago. Eradication programs have been conducted in the United States, Mexico, Puerto Rico, the Virgin Islands, Curaçao (Netherlands Antilles), and all of Central America (except for the southern most part of Panama, known as the Darien Gap, that borders with Colombia and NWS endemic regions).

For more information on NWS see the following Foreign Animal Disease Preparedness and Response Plan (FAD PRoP) documents:

- ◆ *Disease Response Strategy: New World Screwworm Myiasis*
- ◆ Ready Reference Guide: New World Screwworm Maps & Timelines
- ◆ Ready Reference Guide: New World Screwworm Economic Impact.

Sterile Insect Technique—History

Sterile Insect Technique (SIT) employs the irradiation of 5- to 6-day-old NWS pupae with gamma radiation to create sterile NWS flies. When mass produced, the release of these sterile flies results in sterile male flies mating with wild female flies which then lay unfertilized eggs. Since female NWS flies normally mate only once, the population of NWS is progressively reduced and, ultimately, eradicated.

In 1928, Herman J. Muller at the University of Texas used a dentist's X-ray machine to expose male vinegar flies, *Drosophila melanogaster*, to radiation in order render them sexually sterile. In the 1950s, American entomologists Dr. Raymond C. Bushland and Dr. Edward F. Knipling developed a similar technique for male screwworms. USDA scientists performed an experiment in 1954 on the Caribbean island of Curaçao that used the SIT via aircraft to effectively eradicate NWS in approximately six months. Thereafter in 1957, the SIT was initiated in Florida to eradicate NWS from the United States, Mexico, and Central America.

The figure at right is an historical account of NWS eradication efforts; provided by, Babcock. ca. 1960. "Photograph "Loading Fly Cartons in Automatic Fly Dispenser Unit in Airplane." Special Collections, USDA National Agricultural Library. Accessed January 9, 2017, <https://www.nal.usda.gov/exhibits/speccoll/items/show/7012>.



Sterile Insect Technique—The Present

In current practice, sexual sterility is induced by gamma radiation at a dosage inducing no significant adverse effect on the males' longevity, searching behavior, or mating ability. Mating results in sterile eggs; ultimately eliminating the population of NWS flies that has become established.

If it is determined that use of the SIT is warranted to control and eradicate an outbreak of NWS myiasis in the continental United States, APHIS International Services (IS) oversees the production and shipment of irradiated (sterile) NWS pupae from the production facility in Pacora, Panama (right).

Presently, IS co-sponsors foreign pest reduction programs. The Screwworm Barrier Maintenance Program in Panama (COPEG) is one such program. COPEG is managed jointly by the United States and Panamanian governments and continually produces approximately 20 million sterile male flies each week. Flies are released at the Panamanian/Colombian border (also known as the Darien Gap) to maintain Central and North American NWS freedom. COPEG has the ability to ramp-up production when needed to respond to NWS infestations in previously free areas in partner countries.

On September 30, 2016 NWS was detected in the Florida Keys infesting endangered Key Deer. Soon thereafter, COPEG ramped up larvae production so that the SIT program could be initiated in the United States. At this point in time, January 2017, the ground release method (page 2) has been utilized.



Sterile Fly Production Plant—Diet Mixing Room

Historically, screwworms were reared by infesting rabbits or calves. By the 1940s, Bushland had developed a humane artificial diet consisting of lean ground beef, blood, water, and 0.2% formaldehyde to prevent decomposition. Current screwworm pupae diets are usually made with combinations of spray-dried whole bovine blood or meat protein, dry poultry egg, honey, molasses, and/or dry milk substitute.

The following are images from the production facility in Pacora, Panama.



Diet conveyor belt



Mixer, 4500 liter capacity



Dry diet mixer

Sterile Fly Production Plant—Rearing Room

Along with proper nutrition, many other factors impact the growth, development, survival, and overall quality of sterile screwworm production. Some examples are: temperature, relative humidity (RH), physical handling, and insect densities.



Rearing room @ 88°F, 60% RH



Mature larvae exit feeding trays



Collection

Sterile Fly Release

The simplest and most rapidly implemented dispersal of sterile NWS flies occurs through ground release, though aerial release is also possible. Ground dispersal chambers were used in Chiapas, Mexico during 2001 and 2003 outbreaks to augment aerial dispersal of sterile flies in specific areas. Ground containers were the sole means of dispersing sterile flies to eradicate outbreaks in Aruba in 2004 and 2011.

The pupae must be transported from the arrival airport to a handling site near the release area. This site can be as basic as an air-conditioned room, or an open air space shaded by a roof. At this point, the pupae must be transferred from the shipping coolers into their intended ground release containers. These containers may be cardboard or plastic boxes, or even larger structures, depending on the needs of the particular situation. Release containers (right) can be placed in the field as early as the day following arrival from Panama, or the emergence of the flies can be delayed for a few days by chilling the pupae to 50° F.

Ground release chambers are currently being utilized (as of January 2017) in Florida in response to the NWS detections in the State.



Release container used in Aruba, 2011
Source: USDA APHIS IS