

DEPARTMENT OF AGRICULTURE
Honolulu, Hawaii

SUCCESSFUL HDOA BIOCONTROL PROJECTS
(1968 to Present)

Bean Fly, *Ophiomyia phaseoli* (Tryon) (Diptera: Agromyzidae); larvae are serious pests of bean seedlings; detected on Oahu first and on all of the other islands in 1968; larval-pupal parasitoids (parasitic wasps), *Opius importatus* Fischer and *Opius phaseoli* Fischer (Hymenoptera: Braconidae), introduced from Africa in 1969; excellent control of pest by early 1970's.

Monkeypod-Kiawe Caterpillar, *Melipotis indomita* (Walker) (Lepidoptera: Noctuidae); larvae defoliate monkeypod and kiawe trees; detected on Oahu first and on Kauai, Maui, and Molokai in 1969, Hawaii in 1970, and Lanai in 1971; larval-pupal parasitoid (parasitic fly), *Eucelatoria* sp. nr. *armigera* (Coquillett) (Diptera: Tachinidae), introduced from Mexico in 1974; supplemented control by locally established parasitoids to significantly reduce pest population to manageable densities by 1980's.

Eurasian Pine Adelgid, *Pinus pini* (Macquart) (Hemiptera: Adelgidae); nymphs and adults suck on terminal shoots of pine; detected on Hawaii first and on Oahu in 1970, Maui in 1971, Molokai in 1976, and Kauai in 1978; predacious fly, *Leucopis tapiae* Blanchard (Diptera: Chamaemyiidae), introduced from Pakistan in 1972; predacious fly, *Leucopis obscura* Haliday (Diptera: Chamaemyiidae), introduced from France in 1976; ladybird beetle, *Scymnus suturalis* Thunberg (Coleoptera: Coccinellidae), introduced from France in 1976; excellent control of pest by 1980's.

Citrus Swallowtail, *Papilio xuthus* Linnaeus (Lepidoptera: Papilionidae); larvae feed on young leaves of citrus; detected on Oahu in 1971 and on all of the other islands in 1974; pupal parasitoid (parasitic wasp), *Pteromalus luzonensis* Gahan (Hymenoptera: Pteromalidae), introduced from Guam in 1975; supplemented control by locally established egg parasitoid (parasitic wasp), *Trichogramma* spp., resulting in complete control of pest by 1980's.

Banana Skipper, *Erionota thrax* (Linnaeus) (Lepidoptera: Hesperiiidae); larvae feed on banana foliage; detected on Oahu in 1973, Kauai and Maui in 1974, and on the other islands in 1975; banana skipper egg parasitoid (parasitic wasp), *Ooencyrtus erionotae* Ferriere (Hymenoptera: Encyrtidae), introduced from Guam in 1973, banana skipper larval parasitoid (parasitic wasp), *Cotesia erionotae* (Wilkinson) (Hymenoptera: Braconidae), introduced from Thailand in 1973; complete control of pest statewide by 1977.

Orange Spiny Whitefly, *Aleurocanthus spiniferus* (Quaintance) (Hemiptera: Aleyrodidae); nymphs suck plant fluids from leaves of rose, citrus, grape, pear, and persimmon, detected on Oahu in 1974, Molokai in 1978, Kauai, Maui, and Lanai in 1980.

and Hawaii in 1993; parasitoid (parasitic wasp), *Amitus hesperidum* Silvestri (Hymenoptera: Platygasteridae), introduced from Mexico in 1974; parasitoid (parasitic wasp), *Encarsia smithi* (Silvestri) (Hymenoptera: Aphelinidae), introduced from Japan in 1974; parasitoid (parasitic wasp), *Encarsia opulenta* (Silvestri) (Hymenoptera: Aphelinidae), introduced from Texas in 1975; excellent control of pest by 1980's

Hamakua Pamakani (Spreading Mistflower), *Ageratina riparia* (Regel) R. King & H. Robinson (Asterales: Asteraceae); invasive weed of pastures and wayside areas; native to Mexico and the West Indies; naturalized in Hawaii by 1926 in relatively dry, disturbed habitats to mesic and wet forests, 3-1,200 meters on Oahu, Molokai, Maui, and Hawaii (Wagner, et al. 1990); Hamakua pamakani plume moth, *Leioptilus* (= *Oidaematophorus*) *beneficus* (Yano & Heppner) (Lepidoptera: Pterophoridae) introduced from Mexico in 1973; Hamakua pamakani gall fly, *Procecidochares alani* Steyskal (Diptera: Tephritidae) introduced from Mexico in 1973; a white smut fungal pathogen, *Entyloma ageratinae* Barreto & Evans (Ustilaginales: Basidiomycotina) introduced from Jamaica in 1974 by UH-Manoa Plant Pathologist Dr. Eduardo Trujillo; excellent control of weed by early 1980's, mainly by the fungus, but gall fly proved to be valuable in drier localities not favorable for the fungus.

Vegetable Leafminer, *Liriomyza sativae* Blanchard, and **Chrysanthemum Leafminer**, *L. trifolii* (Burgess) (Diptera: Agromyzidae); larvae mine leaves of various vegetable crops and ornamental plants (*L. sativae*: pest of beans, tomato, eggplant, cucurbits, etc.; *L. trifolii*: pest of beet, spinach, beans, clover, onion, okra, tomato, eggplant, potato, cucurbits, carrot, celery, chrysanthemum, etc.); *L. sativae* detected on Molokai first and on Oahu in 1952, and later on all of the other islands; *L. trifolii* detected on Oahu first and on Molokai in 1978, on Hawaii in 1979, and currently statewide; parasitoid (parasitic wasp) *Diglyphus inermidius* (Girault) (Hymenoptera: Eulophidae) introduced from Delaware in 1975; parasitoid (parasitic wasp) *Chrysocharis oscinidis* Ashmead (Hymenoptera: Eulophidae) introduced from California in 1976 and 1981; parasitoid (parasitic wasp) *Chrysonotomyia punctiventris* (Crawford) (Hymenoptera: Eulophidae) introduced from Mexico in 1976, and California in 1977 and 1982; parasitoid (parasitic wasp) *Ganaspidium utilis* (Beardsley) (Hymenoptera: Cynipidae) introduced from Texas in 1976; parasitoid (parasitic wasp) *Diglyphus begini* (Ashmead) (Hymenoptera: Eulophidae) introduced from Mexico in 1976; parasitoid (parasitic wasp) *Halticoptera circulus* (Walker) (Hymenoptera: Pteromalidae) introduced from Trinidad in 1980 and California in 1982; parasitoid (parasitic wasp) *Chrysocharis curihea* Boucek (Hymenoptera: Eulophidae) introduced from Trinidad in 1980; parasitoid (parasitic wasp) *Opius dissitus* Muesebeck (Hymenoptera: Braconidae) introduced from Florida in 1981; excellent control of pests in the absence of broad-spectrum insecticides.

Spiraling Whitefly, *Aleurodicus dispersus* Russell (Hemiptera: Aleyrodidae); nymphs and adults suck plant fluids from leaves of more than 100 species of ornamental plants and fruit trees; detected on Oahu in 1978, Maui in 1979, Kauai, Lanai, and Hawaii in 1980, and Molokai in 1981; predacious ladybird beetles *Nephuspis indus* Gordon and *Nephuspis bicolor* Gordon (Coleoptera: Coccinellidae) introduced from Trinidad in 1979; predacious ladybird beetle *Delphastus catalinae* (Horn) (Coleoptera: Coccinellidae)

introduced from Trinidad in 1980; parasitoid (parasitic wasp) *Encarsia* sp. nr. *haitiensis* Dozier (Hymenoptera: Aphelinidae) introduced from Trinidad in 1979; parasitoid (parasitic wasp) *Encarsia guadeloupa* Viggiani (Hymenoptera: Aphelinidae) introduced from Trinidad in 1980; very good control of pest overall throughout the year by the mid-1980's except for annual upsurges during the warmer months of the year on highly favored host plants in hot, dry, windy localities.

Woolly Whitefly, *Aleurothrixus floccosus* (Maskell) (Hemiptera: Aleyrodidae); nymphs and adults suck plant fluids from leaves of citrus, guava, Surinam cherry, and sea grape; early infestations hidden amid spiraling whitefly infestations; detected on Oahu in 1981, Molokai and Lanai in 1982, and on the other islands in 1983; parasitoid (parasitic wasp) *Amitus spiniferus* (Brethes) (Hymenoptera: Platygasteridae) introduced from California in 1981; parasitoid (parasitic wasp) *Cales noacki* De Santis (Hymenoptera: Aphelinidae) introduced from California in 1981; fortuitous biocontrol by adventive parasitoid (parasitic wasp) *Eretmocerus* sp. (Hymenoptera: Aphelinidae); excellent control of pest throughout the year by the mid-1980's.

Diamondback Moth, *Plutella xylostella* (Linnaeus) (Lepidoptera: Plutellidae); larvae feed on leaves, petioles, stems, and terminals of vegetable crops in the cabbage family (Brassicaceae, formerly Cruciferae), including various cabbages, broccoli, cauliflower, collard, kale, radishes (daikon), turnip, watercress, etc.; first recorded in Hawaii in 1907 from specimens collected on Hawaii (1892), Molokai (1893), and Kauai (1895), recorded much later on Oahu and Maui (1966), and Lanai (1975); parasitoid (parasitic wasp) *Diadegma insularis* (Cresson) (Hymenoptera: Ichneumonidae) introduced from Kenya in 1953; parasitoid (parasitic wasp) *Cotesia plutellae* (Kurdjumov) (Hymenoptera: Braconidae) introduced from Taiwan and Trinidad in 1972, Trinidad in 1980, and Taiwan in 1983; parasitoid (parasitic wasp) *Diadromus collaris* (Gravenhorst) (Hymenoptera: Ichneumonidae) introduced from Trinidad in 1972 and Pakistan in 1983 (est. ?); parasitoid (parasitic wasp) *Diadegma semiclausum* (Hellen) from Pakistan in 1985 (est. ?); good control of pest by *D. insularis* and *C. plutellae* (Taiwan 1983) in the absence of broad-spectrum insecticides.

Leucaena Psyllid, *Heteropsylla cubana* Crawford (Hemiptera: Psyllidae); nymphs and adults suck plant fluids from leaves and stems of terminal growths of leucaena and monkeypod; detected on Oahu first and all other islands in 1984; parasitoid (parasitic wasp) *Psyllaephagus yaseeni* Noyes (Hymenoptera: Encyrtidae) introduced from Tobago in 1985; fortuitous biocontrol by predacious dark blue lady beetle, *Cirinus coeruleus* Mulsant (Coleoptera: Coccinellidae), introduced from Mexico in 1922 as a biocontrol agent of the coconut mealybug; supplemental predation by predacious ladybird beetle *Olla abdominalis* (Say) (Coleoptera: Coccinellidae) introduced from Mexico in 1908 for control of various scale insects; very good control of pest overall throughout the year, since the 1990's, except for seasonal upsurges during the spring flush of monkeypod trees

Blue Coconut Leaf Beetle, *Brontispa chalybeipennis* (Zacher) (Coleoptera: Chrysomelidae). larvae and adults scarify tissue of leaflets of immature, unopened, spindle leaves of coconut trees resulting in severe discoloration when the leaves unfurl;

detected on Oahu in 1985 and on Maui recently; larval-pupal parasitoid (parasitic wasp) *Tetrastichus brontispae* (Ferriere) (Hymenoptera: Eulophidae) introduced from Guam in 1986; parasitoid appears to have accompanied the pest to Maui; excellent control in inland landscaped areas away from strong prevailing winds but only fair to good control in windy localities, especially coastal areas.

Lesser Cornstalk Borer, *Elasmopalpus lignosellus* (Zeller) (Lepidoptera: Pyralidae); larvae bore into stalks of young sugarcane and other grasses, including corn, sorghum, and oats, and legumes, including beans, cowpeas, peanuts, peas, and soybeans, and also ginger and strawberry; damage is most serious when they burrow into the heart of unopened leaves and feed, killing the terminal growth, resulting in "dead hearts"; detected on Kauai first and on Oahu and Maui in 1986, and on Molokai and Hawaii in 1987; parasitoid (parasitic wasp) *Orgilus elasmopalpi* Muesebeck (Hymenoptera: Braconidae) introduced from Texas and Florida in 1986 and from Mexico in 1987; parasitoid (parasitic wasp) *Horismenus elineatus* Schauff (Hymenoptera: Eulophidae) introduced from Bolivia by Texas A&M University collaborators in 1989; resulted in good control in fields of young sugarcane by the mid-1990's.

Ivy Gourd (Scarlet-fruited Gourd), *Coccinia grandis* (L.) Voigt (Violales: Cucurbitaceae); invasive, climbing, perennial herb with tuberous rootstock producing long, annual stems; native to East Africa; naturalized and widespread on Oahu and in Kailua-Kona on the island of Hawaii (Wagner, et al. 1990); ivy gourd vine borer, *Melittia oedipus* Oberthur (Lepidoptera: Sesiidae) introduced from Kenya in 1996; ivy gourd leafmining weevil, *Acythopeus coccinae* O'Brien (Coleoptera: Curculionidae) introduced from Kenya in 1998; ivy gourd gall weevil, *Acythopeus burkhartorum* O'Brien (Coleoptera: Curculionidae) (est. ?) introduced from Kenya in 1998; excellent suppression of weed in drier leeward localities; noticeable reduction in ivy gourd densities in wetter windward localities with ideal microclimate for proliferation; displacement of ivy gourd by other invasive alien weeds occurring.

Miconia, *Miconia calvescens* DC (Myrtales: Melastomataceae); invasive weed in wet forests; native to the Neotropics (southern Mexico to Central and South America); introduced to Hawaii as an ornamental plant in 1961 (Medeiros, et al. 1997) naturalized and widespread in wet sites in East Hawaii and East Maui; miconia fungal pathogen *Colletotrichum gloeosporioides* f. sp. *miconiae* (Melanconiales: Melanconiaceae) introduced from Brazil in 1997; significant effect on seedlings in East Hawaii and East Maui, and especially in French Polynesia, where the climate is very humid and ideal for miconia and the fungal pathogen; pathogen is readily dispersing on its own in French Polynesia (Dr. Jean-Yves Meyer, personal communication).

Citrus Blackfly, *Aleurocanthus woglumi* Ashby (Hemiptera: Aleyrodidae); nymphs and adults suck plant fluids from leaves of citrus, mango, and some less preferred hosts including coffee, pink tecoma, and Japanese pear, detected on Oahu first and on Maui and Hawaii in 1996, and on Kauai in 2000; parasitoid (parasitic wasp) *Amitus hesperidum* Silvestri (Hymenoptera: Platygasteridae) introduced from Guatemala in 1999; parasitoid (parasitic wasp) *Lucasina perplexa* Huang and Polaszek

(Hymenoptera: Aphelinidae) (misidentified previously as *Encarsia opulenta* (Silvestri)) introduced from Guatemala in 1999 but was found to be already established on Oahu at very low densities just prior to the release of the purposely introduced Guatemalan biotype, most likely the result of fortuitous biocontrol introduction; excellent control of pest statewide by 2003.

Sago Palm Scale, *Aulacaspis yasumatsui* Takagi (Hemiptera: Diaspididae); nymphs and female adults suck plant fluids from leaflets and petioles of cycads, mainly Japanese sago palm, *Cycas revoluta*, and queen sago palm, *Cycas circinalis*; detected on Oahu in 1998 and subsequently on the other islands; fortuitous control by predacious ladybird beetle *Rhyzobius* (= *Lindorus*) *lophanthae* (Blaisdell) (Coleoptera: Coccinellidae) introduced from California in 1894 for biocontrol of armored scales; excellent host-finding capability of the ladybug and steady buildup of its population density resulted in excellent overall control of the scale within a period of few months at most sites; scale population densities upsurge periodically throughout the year; field collection and dispersal of the ladybugs by PPC Branch personnel facilitated statewide suppression.

Citrus Leafminer, *Phyllocnistis citrella* Stainton (Lepidoptera: Gracillariidae); larvae feed on epidermal tissue and form mines mainly in citrus leaves but also in succulent stems and sometimes in fruit, causing severe deformity of the foliage; detected on Oahu in 2000 and subsequently on the other islands; fortuitous biocontrol by larval-pupal parasitoid (parasitic wasp) *Ageniaspis citricola* Logvinovskaya (Hymenoptera: Encyrtidae), which was found in association with the pest in June 2000 when it was first discovered; field collection and distribution of parasitoid to neighbor islands by PPC Branch personnel facilitated excellent statewide control.

Giant Whitefly, *Aleurodicus dugesii* Cockerell (Hemiptera: Aleyrodidae); nymphs and adults suck plant fluids from leaves of a wide variety of host plants, including ornamental shrubs, trees, and vines, and also fruit trees (favored hosts in Hawaii are hibiscus, fiddlewood, and plumeria), copious amounts of honeydew excreted on plants by heavy infestations of nymphs result in unsightly layers of black sooty mold that may reduce plant vigor by interfering with transpiration and photosynthesis; white flocculence secreted by the nymphs combined with the sooty mold cause plants to be unsightly and be a nuisance for homeowners and plant fanciers; detected on Oahu first in 2002, Kauai and Hawaii in 2003, and Maui in 2004; fortuitous biocontrol by parasitic wasp *Idioporus affinis* LaSalle and Polaszek (Hymenoptera: Pteromalidae), which is believed to have arrived in Hawaii in association with the giant whitefly from California to where it was purposely introduced from Mexico in 1997 for biocontrol of the pest; *I. affinis* began to multiply and disperse after it was first detected on Oahu in 2003; field collection and distribution of this parasitoid by PPC Branch personnel, first throughout Oahu and subsequently statewide greatly facilitated this project and hastened suppression of this potentially serious pest to where it is was no longer a pest of significance just two years after it was first discovered

Glassy winged Sharpshooter, *Homalodisca vitripennis* (Germar) (Hemiptera: Cicadellidae), nymphs and adults suck plant fluids from the xylem tissue of the leaves

and stems of a wide variety of plants (more than 200 species); hosts in Hawaii include African tulip, monkeypod, hibiscus, gardenia, Tahitian gardenia, croton, crown flower, oleander, mountain apple, plumeria, pittosporum, citrus, Java plum, kou, bottlebrush, and ti; nymphs and adults remove large amounts of watery plant fluids from the xylem tissue of plants to increase water stress that can result in dehydration of plants in dry climates; nymphs and adults, as they feed, excrete a very watery form of honeydew in intermittent streams known as "leafhopper rain," which can annoy people and be a nuisance; detected on Oahu in early 2004; fortuitous biocontrol by a parasitic wasp *Gonatocerus ashmeadi* Girault (Hymenoptera: Mymaridae), an egg parasitoid, detected later in 2004, that is believed to have arrived in Hawaii from California in association within the eggs of the sharpshooter; spectacular biocontrol work by the parasitoid quickly suppressed the increasing population density of the pest to such a low level that it is now barely detectable and prevented its dispersal to the neighbor islands.

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