HAWAII DEPARTMENT OF AGRICULTURE
ANNUAL REPORT FY 2006

PLANT INDUSTRY DIVISION

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The Division of Plant Industry consists of three branches, the Pesticides Branch, Plant Quarantine Branch, and Plant Pest Control Branch. Together, the Branches work to protect Hawaii's agricultural industries by preventing the entry and establishment of detrimental insects, weeds and other pests and by assuring the safe and efficient use of pesticides in Hawaii.

PESTICIDES BRANCH
Robert A. Boesch, *Manager*

PLANT QUARANTINE BRANCH (PQ)
Carol L. Okada, *Manager*

PLANT PEST CONTROL BRANCH (PPC)
Neil J. Reimer, *Manager*

The primary function of the Plant Pest Control Branch is to reduce population densities of plant pests that cause significant damage to agriculture and the environment to manageable levels. This is achieved through statewide programs to eradicate or control plant pests, which include destructive insects, mites, snails and slugs, noxious weeds, plant diseases, and any other organisms harmful to plants, by utilizing chemical, mechanical, biological, and integrated control measures. The Branch consists of the Biological Control Section and the Chemical/Mechanical Control Section.

Statistical data from the Plant Pest Control Branch may be found on pages ?????.

Some of the activities of the Branch during FY 2006 included the following:

New Pest Detection and Identification

Identified 527 samples of insects and other organisms from which 130 specimens were processed and added to the Branch's Zoological Reference Collection. The collection now contains approximately 166,200 specimens. In addition, 120 samples of insect specimens and 327 samples of plant diseases intercepted by the Plant Quarantine

Branch were identified and 223 calls regarding various pests were received from the general public and processed.

The branch recorded ten (10) new immigrant insects in Hawaii during FY 2006. Eight are plant pests, one is a fortuitous beneficial parasitic wasp, and one is a health concern. These were:

- **A mealybug**, *Hypogeococcus pungens* Granara de Willink (Hemiptera: Pseudococcidae). Specimens of this mealybug were collected from hibiscus at Waimanalo, Oahu, in September 2005. Infestations of this mealybug resemble those of the pink hibiscus mealybug, *Maconellicoccus hirsutus* (Green), but the clusters of *H. pungens* are generally smaller. On hibiscus, terminal shoots were mostly affected by this mealybug.

- **A mealybug parasitoid**, *Aprostocetus* sp. (Hymenoptera: Eulophidae). Specimens of this mealybug parasitoid were reared from an infestation of *Hypogeococcus pungens* Granara de Willink collected from joyweed, a bedding plant, at a retirement housing site in Pawaa in June 2006. This parasitoid does not match other *Aprostocetus* species in the HDOA Insect Reference Collection and is new to the State.

- **A mealybug**, *Rhizoecus americanus* Hambleton (Hemiptera: Pseudococcidae). After receiving a rejection notice from the California Department of Food and Agriculture, HDOA personnel inspected a nursery at Panaewa on the island of Hawaii and collected samples of mealybugs from fishtail palm, *Caryota mitis*. This detection represents a new State record for this species.

- **A thrips**, *Thrips imaginis* Bagnall (Thysanoptera: Thripidae). During surveys to study ants at Haleakala National Park on July 11-14, 2003, specimens of this thrips were collected from litter extractions and beating of pukiawe, *Styphelia tameiameiae*, within the Park. This collection in Hawaii represents a new U.S. record. The distribution of this thrips includes Australia, New Zealand, New Caledonia, and Fiji. It is known as the "plague thrips" in Australia. Crops, such as apples, pears, tomatoes, roses, and other flowers, are sometimes seriously damaged.

- **A coconut whitefly**, *Aleurotrachelus atratus* Hempel (Hemiptera: Aleyrodidae). Specimens of this whitefly were first found on Maui on coconut tree foliage at Kihei in May 2006. Surveys conducted several months later revealed that this whitefly was widespread in Maui's Central Valley. It has been recorded from coconut and other palms in tropical America, Samoa, and Florida. On Maui, nymphs of this whitefly have been observed to be heavily parasitized by a tiny wasp, tentatively believed to be a species of *Encarsia*.

- **European paper wasp**, *Polistes dominula* Christ (Hymenoptera: Vespidae). Specimens of this wasp were first collected in June 2006 by City and County of

Honolulu Parks and Recreation personnel on Oahu after workers were stung as they were trimming trees. This potentially aggressive paper wasp hides its nest in voids and other enclosures, thus increasing the risk for unexpected encounters with human beings. First recorded in North America in 1981, it has rapidly increased its distribution in the United States in the past 20 years. It is the most abundant paper wasp in countries around the Mediterranean, its native region. Its distribution also includes southern Europe, northern Africa, and the Middle East, eastward to China.

- **Asian citrus psyllid**, *Diaphorina citri* Kuwayama (Hemiptera: Psyllidae). Specimens of the Asian citrus psyllid (ACP) were first found in a sample of navel orange foliage submitted by a resident of Waiakea on the island of Hawaii in May 2006 for advice on an infestation of aphids. Subsequent surveys in the State revealed that ACP infestations were present only in the southeastern part of East Hawaii in the districts of South Hilo and Puna. Adult psyllids are small (3-4 mm), mottled, brown, winged, jumping insects. Immature psyllids, called nymphs, appear like greenish or dull orange, flattened scales. The host range of the ACP is restricted to citrus and other plants in the family Rutaceae, most favorably mock orange, *Murraya paniculata*, also known as orange jasmine. The ACP is a known vector of citrus greening disease (CGD), also known as Huanglongbing (HLB or yellow dragon disease) in Asia. This disease has devastated citrus trees in Asia, Africa, and Brazil. It causes mottling and yellowing of the veins of citrus leaves and misshapen, green, and bitter-tasting fruit. There is no known cure for this disease and the only option is to destroy infected plants. It is not yet known if CGD is present in Hawaii. Surveys will be initiated and samples collected and sent to a USDA facility at Gastonia in North Carolina for disease analysis.

- **An armored scale**, *Pseudaulacaspis brimblecombei* Williams (Hemiptera: Diaspididae). After receiving information from the California Department of Food and Agriculture about this armored scale being occasionally intercepted on cut protea flowers exported from Hawaii to California since 2003, specimens previously collected at Kula, Maui, in 2000 were reexamined at the UH-CTAHR Insect Diagnostic Clinic. Those specimens were determined to be identical to currently identified *P. brimblecombei* specimens, thus confirming a new State record. Subsequent surveys conducted in Kula in May 2006 resulted in the collection of additional *P. brimblecombei* specimens.

- **Avocado thrips**, *Scirtothrips perseae* Nakahara (Thysanoptera: Thripidae). Specimens of the avocado thrips were collected from the foliage and flowers of avocado, *Persea americana*, at Kula, Maui, in March 2006. Subsequent surveys revealed severe scarring on the fruit of avocado trees that were apparently caused by this thrips. The results of the surveys indicate that this species appears to be restricted to the Upcountry area of Maui. Literature information suggests that the avocado thrips is not suited to high temperatures.

- **Kelly's citrus thrips**, *Pezothrips kellyanus* (Bagnall) (Thysanoptera: Thripidae). Specimens of this thrips were collected from loquat trees at Kula, Maui, in January 2006. According to the UH-CTAHR Insect Diagnostic Clinic, specimens were previously collected on Maui in 2000. This thrips is known from Australia and New Zealand. In New Zealand, it is mostly found on citrus leaves, flowers, and fruits. Collections have also been made from the flowers of Compositae, *Lycopersicon*, *Brassica*, *Acmena*, and *Camellia*, and the leaves of *Sparmannia africana*.

Projects of the Branch's Biological Control Section included the following during FY 2006:

- **Nettle Caterpillar** [*Darna pallivitta* Moore]. *D. pallivitta*, after dispersing from its initial infestation site in Panaewa to Waiakea and Hilo in the South Hilo District and to Keaau, Kurtistown, and the Hawaiian Paradise Park (HPP) Subdivision in the Upper Puna District during FY 2005, continued to steadily extend its range of infestation. In FY 2006, the nettle caterpillar was commonly found in residential areas of Waiakea and Hilo and became widespread in HPP, extending southeastward into the Ainaloa Estates Subdivision. However, it is still confined to the southeastern portion of the island of Hawaii. Reports of sightings have been made on few occasions in Kona but none have ever been confirmed.

  Pest calls regarding this stinging caterpillar increased in mid-July 2005, mostly from HPP. This area is rapidly being developed so substantial numbers of landscaped house lots occur there now. In September, many calls continued to be received from HPP, but also from Waiakea, Waiakea Uka, and Kaumana. A total of 27 were received that month, most as a result of stinging incidents. Light trap counts of adults in HPP made by volunteers suggested some synchrony of the life cycle. The numbers of moths caught at lights were highest in September, following the outbreak of larvae. By November, only a single call was received, regarding the caterpillars.

  In a cooperative effort with HDOA-PPC Branch personnel in Hilo, Dr. Matthew Siderhurst (USDA-ARS-PBARC), funded by HISC, developed a pheromone lure for *D. pallivitta* males. Lures given to Hilo PPC personnel for trials were set out in Kona to try to confirm recent reports of the nettle caterpillar at three different sites. No moths were captured in the traps at any of the sites so its presence in Kona remains unconfirmed.

  Rearing of *D. pallivitta* in the Hilo Insectary continued to be a difficult challenge due to the infection of the larvae by a nuclear cytoplasmic polyhedrosis virus. It has become a routine practice to kill off the colony after enough pupae are collected because the infection becomes epidemic in the rearing cages. All supplies and equipment must then be sterilized and the colony restarted using eggs from the emerged moths of the last generation. Nonetheless, the Hilo

Insectary has so far been able to keep the HDOA Insect Quarantine Facility (IQF) in Honolulu supplied with larvae as needed for rearing the parasitoid that was introduced from Taiwan.

Exploration for nettle caterpillar natural enemies in Taiwan during October 2004 resulted in the collection of a parasitic wasp, *Aroplectrus dimerus* Lin (Eulophidae) that was found attacking *D. pallivitta* larvae. Host-specificity testing in the IQF was conducted to determine if this potential biological control agent will attack any non-target species, mainly native Hawaiian caterpillar species or species that have been introduced as weed biocontrol agents. The testing was completed and a report of the results is being written for submission to the Board of Agriculture to request the release of this biocontrol agent from quarantine.

Propagation of the parasitoid *A. dimerus* is continuing in the IQF, however, it is greatly dependent on shipments of *D. pallivitta* larvae from the Hilo Insectary. Laboratory conditions appear conducive to the spread of the virus that has plagued the *D. pallivitta* colonies for several years. After rearing the larvae for one generation in the laboratory, the colony becomes badly diseased and propagation stock is needed for further colonization. Thus, supplemental larval shipments are routinely sent from the Big Island, where the virus disease is less prevalent but still an ongoing problem.

- **Giant Whitefly** [*Aleurodicus dugesii* Cockerell]. The Giant Whitefly Biocontrol Project was terminated in FY 2006. There were no significant problems of this pest statewide. Although isolated outbreaks were detected in previous years, the parasitic wasp *Idioporus affinis* LaSalle and Polaszek (Hymenoptera: Pteromalidae) always managed to suppress infestations to low levels. The giant whitefly was first detected on Oahu during May 2002, followed by the discovery of *I. affinis* in March 2003 as a fortuitous biological control introduction. This parasitoid was found in association with the giant whitefly as an accidental introduction from California, where it had been purposely introduced from Mexico as a biocontrol agent.

- **Cardin's Whitefly** [*Metaleurodicus cardini* (Back)]. Surveys for this whitefly continued in the Hilo area, where it was generally found at low levels. Occasionally, it was observed in moderate numbers at different sites, although never becoming a problem due to the presence of predacious ladybugs and parasitic wasps. It has yet to be detected on any of the other islands. To date, it has not shown itself to be a significant pest on any ornamental plants or crops. Ornamental hosts identified so far include plumeria (*Plumeria* spp.), fiddlewood (*Citharexylum spinosum*), and golden dewdrop (*Duranta erecta*). Fiddlewood seems to be a preferred host, just as it is for the giant whitefly. On crops, it was detected on common guava (*Psidium guajava*), but densities observed in the Panaewa area were too low to have any effect on guava production. Citrus is the only other known crop host, but this whitefly has not yet been found on this plant in Hawaii.

It appears that this whitefly is under good biological control by the coccinellids *Halmus chalybeus* (Boisduval) and Nephaspis spp. and the parasitoid *Encarsia hispida* De Santis, as they suppress the densities of the whitefly nymphs. Survey counts of whitefly nymphs this year indicated that the giant whitefly was much more common wherever *M. cardini* had occurred previously.

- **Pickleworm** [*Diaphania nitidalis* Cramer]. The Pickleworm Biocontrol Project was put on hold for the present time in favor of the Erythrina Gall Wasp Biocontrol Project, which was given a higher priority due to the severity of the damage being inflicted on the endemic wiliwili trees as well as on introduced ornamental *Erythrina* species. Another critical consideration was that, based on surveys and discussions with commercial farmers, timely insecticide applications are very effective in controlling the pest. The pickleworm is already well dispersed on all four of the major Hawaiian Islands. A report from Maui indicated that only organic cucurbit growers are still having problems with the pest. A survey of an Oahu farm at Ewa in August 2006 revealed that the cucumber fields were free of pickleworm damage. The grower reported that he was not using any insecticides to control the pickleworm. He firmly believed that his crop rotation practices and physical barriers were keeping the pest out of his plantings. Funds for the USDA (CAPS) Pickleworm Survey Project were received in August 2006. Orders were placed to purchase traps and lures. A statewide survey of this pest will commence as soon as the traps and lures are received.

- **Glassywinged Sharpshooter** [*Homalodisca coagulata* (Say)]. An immigrant mymarid parasitic wasp, *Gonatocerus ashmeadi* Girault, played a major role in the fortuitous suppression of the population of the glassywinged sharpshooter (GWSS) in Hawaii. In all likelihood, *G. ashmeadi* arrived in Hawaii in association within parasitized GWSS eggs on infested host plants that were shipped from the southern United States, most probably California or Florida. The presence of the parasitoid was not apparent when the pest was first detected in early 2004. Heavy infestations were observed on a wide variety of plants and an average of six dispersing adults was consistently caught per yellow sticky card until November 2004. However, beginning in December 2004, the trap counts began to decline to fewer than half as many adults caught per trap. The dramatic decline in GWSS densities continued throughout much of 2005 and, by June 2006, no GWSS was trapped anymore.

  Concurrent to the rapid decline of GWSS, the very first evidence indicating the presence of *G. ashmeadi* in Hawaii was recorded in November 2004. Although GWSS parasitization was initially low (20%), by April 2005, the rates of parasitization had exceeded 90%. Periodic monitoring of GWSS eggs from at least seven locations indicated that 96% of 3,383 total eggs sampled from July to November 2005 were heavily parasitized. Subsequently, no parasitization data were generated because no GWSS eggs could be detected in the host habitat.

GPS surveillance, visual inspection of host plants, and egg sampling showed that the GWSS distribution was limited to the leeward side of Oahu. In addition to previously recorded hosts, tropical almond, *Terminalia* sp. (Family Combretaceae) and *Erythrina variegata* (Family Fabaceae) were also found to be infested by the GWSS. Although a small infestation was detected at Heeia in Kaneohe, continuous monitoring of the area indicated that the pest had not spread to other locations in Windward Oahu. Moreover, surveys conducted in February and March 2006 on Kauai and Maui showed that the GWSS had not yet dispersed to those islands.

- **Papaya Mealybug** [*Paracoccus marginatus* Williams and Granara de Willink]. The papaya mealybug (PM) was discovered on Oahu for the first time in September 2005 at Laie near the northernmost point of the island. Infestations were observed on papaya and hibiscus plantings. It was learned that the mealybugs were very likely introduced there from a nursery in Waimanalo that provided the hibiscus plants purchased by BYU-Hawaii to spruce up the campus for their Centennial Celebration. A visit to the Waimanalo nursery confirmed this information when PM infestations were found on hibiscus plants. It was disclosed that the nursery obtained some of the infested hibiscus from Maui, where the PM was first detected in Hawaii in May 2004. On Oahu, the PM was subsequently found in Downtown Honolulu and Hawaii Kai. So far, on Oahu, only generalist predators like syrphid larvae, brown lacewings, and ladybugs have been found in association with this mealybug. On Maui, however, a wasp, tentatively identified as *Anagyrus* sp. prob. *loecki*, has been found to parasitize the papaya mealybug and is exerting some control.

  A PM infestation was reported in June 2006 on some mature, fruiting, papaya trees at a Mililani residence in Central Oahu. It may have become established via a hibiscus plant that was purchased by the homeowner from a garden store in Waikele although he did not recall any infestations on the plant after the purchase. Ornamental plants, including hibiscus, are distributed to garden stores by nurseries in Waimanalo, where the PM is now well established. A follow-up survey of the Mililani infestation disclosed that the pest had already dispersed into the neighborhood. Heavy infestations were observed on a hedge of hibiscus, a papaya tree, and a rose-flowered jatropha shrub.

  Four shipments of parasitic wasps for biocontrol of the PM had been sent in June 2005 from a USDA affiliated laboratory in Puerto Rico to the HDOA Insect Quarantine Facility in Honolulu. Propagation of *Pseudleptomastix mexicana* Noyes and Schauff, one of three species of PM parasitoids, has progressed well and host specificity studies have been initiated following colonization. Rearing of the other two parasitoids, *Acerophagous papayae* Noyes and Schauff and *Anagyrus loecki* Noyes, was not successful and they failed to colonize. In the lab, *P. mexicana* appeared to be the most dominant of the three encyrtid species. After a while, the host plants for rearing the mealybug was switched from potato

sprouts and sweet potato plants, used by the USDA lab, to papaya plants in an attempt to increase host density and parasitoid production.

- **Macadamia Felted Coccid** [*Eriococcus ironsidei* Williams]. The macadamia felted coccid (MFC) was first discovered in February 2005 in a macadamia nut orchard at Honomalino in the South Kona District of the island of Hawaii. Initial fears that this pest would spread rapidly and cause crop losses have not been realized. The grower has gained good control over the infestation using horticultural oil that had been tested and recommended by a UH-CTAHR entomologist. An outbreak was occurring in a mauka field of approximately 25 acres when the scale was first detected. Since then, the lower branches of the trees were attacked by boring beetles (probably Scolytidae) and many of the branches died. The manager mentioned that variety 344 (also known as Ka'u) was more susceptible to the MFC and damage seemed worse where canopies were denser. He was not overly concerned about the "biological pruning" of the branches because the trees had been planted too close together and were effectively pruned by the pest. The infestation was brought under good control with spray application of the oil. The MFC has not been much of a problem in other parts of the orchard.

  A macadamia nut seedling nursery, which is a part of the business owned by the infested orchard, has been checked regularly by PPC staff personnel for MFC infestations and also to ensure that the plants being sold are sprayed by the nursery employees. No sign of the MFC has ever been observed at the seedling nursery. These plants are being sold to other growers so they present a risk of spreading the MFC to other parts of the island. An insect growth regulator will be tested by the UH-CTAHR researcher when MFC populations are high enough on infested trees in the orchard. This product may prove to be very beneficial in keeping the seedlings from becoming infested.

- **Erythrina Gall Wasp** [*Quadrastichus erythrinae* Kim]. The erythrina gall wasp (EGW) was first discovered in Hawaii in Honolulu in April 2005 and rapidly dispersed throughout the island of Oahu. Within six months, it had spread statewide and devastated nearly all of the most susceptible species of *Erythrina* trees. The alarming rate at which it spread had researchers both in the government and private sectors scrambling for ways to combat the invader with only limited success using imidacloprid formulations.

  The Erythrina Gall Wasp Biocontrol Project was initiated in August 2005 with the planning of an exploration by the Branch's Exploratory Entomologist in East Africa in December 2005. Preparation to receive shipments of natural enemies required information on the gall wasp biology and its development on *Erythrina* plants. No life history data was found in scientific literature because this wasp was a newly described species. Thus, studies were initiated in the HDOA Insect Propagation Facility by the EGW Project Leader and Assistant. *Erythrina variegata* was chosen as the host plant to conduct these studies because of its

susceptibility to the gall wasp, availability of seeds, and ease of propagation. Seeds were an efficient way to grow uniformly sized potted plants for laboratory work. Scarified seeds germinated in seven days and produced seedlings, six to eight inches tall, in three to four weeks. Plant pests, mainly mites, thrips, and a fungus disease (powdery mildew), have presented problems during plant propagation. Plants are constantly monitored and routinely culled to eliminate pest infestations. EGW biology studies were also undertaken to determine the relationship with its host plant. Laboratory testing and observations were done to determine what plant parts were attacked and how long the different wasp stages required for development.

The search for EGW natural enemies evolved into a cooperative effort between the University of Hawaii (UH-CTAHR-PEPS) and the Hawaii Department of Agriculture (HDOA). Africa was determined to be the best starting point for the search based on literature information, such as the number of endemic *Erythrina* species in those countries and the presence of *Quadrastichus* species in South Africa. Another decisive factor was the proximity of two islands off the coast of East Africa, Mauritius and Reunion, where initial outbreaks of the EGW were reported. UH-CTAHR researchers selected Kenya, South Africa, and West Africa (Benin, Ghana, and Togo) for their exploration because of their professional contacts in those places. HDOA biocontrol practitioners chose to concentrate their search in Tanzania because of its geographical location in East Africa and the highest number of endemic *Erythrina* species in all of Africa. However, the HDOA explorer began his trip in South Africa to check out the report of the presence of some species of *Quadrastichus* and to take advantage of better travel and shipping options. Nevertheless, the highest priority for the HDOA Biocontrol Program is to determine the native origin or range of the target pest species and to collect parasitoids found in association with the specific target species, or those very closely related to it. This strategy gives the best chance of finding biocontrol agents that will be highly specific to the target pest species.

Collaborators of the UH researchers in Africa sent one shipment each of galled *Erythrina* leaves from their respective countries, the first from South Africa during December 2005 and the second from Kenya during January 2006. The HDOA Exploratory Entomologist began his travel in late December 2005, collecting extensively in Tanzania and South Africa, and making a total of six shipments before returning to Honolulu in February 2006. Three UH researchers traveled to South Africa and made four shipments during April 2006. Another UH researcher made collections from Benin, Ghana, and Togo during May and June 2006 and sent back three shipments. As a result of these explorations, three potentially promising parasitoid species have been colonized in the HDOA Insect Quarantine Facility (IQF) in Honolulu. Specimens have been sent to specialists for species determination. This may take quite a while because, like the EGW when it first invaded Taiwan, Singapore, Mauritius, and Reunion in 2004, these parasitic wasps will most likely be found to be unknown species so they will have

to be described by specialists and given a species name. One species belongs to the family Eurytomidae and the other two to the family Eulophidae. Each parasitoid will have to undergo host specificity testing in the IQF to determine that it is suitable for release in Hawaii as a biocontrol agent to suppress EGW infestations. The data collected from the studies must provide assurance that the release will have minimal risk of impact on non-target organisms and native ecosystems in the Hawaiian Islands.

- **Asian Citrus Psyllid** [*Diaphorina citri* Kuwayama]. The Asian citrus psyllid (ACP) was found accidentally in May 2006 when a resident of Waiakea, a suburban residential area adjacent to and southwest of the City of Hilo on the island of Hawaii, submitted a branch from a navel orange tree that was infested with aphids to the HDOA Lanikaula Office for control recommendations. During microscopic examination of the aphids by PPC Branch personnel, one adult psyllid and some nymphs were found. Since no psyllids occur on citrus in Hawaii, the psyllid was believed to be the ACP on the basis of literature information about its recent invasion in Florida. Transmission of digital photos of the specimens initially, followed by the shipment of mounted specimens to the USDA Systematic Entomology Laboratory in Beltsville, Maryland, confirmed the identification as *D. citri*. The association of the ACP as the primary vector of citrus greening disease (CGD), known in Asia as Huanglongbing (HLB), resulted in the immediate shipment of a sample of chlorotic foliage from the infested tree at the Waiakea residence to the National Plant Germplasm and Biotechnology Laboratory in Beltsville, MD. The results were negative for CGD, caused by the bacterium *Liberibacter asiaticus*. However, only one citrus foliage sample has been sent to the USDA lab for detection of the bacterial DNA. Funds are being sought to ship more samples for diagnosis.

  By the end of May 2006, surveys of East Hawaii had been made from Waimea to South Point Road by a joint effort of HDOA personnel (PQ and PPC Branches) and USDA-APHIS-PPQ personnel stationed in Hilo. The ACP distribution on the Big Island was determined to be extend from the original detection site in Waiakea north to Papaikou, southeast to Kalapana, and southwest to Glenwood and Ainahou Ranch (within Hawaii Volcanoes National Park). Island-wide surveys for the psyllid continued through June. Preliminary surveys of all districts except North Kona for the ACP were completed with negative results. Surveys focused on mock orange, *Murraya paniculata* (also known as orange jasmine), because it is the preferred host of the ACP, and on residential citrus plantings because of limited commercial plantings in Hawaii. No ACP was detected during cursory surveys in West Hawaii. A GIS map has been generated by the Hilo PPC staff to show its range of establishment.

  Samples of mock orange foliage infested with psyllid nymphs have been collected from several sites around Hilo to hold for parasitoid emergence. None had been recovered by the end of June. Some ladybird beetles, including *Halmus chalybeus* (Boisduval), *Olla v-nigrum* (Mulsant), and *Coccinella*

septempunctata L., have been observed in association with the ACP nymphs.

- **Ivy Gourd** [*Coccinia grandis* (L.) Voigt]. Propagation of the ivy gourd gall weevil, *Acythopeus burkhartorum* O'Brien, was terminated at the end of September 2005. The final two releases, consisting of 20 and 126 adults, were made on September 26 and 27, respectively, in Waimanalo along Kalanianaole Highway near Sea Life Park. Propagation and establishment of this ivy gourd biocontrol agent has experienced difficulties because of its long life cycle, need for shady conditions, and probable field predation by ants and birds. Establishment had been spotty and, despite limited success at some sites, may now be in doubt. Fortunately, the ivy gourd vine borer and ivy gourd leafmining weevil are well established and widespread on Oahu, as well as in Kailua-Kona on the Big Island. They are having significant impacts in suppressing ivy gourd population densities. Ivy gourd is now commonly observed only in localities, such as Waimanalo, Kahuku, and Waialua on Oahu, where the microclimate is most favorable for its proliferation. It is very rarely seen in drier localities on the leeward side of Oahu, such as on the slopes of Punchbowl Crater, where it was once the dominant vegetation, shrouding all of the other plants, including many invasive weeds.

- **Miconia** [*Miconia calvescens* DC]. Due to its aggressive, invasive nature, miconia continues to be a major threat to ecosystems in the Hawaiian Islands, and exploration for, and research to utilize, other biological control agents continue to be ongoing projects. In 1997, Plant Pathologist Robert Barreto of the University of Viçosa, Viçosa, Brazil, identified a foliar nematode on miconia in Brazil and Costa Rica. This newly described nematode, *Ditylenchus gallaeformis*, causes severe leaf distortion and galling and was proposed by Dr. Barreto as a potentially good biocontrol agent. In March 2006, nematode galls collected in Brazil were shipped to the HDOA Plant Pathogen Quarantine Facility (PPQF) for host range testing and a colony has been established. However, infection of this nematode onto miconia plants in the quarantine facility has been painstakingly slow, prompting Dr. Barreto to conduct a reassessment of the parasitism of the nematode to the Hawaiian miconia biotype. He is collaborating with Dr. Tracy Johnson of the USDA Forest Service Quarantine Facility at Hawaii Volcanoes National Park on the island of Hawaii to test the nematode in Costa Rica, where the miconia biotype more closely matches the biotype in Hawaii. A graduate student was hired to isolate the nematode in Costa Rica and to determine its pathogenicity to the Hawaiian miconia biotype. Shipments of the nematode and another fungal pathogen, *Coccodiella miconiae,* on miconia to the PPQF in Honolulu are scheduled for August 2006. Meanwhile, the biocontrol fungal pathogen *Colletotrichum gloeosporioides* f. sp. *miconiae* continues to be active in the wet Onomea area of East Hawaii and may be keeping miconia plants from becoming the dominant vegetation in that locality.

- **Fireweed** [*Senecio madagascariensis* Poiret]. The colonies of the two very promising, potential biocontrol agents of fireweed, *Secusio extensa* (Butler), an

arctiid moth, and *Sphenella austrina* Munro, a tephritid fly, have died out in the HDOA Insect Quarantine Facility. The probable cause of the demise of both colonies was a decline in host plant suitability as a result of heavy aphid infestations and severe damage. A third highly promising agent, *Nyctemera apicalis*, an arctiid moth, is being reared successfully and is undergoing host range testing. The first two species had been collected in Madagascar and South Africa, respectively, during an exploration for fireweed natural enemies in 1999. The third species was collected more recently in South Africa during a second fireweed exploration in 2005. The loss of the colonies of the first two agents was very unfortunate because host specificity studies were completed for the first species and nearing completion for the second. Both species are believed to be highly suitable for release in the Hawaiian Islands to suppress fireweed infestations, which are mainly found in pastures and wayside areas on Hawaii and Maui. Although this setback will delay the anticipated releases of *S. extensa* and *S. austrina*, which are eagerly being awaited by the cattle industry, it may have been a blessing in disguise because those insects were originally collected in 1999 and seven years of rearing in quarantine has very likely resulted in inbreeding. Plans are being made for new collections in Africa.

- **Maile Pilau** [*Paederia foetida* L.]. The Skunk Vine Biocontrol Project is a collaborative effort between the HDOA Plant Pest Control Branch and the USDA-ARS Invasive Plant Research Laboratory (IPRL) in Ft. Lauderdale, Florida. During FY 2006, IPRL researchers informed the PPC Branch that a new IPRL quarantine facility was being built and that this activity would delay their efforts to collect and ship natural enemies of skunk vine (maile pilau) from Nepal and Thailand. Also, political unrest in Nepal has impacted the greatly anticipated collection and shipment of a highly promising metallic green, leaf-feeding chrysomelid beetle to the HDOA Insect Quarantine Facility for colonization and testing. The larvae of this beetle also feed on the foliage. Studies of another chrysomelid beetle, whose larvae feed on the roots, are still being conducted at Kyushu University in Fukuoka, Japan.

- **Banana Poka** [*Passiflora tarminiana* Coppens & Barney, sp.nov. (formerly *P. mollissima*)]. Personnel of the Plant Pathology Unit and the DLNR-DOFAW Maui forester collaborated on two augmentation releases of the banana poka biocontrol pathogen *Septoria passiflorae* on Maui. The first release was made in the Kula Forest Reserve and the other at Poli Poli State Park. In order to obtain a culture of *S. passiflorae*, infected material was collected from roadside banana poka and sent to the Plant Pathogen Quarantine Facility (PPQF) in Honolulu, where the fungus was isolated. The Septoria isolate was then tested for pathogenicity. For each release, 200 culture plates were prepared in the PPQF and taken to the Kahului Biocontrol Lab for preparation. The inoculating procedure called for a solution of 2% sucrose and 0.5% gelatin with Septoria fungus spores at a concentration of 1×10^{6} spores per ml. This solution gives the fungal spores a boost in the germination and the infection process. Approximately 5 gallons of spore solution was prepared and sprayed on each

occasion.

The Kula site was a follow-up release because the effects of previous fungal releases had diminished as a result of dry weather conditions that plagued the area for several years. During recent surveys of forests on Maui, new banana poka infestation sites have been identified, including the one at Poli Poli. The fungus had apparently not reached these sites because its dispersal requires wind and rain, which typically flow up the mountain from the plains below. Infestations that are laterally adjacent to the infected sites have remained free of the disease. Several months after the fungus was sprayed at Poli Poli, the disease was observed at that site and in the adjacent down-wind areas as well. This project has shown that some fungi may require a little manipulation to expand their range to be more effective in their role as biocontrol agents.

Projects of the Branch's Chemical/Mechanical Control Section included the following during the FY 2006:

- **Little Fire Ant** [*Wasmannia auropunctata* (Roger)]. Personnel of the Chemical/Mechanical (C/M) Control Section continued to treat infestations of the little fire ant (LFA) on the Islands of Kauai and Hawaii. On the Big Island of Hawaii, CM staff assisted nurserymen in the detection of LFA and trained nursery personnel to detect and treat infested property. On Kauai, staff conducted quarterly monitoring at the one infested site on the island in collaboration with personnel from the Kauai Invasive Species Committee (KISC). Chemical trials were conducted jointly with UH-CTAHR-PEPS researchers to find effective insecticides for use at various LFA infestation sites, including plant nurseries, residences, golf courses, pastures, and fruit and nut orchards.

- **Coqui Frog** [*Eleutherodactylus coqui* Thomas]. Coqui frog control efforts and sprayer loan programs continued on the islands of Hawaii, Maui, Oahu, and Kauai. Community groups, plant nurseries, and private individuals were allowed to borrow spray equipment from the HDOA at no charge on these islands. On the Island of Kauai, CM staff worked with members of KISC to prepare the one wild coqui infested site for chemical treatment. Ground and trail clearing was initiated to enhance access for personnel and to create less habitable environments for the coqui in designated areas. This also forced the frogs into green islands where treatment could be concentrated. HDOA, KISC and private agencies contributed to funding for chemicals and equipment. Because of the concerted group efforts, the frog population diminished to lower levels than those observed the previous year. This assessment was based on the decrease in male frog vocalizations. HDOA personnel assisted the Oahu Invasive Species Committee (OISC) and the U.S. Army, with surveys at the one wild population on Oahu. HDOA participated in night surveys for the frogs and OISC sprayed infested locations during the day. These efforts have decreased frog populations to a handful of frogs in a couple of locations in what was once a heavily infested

fifteen acre site. HDOA, OISC, and DLNR-DOFAW monitored and treated Oahu commercial nurseries for coqui frogs. The nursery staff also received training for coqui frog control by these groups. Frog populations have been eliminated at two of the three infested nurseries and have declined significantly at the third nursery due to these collaborative efforts.

- **Erythrina Gall Wasp** (EGW) [*Quadrastichus erythrinae* Kim]. C/M personnel collaborated with UH-CTAHR and DLNR - DOFAW in chemical trials of systemic insecticides on native wiliwili (*Erythrina sandwicensis*) for use against the EGW. These treatments are demonstrating some effectiveness but are still ongoing.

- **Banana Bunchy Top Virus** (BBTV). Containment and management practices for the banana bunchy top virus (BBTV) continued on the Islands of Hawaii, Kauai, and Maui, with limited chemical control work on commercial farms by HDOA personnel. On Oahu, HDOA personnel assisted commercial farmers in detecting and providing counseling on management of the disease.

- **Fireweed** [*Senecio madagascariensis* Poiret]. Fireweed infestations on the Islands of Kauai and Oahu are contained. Personnel on both islands managed the sites and have no new plants since November 2005. Previously, this invasive weed had infested two acres on Kauai and about seven acres on Oahu. Increased communication between the Hawaii Department of Transportation (HDOT) and HDOA has resulted in a decline in the use of carpet grass seeds for HDOT roadside landscaping projects on Oahu. In previous years, fireweed emerged at several locations after carpet grass seeds, produced in Australia, were incorporated into hydromulch material to seed bare lands along roadways. Surveys were continued for the detection of new infestations of fireweed on Kauai, Oahu, Lanai, and Molokai.

- **Fountaingrass** [*Pennisetum setaceum* (Forssk.) Chiov.]. Collaborative work was conducted by State, County, Federal, and private sector agencies to detect and remove fountaingrass on Kauai, Oahu, and Lanai. Populations of plants discovered in the surveys were removed.

- **Long Thorn Kiawe** [*Prosopis juliflora* (Sw.) DC]. Control efforts continued on Kauai and Oahu to remove long thorn kiawe (LTK) from shoreline areas. The work on Kauai was a cooperative effort with the Kauai Invasive Species Committee and the U.S. Navy's Pacific Missile Range Facility. On Oahu, responsible agencies such as Hawaii Department of Transportation – Harbors Division and the University of Hawaii have cleared LTK from properties which fall under their management.

- **Miscellaneous Noxious Weeds**. Chemical or mechanical control of designated noxious weeds continued for gorse (*Ulex europaeus)*, miconia (*Miconia calvescens*), turkeyberry (*Solanum torvum*), and glory bush (*Tibouchina* spp.). Other species such as false kava (*Piper auritum*) and tetrastigma (*Tetrastigma*

pubinerve) were controlled in limited areas that were deemed eradicable. The work on false kava and tetrastigma were cooperative efforts with the OISC.

- **Public Awareness Activities**. C/M personnel participated in educational outreach programs for public awareness at activities such as the Hawaii County Fair, Maui County Fair, and Kauai County Fair. Topics of the presentations included noxious weeds, little fire ant, nettle caterpillar, and coqui frogs.

- **Seed Inspection**. Routine surveys of agricultural and vegetable seed vendors to ensure the quality and proper labeling of seeds sold to consumers were conducted. Examination of seed lots entering the United States from foreign ports was performed in the C/M Control Section Seed Laboratory under an agreement with the U.S. Department of Agriculture, Animal and Plant Health Inspection Service. Seed lots containing prohibited noxious weed seeds or seeds of quarantine status were refused entry into U.S. commerce. Germination tests were performed on vegetable and agricultural seed lots to ensure that minimum germination standards under the Hawaii Seed Rules were met. Tests were performed in the seed laboratory for Hawaii seed distributors, upon request, to ensure compliance with the Hawaii Seed Rules.

NOXIOUS WEED CONTROL ACTIVITIES FY 2006

Number of plants treated with herbicide or removed mechanically:

Fireweed	Kauai	0	
	Oahu	2	***
Fountaingrass	Oahu	58	
	Kauai	3,507	*
Thorny kiawe	Oahu	353	
	Kauai	1,106	*
Gorse	Hawaii	2	
Miconia	Kauai	3,892	*
	Oahu	1	
Turkeyberry	Oahu	450	
Arundo	Kauai	553	*
Bull thistle	Kauai	25	
False kava	Oahu	399	**
Tetrastigma	Oahu	255	**

* Plants found during surveys; performed cooperatively with Kauai Invasive Species Committee (KISC)
** Performed cooperatively with Oahu Invasive Species (OISC)
*** Performed cooperatively with OISC and Department of Transportation (HDOT)

SEED REGULATORY ACTIVITIES FY 2006

Seed Importer Licenses Issued	45
Foreign Seed Lots Examined	91
Federal Seed Act - Rejections due to Prohibited Contaminants	3
Germination Tests Performed	51
Hawaii Seed Law - Seed Lots Germinating Below Standard	0
Hawaii Seed Law- Noxious Weed Seed Interceptions	
Lots rejected	4
Seed Tests Performed on Request	14
Seed Vendor Inspections Performed	22
Number of pounds of seed removed from sale	534
Number of seed packages removed	402
Seed Regulatory Fees Collected	
Test on Request	$35
Seed License Fees	$1,125
Total Fees Collected	$1,160

PLANT PEST CONTROL ACTIVITIES FY 2006

BANANA BUNCHY TOP PROJECT

Oahu:

Number of mats tagged, commercial farms	2,800	
Number of mats tagged, residential	85	

Hawaii:

Number of diseased mats rouged (Kona)	20	
Number of diseased mats rouged (East Hawaii)	269	

Kauai:

Number of diseased mats tagged, commercial farms	4,156	
Number of mats destroyed, residential	50	

Maui:

Number of mats tagged commercial farms	318	
Number of mats destroyed, residential	50	

PAPAYA RINGSPOT VIRUS PROJECT

Oahu:

Number of diseased plants tagged	450	

Kauai:

PRV free as of June 2006; Acres surveyed	100	

CARIBBEAN FROG CONTROL

Oahu:

Number of Acres Treated with Citric Acid, estimated	15	*1
Number of known Wild coqui Population Sites Treated	1	*1
Number of frog calls received	97	*7
Number of commercial nurseries assisted	1	*1

Maui:

Number of days 100 gallon sprayer loaned out	350	*2
Number of days 50 gallon sprayer loaned out	350	*3
Number of frog calls received	10	

Kauai:

Number of acres treated with citric acid	18	*4
Number of Known Wild Frog Population Sites Treated	1	*5
Number of Frogs Caught by Hand	85	*4
Number of frog calls received	3	*4

Hawaii:

Number of loans made for 100 gallon sprayer		
East Hawaii	75	*3
West Hawaii	24	*3
Number of Educational Outreaches Made	13	*6
Number of Calls Received	358	
Number of Commercial Nurseries Assisted	6	*6

LITTLE FIRE ANT

Kauai:

Number of Acres Infested	0.5	*4
Number of Properties Infested	2	*4

Hawaii:

Number of New Nursery Sites Infested	9	
Number of Properties Surveyed	70	
Number of Sites Treated	5	

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*1 Cooperative effort with HDOA, OISC, DLNR, U.S. Army Environmental Division (for wild population)
*2 Cooperative effort with HDOA, Maui Invasive Species Committee (MISC)
*3 Sprayer Loan Program; residents to purchase citric acid and borrow HDOA sprayer
*4 Cooperative effort with HDOA, KISC
*5 Cooperative effort with HDOA, KISC, DLNR, USDA-Fish & Wild Life Services, private industry
*6 Cooperative effort with HDOA, University of Hawaii, College of Tropical Agriculture & Human Resources, Cooperative Extension Service - Hilo
*7 Majority of calls revealed green house frog, *Eleutherodactylus planirostris*