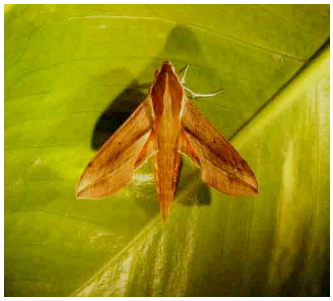
BASELINE SURVEY OF ARTHROPODS (INSECTS AND RELATIVES) OF KAHULUI AIRPORT ENVIRONS MAUI, HAWAII

FINAL REPORT

6 September 2002



Hippotion rosetta **(Swinhoe)**

Manduca blackburni **(Butler)**

Schistocerca nitens **(Thunberg)**

By

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1525 Bernice Street
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Isometrus maculatus **(DeGeer)**

Plagithmysus new species

Prepared for

Edward K. Noda & Associates, Inc.
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Honolulu, Hawaii 96814-3139

And for the

State of Hawaii, Department of Transportation, Airports Division

Hawaii Biological Survey Contribution No. 2001.009

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DEDICATION

Dr. John Wyman Beardsley, Jr.

(1926 – 2001)

We dedicate this report to Dr. John "Jack" Beardsley, our esteemed mentor, friend, colleague, and collaborator. Jack, who was emeritus professor of entomology at the University of Hawaii and a research Associate at Bishop Museum, passed away suddenly on 5 February 2001, while visiting Bishop Museum and assisting us in sorting and identifying the wasps for this project. His passing left a huge void in our work and in our hearts. He was happiest when in the field collecting insects and also when identifying insects using a microscope, with his trademark pair of jewelers' glasses flipped out of the way on his head. His love of the study of insects was infectious and he shared his knowledge generously. His knowledge of Hawaiian insects was legendary. If he didn't recognize a species, it probably was a new species or new immigrant. He vigorously kept track of the arrival of new immigrant insects, and for years maintained an insect trap in Honolulu and identified insects for colleagues, publishing more than 500 notes on the species collected. His data provided the foundation for the present survey, and his assistance on the project has been greatly appreciated.

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EXECUTIVE SUMMARY

A survey of the arthropod fauna occurring within the Kahului Airport Environs at Kahului, Maui, was conducted between August 1999 and November 2000 to fulfill requirements of the Federal-State Alien Species Action Plan for the Kahului Airport (pursuant to the Memorandum of Understanding signed August 1998). The main objective of the survey was to develop a list of species and set of authoritatively determined specimens of the arthropods collected. The survey was comprehensive, but a few groups (vertebrate parasites, truly aquatic species, and small cryptic species) were excluded. The list and voucher specimens are to provide quarantine officials with information to improve quarantine procedures at the airport, as well as facilitate rapid response efforts that deal with newly recognized harmful alien or non-indigenous species. In addition, we determined the status of the recently listed federally endangered species, Blackburn's sphinx moth *(Manduca blackburni)* within the Airport Environs and herein make recommendations on its protective management.

A total of 624 species were collected during the survey, of which 584, or 94%, could be identified to species. These include 473 adventive species, 47 purposefully introduced species, 59 endemic species, eight indigenous species, and 37 species whose status is unknown. The majority were insects with the beetles, flies, moths, and wasps each represented by 100 species or more. A significant percentage of both the native and alien species represent additions to the known fauna of Maui. Among the 520 recognized alien species, 328 species (63%) were previously reported from Maui; 158 species (30%) were previously known from another island and here reported from Maui for the first time; and 34 species (7%) are new records for the state. At least 23 of the 67 identified native species (34%) represent new island records for Maui, and ten of the 23 are new species. About 40% of the alien species reported as new island records have been in Hawaii for more than 50 years. These data indicate that there is a long lag period between the time that a species becomes established and its eventual recognition and published record.

The biologies of most of the species are unknown. However, a few of the new records appear to be potential pests. For example, six new wood boring beetles (an *Agrilus* species, two Platypodidae and three Scolytidae) could become injurious to native or commercially valuable trees. A new biting midge (*Culicoides* species) belongs to a group of notorious pests of vertebrates. The predatory assassin bug (*Sinea rileyi*) and the parasitic and predatory wasps could affect populations of beneficial arthropods. Some of the moths could attack economic crops or native plants.

The survey is not yet complete; a few groups have not been identified; and the severe drought preceding and during the survey greatly limited arthropod activity within the study area. Therefore, it is recommended to continue the survey as a monitoring program. Such a survey would concentrate on intercepting newly established species (especially potential pest species) as well as completing the list rather than attempting to process all species. Also recommended is the development of a database to manage more efficiently the information regarding the fauna at Kahului Airport. The database should include computer based identification aids for the species,

so that quarantine personnel as well as other stakeholders can identify species unknown to them rapidly on site.

We found the endangered Blackburn's sphinx moth on alien tree tobacco plants at the east end of the airport area near Sprecklesville and also determined that it occurs sporadically within the Kanaha Pond Wildlife Sanctuary. The area at the west end of the runway does not appear to provide good habitat for the moth except perhaps temporarily during wet periods even though tree tobacco, an alternate alien host plant, is common there. The east end of the airport appears to provide a refuge habitat important for the long-term survival of the moth. This area is a windswept coastal shrubland containing a mix of native shrubs and alien plants. The area is within the airport safety zone, which requires that the vegetation remain low in stature. Since the native shrubs rarely grow higher than two meters (about six feet), whereas some of the invasive alien species can become trees and since traditional land clearing activities foster the spread of the taller invasive species, we recommend that the area be managed to enhance the native species. This strategy will be beneficial to the endangered moth as well as other native species (some of which may deserve listing) living in the area. In the long-term, such management may prove to be cheaper, easier, safer, and less damaging than periodic land clearing. The US Fish and Wildlife Service and the Native Plant Society of Maui can provide support for the conservation activities. Continuation of the program to enhance the hosts and habitat for the moth within the Kanaha Pond Wildlife Sanctuary is also recommended.

Other notable native species included a flightless *Acalles* weevil, a new species of the endemic *Plagithmysus* woodborer, six species (probably all new) of the diverse endemic moth genus *Hyposmocoma*, six other rare moths, two exceptionally rare true bugs, and two predatory wasps. Most native species persist by using one of four strategies: i.e., they have aquatic immature stages, are woodborers or live in other cryptic habitats, or live in windswept coastal habitat.

I. INTRODUCTION

This report represents the final report on the baseline survey of the arthropods (insects and their relatives) occurring within the environs of Kahului Airport, Maui. The survey was performed to fulfill requirements of the Federal-State Alien Species Action Plan for the Kahului Airport, Maui (Pursuant to the Memorandum of Understanding signed August 1998.). The purposes of this project were to conduct a comprehensive survey of the terrestrial arthropods occurring within the environs of Kahului Airport to provide the Hawaii Department of Agriculture quarantine officials and other Federal and State agencies with a list of species. In addition, a set of authoritatively determined voucher specimens of the arthropods collected is to be deposited in the Hawaii Department of Agriculture. These specimens and data will be used to develop improved monitoring and quarantine programs at Kahului Airport. Use of the data and collections gathered during this project should allow officials to more quickly recognize and deal with newly arriving alien species. Shortly before the project started, the United States Fish and Wildlife Service listed Blackburn's sphinx moth as a federally endangered species. Since the moth was known to occur near the airport environs, an additional task was added to determine the status and propose management options for the moth.

The Hawaiian environment is highly vulnerable to the effects of invasive alien species (Zimmerman, 1948a; US Congress, 1993; Loope et al., 2001). An **alien species** is a species that is transported through the aid of humans and establishes a population in an area outside its natural range. A species may be introduced purposefully or accidentally, for example, as stowaways in transported material. Alien species are also called **introduced, non-native, non-indigenous, exotic,** or **adventive species. Invasive alien species** are able to reproduce and spread aggressively and to impact the environment, for example by affecting the well being of native species, agriculture, commerce, or human health. **Native species** occur naturally within a geographic area. In this report these are categorized in two groups: **Endemic species** occur naturally only within a circumscribed geographic region, and **indigenous species** occur naturally both within and outside the delimited region.

Determining whether a newly discovered species is innocuous, beneficial, or harmful to the environment requires an accurate means of identification. This is particularly true for the insects and their relatives, as their diversity of forms in an area can be daunting. Worldwide there are currently over one million species of insects known, with estimates ranging to ten million or more still to be described. A large percentage of these might survive and do well in Hawaii if given the opportunity to colonize. The terrestrial arthropod fauna of Hawaii currently totals over 9,000 species, of which about 64% (5,700 species) are native to Hawaii (Nishida 1997; 2002). Most are insects, with beetles (Coleoptera), flies (Diptera), bees and wasps (Hymenoptera), moths (Lepidoptera), hoppers and scales (Homoptera), and true bugs (Heteroptera) containing the majority of species. Related arthropods in Hawaii include spiders, mites, scorpions and their relatives (Arachnida); woodlice, sandhoppers and relatives (Crustacea); and millipedes (Diplopoda), centipedes (Chilopoda), and related groups.

This study represents the first comprehensive survey of the terrestrial arthropods living within the Kahului Airport environs and among the first for any area within Hawaii. A few arthropod groups were beyond the scope of this survey. These included parasites and commensals of vertebrates, since these would have required a separate intensive vertebrate trapping program.

Also, the strictly marine or freshwater arthropods (i.e., those without a terrestrial dispersal stage) were not specifically sought. Finally, many of the tiny arthropods that inhabit deep soil or live in other cryptic habitats were likely missed since they often require special collecting techniques or are too poorly known to identify.

II. METHODS

II. A: THE AREA:

The area covered in this survey included all terrestrial habitats within the boundary of Kahului Airport, including the Airport Operations Area (AOA), the Kanaha Pond Wildlife Sanctuary, and neighboring areas. The airport property is located along the windward coast of Maui east of Kahului and west of Spreckelsville (**Figure 1**). The land area totals approximately 1447 acres (586 hectares), which originally contained the following natural habitats: sandy and rocky shorelines, strand, lowland shrub, lowland open dry forest with grass and shrub understory, and wetlands (Gagne and Cuddihy, 1990). The Kanaha Pond Wildlife Sanctuary contains about 235 acres (95 hectares) and is currently managed to promote native species. The sanctuary includes permanent ponds and associated seasonal wetlands, Keawe/ mixed understory forest, and small areas of native and alien shrub lands. Urbanization and development of the airport has modified most of the area, and currently the airport environs contain the following habitats and vegetation types. The acreages given are modified from those given in the Final EIS (U.S. Department of Transportation, 1997) and are approximate as vegetation cover changes over time from succession and changes in land use. See **Figure 1** for locations of these habitats.

- Wind sheared dune vegetation
  (including native strand and littoral habitats) (40 acres [16 hectares]).
- Keawe/mixed understory (265 acres [107 hectares]).
- Koa Haole shrub/mixed understory (121 acres [49 hectares])
- Open grassland (286 acres [116 hectares]).
- Cane fields and ruderal borders (258 acres [104 hectares]).
- Airfield (including the terminal, industrial and paved areas and ornamental plantings) (394 acres [160 hectares]).
- Kanaha Pond (water area) and wetlands (83 acres [34 hectares]).

II. B: FIELDWORK:

Ten field trips each about five days duration to Kahului Airport were conducted at approximately monthly intervals between August 1999 and June 2000. Teams consisting of 2 to 5 people spent a total of more than 150 person-days in the field. After a reconnaissance was made of the area, it was decided to concentrate the first phase of sampling in the remaining wet spots and vegetated areas because the recent extreme drought in the area had diminished insect activity within the drier habitats. Furthermore, the wet spots often act as attractants for mobile arthropods, making surveys for them more efficient near moisture. However, a few samples were also taken in drier areas during the drought to be sure we were not missing species. Additional habitats were sampled after the winter rains commenced. Generally, rainfall and resulting flush of plant growth should cause insect activity to increase. However, rainfall was lower than normal throughout the field season, which affected some arthropod populations. All areas examined for

arthropods while traveling on foot between and searching for new collection sites are shown on **Figure 2.**

Over 275 collections were made from about 200 separate sites. See **TABLE 1** for a list of specific sites listed by collection method and **Figures 2 to 7** for general locations of the sites. Nearly all major habitat types have been intensively sampled, including the keawe/mixed understory woodland, the margins of Kanaha Pond and other significant wetlands, former sugarcane fields and ruderal habitats, koa haole dominated scrub, wind sheared vegetation, marine littoral habitats, roadside vegetation, and irrigated ornamental plantings and lawns. Portions of the airfield, terminal buildings, and paved industrial areas were also surveyed. Commercial sugarcane fields were sampled only along their margins.

II. C: COLLECTING METHODS:

II. C1: *Gas Aspirator*

Gas powered asparator
Photo by D.J. Preston, 2001

The principal method used was a gasoline-powered aspirator (vacuum pump), as this proved to be highly effective for sampling arthropods. The aspirator was worn as a backpack, and a 5-inch (12.7 cm) diameter hose, which was fitted with an internal sock of fine mesh screen netting, was moved through and over vegetation and other suitable substrates. Arthropods were sucked into the net along with debris. Each sample consisted of a five to ten minute run over the chosen substrate. Most samples included a range of plant species and associated substrates within the area chosen, usually between about 25 to 50 square feet (2.3 – 4.6 m^2). Often the vegetation could be sampled while walking along trails or roadways. Where host abundance or luxuriance was sufficient, samples from a single host plant species were collected. About 120 aspirator samples were collected and processed. Locations for gas aspirator samples are shown on **Figure 3.** Most were taken during daytime, but several samples were collected at night. After collection, each sample was secured inside its net-bag with a rubber band, sealed in an individual plastic bag with a label giving data on location, substrate, date and circumstances of collection. Samples were stored in a refrigerator until they could be processed. Samples were treated with a fumigant, and the arthropods sorted from the debris while still fresh with the aid of a 10 to 20 power binocular microscope. In this way, most specimens were retrieved and preserved in excellent condition for later identification. However, the method was too labor intensive to allow processing more than a few samples a day. A few groups had to be collected by other methods. These included fragile species (notably moths and butterflies) that were too damaged by the aspirator; sessile insects (such as scales and mealybugs) and those living inside the substrate that were not captured; and larger insects that could climb out of the net and escape during vacuuming. However, a surprising diversity of small wasps and flies came through the process in fine condition.

The gas aspirator has several advantages over other collecting methods. Importantly, the collections are relatively unbiased; that is, everything within its range is captured to be sorted later with the aid of a microscope. Also the efficiency is high and complements other methods

because the hose can be placed over and even shoved into vegetation including spiny plants where nets and other devices cannot be used.

II. C2: *Malaise Traps*

Malaise trap
Photo by D.J. Preston, 2001

Two malaise traps were set up in early November 1999, (see **Figure 4**) and were operated continuously for about 18 months within koa haole thickets within the AOA. An additional malaise trap was run for five days near wet spot # 2 in October 1999. The malaise trap is an open-walled tent with baffles made of fine netting and about six feet high and eight feet long. It is hung between posts or trees and captures mostly flying insects that enter the tent and become confused by the baffles. A canister, containing ethylene glycol (antifreeze) as a preservative, holds the specimens until the trap is serviced. The traps were serviced about every two to three weeks on average. Malaise traps are excellent passive traps for monitoring the presence or activities of certain groups of insects. Dispersing insects that behaviorally try to go over obstacles (such as most wasps, flies and moths) can be sampled in a relatively unbiased manner. Some insects (especially some beetles) habitually go down, and malaise traps often miss these. Placement of the trap is important and can affect the catch. It is best to place the trap across a natural flyway.

II. C3: *Night Collecting*

MV Bulb night collecting
Photo by D.J. Preston, 2001

Many insects are nocturnal and remain hidden during the day. This is especially true in drier lowland habitats, such as at Kahului Airport, because of the extreme desiccating environment during the daytime. We used headlamps for light and employed the same techniques at night as during the day. In addition, night collecting included shining either a 250-watt mercury vapor lamp **(MV-light)** or a 15-watt **black light** on a white bed-sheet strung across insect flyways and collecting the arthropods attracted to the sheet. Specimens representing all species attracted to the light were collected individually into separate vials to obtain quality specimens for identification. The method is labor intensive and only one sample per night could be taken for a total of 19 samples. The method is also sensitive to the locality, especially the presence of competing extraneous lights; thus we could not sample the whole area with this method. The light was run for a three- to four-hour period on two or three nights each month. This method is generally good for collecting night flying insects, and is one of the standard ways of surveying for moths. It is best done in a dark area and when no moon is in the sky, as the lights and moon glow compete with the light. For locations see **Figure 5.**

II. C4: *Fogging*

Dense foliage near the ground was fogged using a biodegradable pyrethroid insecticide "flea fogger." A white plastic sheet (a shower curtain) about 6-feet square (3.3 m^2) was laid on the ground, and the foliage above was fogged for 30 seconds. The stunned arthropods were collected off the sheet as they fell. The method provides a relatively unbiased sample of the species present that are vulnerable to the insecticide. It is the preferred method in vegetation not suitable for the aspirator such as plants with abundant loose dry seed heads that clogged the aspirator. For fogging locations see **Figure 5**.

II. C5: *Ant Baits*

Since ants are considered especially problematic as invaders, we specifically searched for them. The gas aspirator proved to be effective for collecting all species found so far in the survey. We also set out ant bait stations along margins of vegetation and at other likely spots. We used three separate baits at most stations: peanut butter, honey, and canned fish-based cat food. Each bait was smeared on a separate chopstick, and the sticks laid on the ground or on other suitable substrates. The bait sticks were checked after one or more hours, and the ants present were collected. Peanut butter proved to be the most convenient to use and gave good results. Ant bait locations are found on **Figure 6**.

II. C6: *Bait Traps*

Several types of traps were used. **Bait traps** were made from clear 2-litter soft drink bottles, by cutting two 1-inch (2.54 cm) diameter holes on opposite sides about ½ way up from the bottom, adding a few ounces of antifreeze as a preservative, and hanging some bait inside near the holes. Bait consisted of smelly organic matter (blue cheese, rotting mushrooms, or meat) to attract scavenging arthropods. Each trap was then tied securely to a tree trunk and left in place for a few days or longer. For bait trap locations see **Figure 4**.

II. C7: *Pan and trunk traps*

These traps were small flat yellow-colored pans and plastic cups filled part way with soapy water and either laid on the ground (pan traps) or pinned to tree trunks (trunk traps). Pan traps and trunk traps were set out and run for two days or longer. Arthropods attracted to the traps drowned and were collected. For pan and trunk trap locations see **Figure 4**.

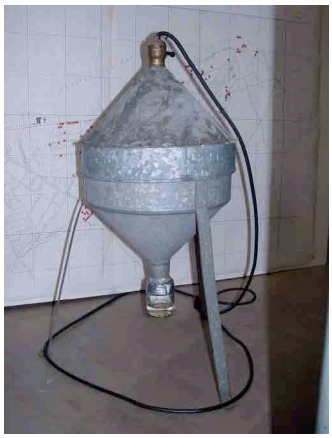
Yellow pan trap, left & Trunk trap, right
Photographs by D.J. Preston, 2001

II. C8: *Beetle trap* (also called Lingren funnels)

Each beetle trap consisted of a set of about eight plastic funnels about 10 inches (25 cm) in diameter fastened to nest about one inch (2.5 cm) apart. The bottom funnel emptied into a small jar with preservative (antifreeze). The traps were hung next to tree trunks and left in place for a month or more. Insects attracted to tree trunks entered the gaps between the funnels and tumbled into the preservative. The traps are efficient for collecting wood-boring beetles as well as insects that migrate from the leaf-litter to the canopy. For beetle trap locations see **Figure 4**.

II. C9: *Berlese Funnels*

Leaflitter and soil arthropods are most efficiently collected with a Berlese funnel, which is made with a large diameter funnel fitted with a jar containing a preservative at the bottom and a wire screen inside just below the rim. A sample of the substrate is placed on the screen, and the funnel loosely covered with a heat source (usually a low-wattage light bulb). As the substrate dries out over a few days, the arthropods move down into the funnel to escape and are captured in the jar. Berlese funnel samples were collected in conjunction with other methods and were processed in the lab. Site locations for samples taken are shown in **Figure 7**.



Berlese Funnel
Photo by D.J. Preston, 2001

II. C10: *Emergence Traps*

Material with insect damage (especially infested branches) was placed in screened cages and the insects captured as they emerged over the course of several weeks. Captured larvae were also reared to adults, by placing them in cages and providing them with their food. Material put in emergence traps was collected from potential hosts while traversing the study area **Figure 2**. Specific locations are listed in **Table 1**.

II. C11: *General Collecting and Host searching*

Substrates and plant hosts were also visually inspected for insects especially in conjunction with other survey methods or while walking between sites. An **insect sweep net** was used to capture specimens. Foliage was also sampled with a **beating sheet**, which is a 3-foot (0.3 m^2) square of muslin stretched tight by a wooden frame. The sheet is held directly below foliage, like an inverted umbrella, and the foliage shaken. Dislodged arthropods were collected from the sheet. Locations for general collecting and host searching are listed in **Table 1** and indicated on **Figures 5** and **7**. Many additional specimens were captured incidentally while walking between sites. The specific localities are not indicated but occur along the routes shown in **Figure 2.**

F.G. Howarth & D.J. Preston using sweep nets to capture dragonflies.
Photo by B. Evans, 2001

II. D: LABORATORY WORK:

F. Starr sorting specimens
Photo by D.J. Preston, 2001

The collected specimens were sorted to separate each morphologically similar form (usually species), and representative specimens of each 'morpho-species' were appropriately mounted, labeled, and curated for identification. Larger insects were mounted on pins and are stored dry. Many soft-bodied groups were collected and remain in ethanol, while the smaller species must be mounted on slides to be identified and preserved. Each morpho-species was identified as far as practical and sent to experts if available. All recognized morpho-species have been identified as far as possible. Some species could not be named and are indicated by letter (e.g., as species A). Some of these are species new to science (and therefore unnamed), and others belong to groups for which a qualified taxonomic authority who is able to identify species within the group is not currently available. Generally, morpho-species that could be identified to genus and securely separated from related species are listed as 'identified'. Forty morpho-species, mostly tiny mites and insects, could not be so identified. Names and status follow Nishida (1997 and 2002), except where updated to include recent changes.

Two sets of vouchers have been prepared. The first set will remain in the Hawaii Biological Survey collections at Bishop Museum, the second set will be deposited in the Hawaii Department of Agriculture collections on Maui. As is customary in entomology, the collaborating specialists may retain a third set of the species they identify, when appropriate and duplicate specimens are available.

III. RESULTS

We collected and processed over 25 thousand specimens representing a total of 624 species, which are listed in **TABLE 2** along with their biogeographic status, which could be determined for 587 species. The biogeographic data are summarized for major taxonomic groups in **TABLE 3.** Of the total, 473 (76%) of the listed species are adventive, 47 (7%) were purposefully introduced, 67 (11%) are native to the islands and 37 (6%) are of unknown status (**TABLE 3**).

Each collection method proved useful in collecting some unique species, although there was considerable overlap among the methods. The malaise trap collected the most specimens and species for the amount of effort expended. Each four-week sample contained over 1000 specimens representing 75 to 100 species. Many species were only collected with this method. Some specimens, notably the moths, did not preserve well and many specimens could not be identified. The gas aspirator proved to be the most comprehensive and possibly least biased method, since most active arthropods within its range were collected. Each five to ten-minute sample contained several 100 specimens representing up to 75 species. Night collecting at a mercury-vapor bulb was excellent for collecting nocturnal insects, and many species were collected only in this way. It is the preferred method for collecting moths, and nearly all of the identified species of moths recorded were collected this way.

III. A: Alien Species, Summary of New Records.

Of the 520 recognized alien species, 192 (37%) represent new records for the island of Maui. Of these about 34 are new records for the state of Hawaii and 158 are new island records. The list of new records is given in **TABLE 4**, and the data summarized by major group in **TABLE 5**. Some of the new state records are also known from other islands, but their presence in Hawaii has not yet been published. When known, these are indicated by "NIR/NSR" in **TABLE 2** and **TABLE 4,** and counted as new island records in the tally of new records. Many of the new island and new state records may have been on Maui for many years but missed in earlier surveys or not reported. For example, the dates of the first record in the Hawaiian Islands for 117 of the 158 new island records are given in **TABLE 4** and summarized by decade in **TEXT TABLE A.** The fact that about 40% of the new island records for Maui have been in Hawaii for over 50 years demonstrates how little is known of the arthropod distributions within the islands. It also underscores the phenomenon of lag time in invasions; that is, the period between a species' establishment and its eventual recognition and appearance in the published record. Specific examples are described below in the species accounts.

TEXT TABLE A: Numbers of species reported as new state records in each decade that are herein listed as new island records for Maui. *

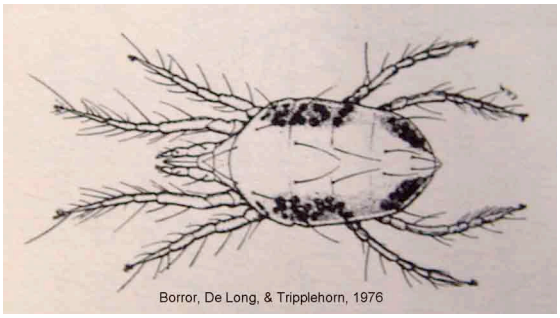
<1900	1900s	1910s	1920s	1930s	1940s	1950s	1960s	1970s	1980s	>1990s
15	5	3	5	5	13	11	18	16	6	20

*** Top row:** decade in which a species was recorded as being established in Hawaii.
Bottom row: number of species in this report that are recorded for the first time as occurring on Maui. (E.g., five of the new island records recorded herein were originally discovered on another island in the decade from 1900 to 1910).

The increase in records during the period from the 1940s to the 1970s corresponds to the publication of the monographic series *Insects of Hawaii* (Zimmerman, 1948-1978; Hardy 1960-1981). The relatively large number of new records among the beetles and wasps is due in part to the fact that these two major insect orders have not yet been treated in the *Insects of Hawaii* series. The recent increase corresponds to the growing interest in invasive species and to the development of the arthropod database and species authority file by the Hawaii Biological Survey (Nishida, 2002). For example, Shelley (2000) reviewed the convoluted history of published records for the giant centipede (*Scolopendra subspinipes*) in Hawaii. This is a large conspicuous species recognized by most people in Hawaii. It was first recorded in Hawaii in 1847, but the island where collected was not given, although it was probably either Maui or Oahu. In 1862, it was recorded from Kauai and Oahu, and in 1880, it was reported from Maui. However, these early island records were missed by Hawaiian biologists because the papers appeared in Europe and at least four different scientific names were used. The advent of electronic databases and growing interest in invasive species encouraged workers to organize older records and identify the gaps in the known distributions of species. The giant centipede has been introduced widely by commerce and is now abundant in most tropical areas. Although the species was present in Hawaii at least by the mid 19th century and may even have been introduced by the Polynesians, it wasn't until 1991 and 2000 that Shelley confirmed the island distribution of the species in Hawaii.

III. B: Taxonomic Overview of Alien Species Collected

Class ARACHNIDA *(Mites, spiders and relatives)*



Tetranychidae: Spidermite

Order Acari: The mites are a large diverse group of mostly tiny arthropods (0.5-3 mm long). Many species are easily dispersed, both through human activities and by natural means. There about 670 species in Hawaii, of which about ¼ are native, but many are of unknown status. Being small and cryptic, they are relatively poorly known. We found 53 species within the airport boundary, of which eight are native, 26 are adventive, and 19 are of unknown status. They include predators, scavengers, herbivores, and parasites. Some species are believed to be invasive in Hawaii, but except for the agricultural pests, their impacts remain poorly documented. Of the families listed, the Acaridae, Tarsonemidae, Tenerifiidae, and Tetranychidae include important crop pests. The grain itch mite (*Pyemotes tritici*) is sometimes abundant enough to cause an unpleasant skin rash in humans. The Fusacaridae species represents a new family in the Hawaiian fauna.

Order Araneae: More than 225 species of spiders are recorded from Hawaii, of which more than half are native. We identified 13 species from the airport, but a few additional species were collected only as immatures and could not be identified. All spiders are predatory on invertebrates, and some appear to be invasive. For example, the alien spinybacked spiders (*Gasteracantha* species) (see adjacent figure) and the pale leaf spider (*Cheiracanthium mordax*) are sometimes nuisances and occasionally bite humans.

Gasteracantha cranciformis C.L. Koch
Photo by D.J. Preston, 2001

Order Scorpiones: Only one scorpion (see adjacent figure) is established in Hawaii. This is the lesser brown scorpion, which has been spread worldwide by humans. It lives in and around houses, and easily stows away in cargo and household goods. It was relatively common under keawe bark and other cryptic habitats at Kahului.

Isometrus maculatus (Degeer)
Photo by D.J. Preston, 2001

Class INSECTA (Insects)

The insects are the most diverse group of organisms in Hawaii with about 8100 species, of which about 5400 are native and 2700 are alien. We list 567 species from Kahului Airport, of which 59 are native, 491 are alien, and 17 are of unknown status. Of the 27 orders found in Hawaii, we found 21, including adding one to the fauna of Maui, the Thysanura (silverfish).

Order Blattodea: Cockroaches are familiar animals to everyone, since many species are important household pests. There are 19 species in Hawaii, all aliens. We found eight species at the airport. One is a new island record, which is surprising since the species (*Symploce pallens)* (see adjacent figure) has been in Hawaii for over 50 years. Its absence from Maui records appears to be an oversight by previous workers rather than the result of its recent arrival. Populations of some species were very low, probably due to the drought. For example, the beetle roach (*Diploptera punctata*) is represented by a single specimen collected during the survey, in spite of searching for it. It is often the most abundant cockroach in leaflitter in Hawaiian lowlands.

S. pallens (Stephens)
Photo by D.J. Preston, 2001

Order Coleoptera: Beetles comprise the largest order of insects and are represented in Hawaii by over 2000 species, including nearly 1400 native species and over 600 alien species. We found 141 species during the current survey, of which 10 are native and 131 are alien. The habits of beetles are also diverse; the group includes many important agricultural, environmental, and household pests. They are often among the dominant herbivores, predators, and scavengers in most terrestrial and freshwater habitats. Twenty-two species found during the survey, mostly lady beetles (Coccinellidae), were introduced into Hawaii for biocontrol of agricultural pests. Forty-three species represent new island records and 15 are new state records. Many of the new island records have been in Hawaii for several decades, and as noted for the cockroaches, a few have probably have been on Maui for a long time but not previously recorded. The difficulties in keeping track of a species' status and distribution in such a diverse group is illustrated by the history of published Hawaiian records for the rove beetle, *Scopaeus* species A (Kumashiro, et al., 2002). Moore (1975) listed the species from Oahu based on specimens collected by Beardsley in 1961, but its status as a new record was subsequently overlooked. Samuelson (1998) recorded it as a new state record based on specimens collected in 1902(!), 1937, 1952, 1958 and 1982 from Oahu, and 1997 from Midway. We record it herein from Maui.

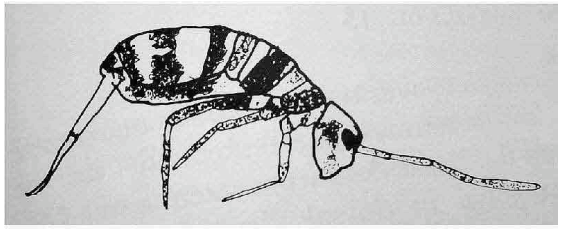
Adoretus sinicus Burmeister
Photo by D.J. Preston, 2002

The metallic woodborer, *Agrilus* species (Buprestidae) is known only from the Kahului Airport area. It is about ¼ inch long and blue-black with a slight metallic sheen. The genus contains many species and is nearly worldwide in distribution; thus it has not been possible to determine from where it came or its identity. All species are woodborers and the larvae of many species feed on the cambium of living plants. The genus includes a number of forest pests. *Agrilus extraneous* Fisher is recorded from Hawaii, but that species has not been recollected in recent years.

Both the pinhole borers (Platypodidae) and bark beetles (Scotylidae) are small wood boring beetles that include serious forest and agricultural pests. Not only do their galleries affect the health of the tree and value of the timber, but also many species of both families transmit fungi, that attack the host tree and provide food for the beetle larvae.

The water scavenger beetle, *Cercyon fimbriatus* (Hydrophilidae) is known from marine littoral habitats along the California coast. The closely related species found at Kahului was also collected on the beach, and the species is probably also marine littoral. Its suspected habitat suggests that the species was introduced via surface vessels, although it is also possible that it arrived as a contaminant in fresh marine shellfish or aquarium shipments in air cargo.

Order Collembola: Springtails are small (1 to 5 mm long), primitive insects without wings that usually live in moist or protected habitats. They are sometimes abundant in leaflitter where they feed on microorganisms and rotting organic material. A few are predators on soft-bodied prey. There are about 170 species in Hawaii, of which nearly 100 are considered native. They are poorly known. We collected only a few species, which remain unidentified. Their populations were probably affected by the drought.



Collembola: Entomobryidae: Christiansen & Bellinger, 1992

Chelisoches morio (Fabricius)
Photo by D.J. Preston, 2001

Order Dermaptera: Earwigs are a small order related to the cockroaches and grasshoppers. The pincers or forceps at the hind end make the group easily recognizable. Most are omnivores, feeding on a wide range of food, including being opportunistic predators. Some catch their prey with the pincers. Only 24 species are known in Hawaii; ten of them are native. We collected three alien species. Except for a flight of one species coming to light on one night in the Kanaha Pond Wildlife Sanctuary, they were uncommon, which probably was a result of the drought.

Order Diptera: Flies have only one pair of wings for flight. This is a large, diverse order and the second largest in Hawaii with 1450 species, of which about 1075 are native. To date, we have identified 103 species from the airport surroundings, of which 87 are alien and 13 are native. Species in a few families have not yet been identified. We collected two of the four problematic true fruit flies (Tephritidae). In addition, the agromyzid leaf miners, calliphorid blow flies, mosquitoes, and house flies listed from the study area include some notorious pests. Six species listed were purposefully introduced as parasites of agricultural pests or for weed biocontrol.

Sarcophaga dux Thomson
Photo by D.J. Preston, 2001

Twenty listed alien species represent new records to the fly fauna of Maui, of which two or three are new state records. The biting midge, *Culicoides* species A (Ceratopogonidae) belongs to a group of important public health, veterinary, and wildlife pests (Loope et al., 2001). Two specimens were found on Oahu in 1999 and 2000 (William Perreira, personal communication), and a single male found in a malaise trap at Kahului Airport in April 2000. Efforts to collect more material have been unsuccessful, and the species may not be established. Since the species

can not be firmly identified until more material is available, its host range is unknown. It appears to belong to the *piliferus* species group from North and South America. This group includes a number of serious pests of birds. The second new state record is an unidentified house fly relative (Muscidae) collected in gas aspirator samples at wetspots and in the malaise trap. Its biology is unknown. The crane fly, *Limonia* species A (Tipulidae), was sometimes common at MV lights and in malaise trap #1. *Limonia* is a large genus with a worldwide distribution. Most species are scavengers in rotting vegetation in moist habitats.

Order Embiidina: The webspinners are a small order of grasshopper relatives. Adults have two pairs of similar wings and resemble termites, and like termites most build nests under bark or in wood. Unlike termites, they have specialized silk glands on the front legs with which they build their silken nests. One alien species (see adjacent figure) is common in lowland habitats in Hawaii, and it was relatively common in keawe forest habitat.

Oligotoma saundersii (Westwood)
Photo by D.J. Preston, 2001

*Brochymena quadripustulata,*Fabricius
Photo by D.J. Preston, 2001

Order Heteroptera: The true bugs are represented in Hawaii by over 400 species, of which over 300 are native and 100 are alien. They are characterized by having the front pair of wings one half thickened and one half membranous and held overlapping each other creating an "X" pattern on the back. Nymphs resemble adults but are wingless. They have piercing-sucking mouthparts and attack in concert a wide range of plants and animals. We collected 39 species of which 36 are aliens. Thirteen of these represent new island records and two are new to the state. The new burrowing bug (Cydnidae) is known so far by only a single specimen collected at light near wet spot # 3. It remains unidentified. Burrowing bugs suck sap from plant roots, and some are pestiferous. The assassin bug, *Sinea rileyi* (Reduviidae) is native to southeastern United States and is a voracious predator of other arthropods. It is potentially invasive by preying on or competing with beneficial insects. Its smaller relative, *Zelus renardii,* native to California and long present in Hawaii, has been implicated in disruption of biocontrol in agricultural fields. Subsequent to our collection at the airport, Dan Polehemus (personal communication) found it in the Kanaio Natural Area Reserve. It has not been found on any other island. Among the new island records is a species of *Appolonius* (Lygaeidae), which was first collected on Oahu in the 1970s. Only a few specimens were known and its biology remained a mystery. We collected a long series including nymphs by fogging an iron wood tree (*Causurina*) at night. The presence of nymphs strongly suggests that its host is *Causurina*. This species appears to be undescribed, but the genus is native to Southeast Asia.

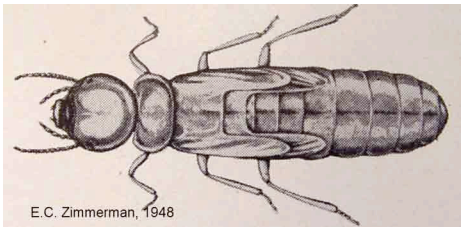
Order Homoptera: The homopterans are related to the true bugs and also have sucking mouthparts and nymphal immatures. The winged species have thickened front wings held roof-like over the body when at rest. All feed on plants and some are serious crop pests. The group includes the leafhoppers, treehoppers, planthoppers, aphids, scales and allied forms. About 700 species are found in

Gyponana germari (Stål)
Photo by D.J. Preston, 2001

Hawaii, of which about 400 are native and 300 are alien. At Kahului Airport, we collected 36 species, of which two are native and 28 are adventive. An additional six species of leafhoppers (Cicadellidae) have not been identified and their status is unknown. There were eight new island records and no new state records, but some of the unknowns may represent additional new records. The aphids and scales (Coccidae, Diaspididae, and Pseudococcidae) have not been completely identified.

Ampulex compressa (Fabricius)
Photo by D.J. Preston, 2001

Order Hymenoptera: The bees and wasps have two pairs of narrow membranous wings hooked together to function as one pair in flight. They have chewing mouthparts, but in the bees, these are modified into tongues for gathering nectar. The majority of primitive wasps are parasites of other arthropods, and many species have been introduced as biocontrol agents against agricultural pests. However, some feed on plants as gall-makers, seed predators, or wood borers. Higher wasps (including the ants) are mostly predators, but many are omnivorous. There are about 1300 species in Hawaii, with 650 native, 450 adventive 170 introduced, the remaining of unknown geographic status. We collected 100 species in this study, of which six are native, 81 adventive, and 11 purposefully introduced. Thirty-seven species are new island records, and ten are new to the state. The majority were identified by the late John W. Beardsley, who unfortunately passed away before completing the identifications. A large percentage of the species were in his possession in California at the time of his untimely death, and we have not been able to locate the specimens representing some groups. Where possible these are listed from his notes. In addition to providing identifications, Dr. Beardsley was generously collaborating on many phases of this survey, and his friendship, expertise and continued assistance have been sorely missed.



Nymph of alate termite

Order Isoptera: Termites are a small order of grasshopper relatives with four narrow membranous wings that flutter independently in flight. Termites feed on wood or other dry vegetation and are social, living in colonies in wood or underground. Many are serious urban or agricultural pests. There are six species in Hawaii, all adventive and feeding on wood. We found two species, one of which is the subterranean termite, considered the most destructive pest in Hawaii.

Agraulis vanillae Linnaeus
Photo by D.J. Preston

Order Lepidoptera: Moths and butterflies have two pairs of membranous wings that are ornamented with overlapping scales. Adults have mouthparts modified into long tongues for sipping nectar and other fluids. The larvae, called caterpillars, feed mostly on plants and some are serious crop pests. There are about 1150 species in Hawaii, of which 950 are native, 163 adventive, and 28 introduced. The latter were introduced for biocontrol of weeds. We

collected 102 species within the airport environs, of which 21 are native, 76 adventive, and 5 purposefully introduced. Among the alien species, 18 are new island records, and 3 are new state records.

The unidentified crambid moth does not match anything in the Hawaiian or Pacific area collections at the museum. We collected a single specimen at light near wet spot # 2. The *Ctenoplusia albostriata* (Noctuidae) is also represented by a single specimen collected at light from Kanaha Pond Wildlife Sanctuary. The species is known from Fiji and neighboring south Pacific islands. It has a wide host range, and related plusiine noctuids include several notorious crop pests. The unidentified gelechiid near *Autosticha* is a tiny brown moth (wingspan ~5 mm), which was collected a few times at light. *Autosticha* species are mostly scavengers in the leaflitter suggesting the habits of this species also.

Adults of the rosette sphinx moth (*Hippotion rosetta*) were first collected on Oahu in January 1998 and on Kauai in November 1998 (Kumashiro et al. 2002). At Kahului Airport, it was present in our early malaise trap samples in November 1999 and was probably present before we began our survey. By the time it was discovered, it had already completed one or more generations in the islands, and it is not possible to determine the island where it first became established. The species is widespread in tropical Asia and western Indo-Pacific to northern Australia and the Solomons. It has frequently been confused with the closely related *Hippotion boerhaviae*, and most published larval host records could refer to either species. Thus the host range of *H. rosetta* is unknown but possibly includes plants in the following families: Amaranthaceae, Balsaminaceae, Cucurbitaceae, Leguminosae, Nyctaginaceae, Rubiaceae, Scrophulariaceae, and Theaceae.

Order Mantodea: Preying mantids are familiar insects related to the grasshoppers. They have chewing mouthparts and thickened spiny forelegs, which they hold in a prayer-like pose ready to capture prey. There are six species recorded from Hawaii, all adventive. We collected two species during this study. The *Hierodula* is more arboreal, and although possibly common, it is not often seen. *Tenodera* prefers low vegetation in open areas; its egg cases are common on the wooden fence along the bike path.

Tenodera australasiae (Leach)
Photo by D.J. Preston

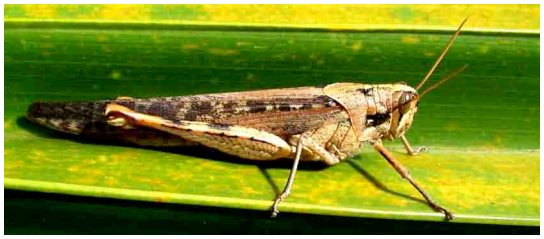
Order Neuroptera: Lacewings, antlions, and their allies are predatory in both the larval and adult stages. They have chewing mouthparts and two pairs of membranous, net-veined wings. There are 58 species known from Hawaii, of which 50 are native. We record four species from the airport environs: one native species, two adventive, and one purposefully introduced.

Micromus timidus Hagan
Photo by D.J. Preston, 2001

Order Odonata: Dragonflies and damselflies are large (The wingspans of Hawaiian species range from 7 cm to 15 cm.), conspicuous insects with two pairs of net-veined membranous wings, chewing mouthparts, and large eyes. Nymphs are aquatic or live in moist habitats. All are predatory. There are 40 species in Hawaii, of which 32 are native and eight adventive. We collected four species, two native and two adventive.

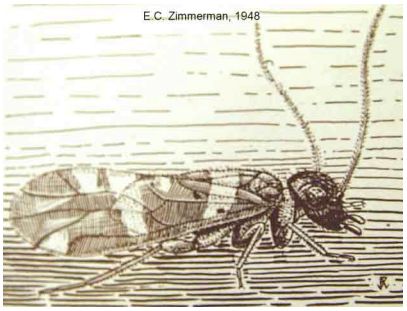
Pantala flavescens (Fabricius)
Photo by D.J. Preston

Order Orthoptera: Grasshoppers and crickets are familiar insects with leathery forewings and fan-shaped membranous hindwings, chewing mouthparts, and jumping hind legs. Most are omnivores, but many prefer plant material and some are predatory. There are 287 species recorded from Hawaii, of which 260 are native, and 27 adventive. We list nine adventive species from the airport environs. The katydid, *Elimaea punctiera*, is a new island record, although a specimen in the Hawaii Biological Survey collection dating from the early 1900s indicates that it has been on Maui for a century or more.



Schistocerca nitens (Thunberg)
Photo by D.J. Preston

Order Psocoptera: Barklice are small (body-length ~1-5 mm) fragile-looking insects with chewing mouthparts and two pairs of membranous wings. Nymphs resemble adults. Most are scavengers on tree trunks, leaflitter, and similar habitats. A few have invaded human habitations and have become household pests. There are 134 species recorded from Hawaii, of which 92 are native and 42 adventive. We collected at least five species, four of which have not been identified. One species, the book louse, is a cosmopolitan household pest that probably lives in nearly every building, larger container, ship, and aircraft worldwide. Surprisingly, it is recorded herein from Maui for the first time, even though it possibly arrived with Captain Cook (if not earlier with the Polynesians) and has been continually introduced ever since. It is so ubiquitous that new distribution records are sometimes not reported, and in fact, curated specimens are relatively rare in entomological collections, and its taxonomy poorly understood.



Psocoptera

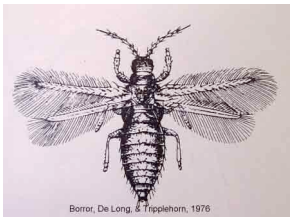
Order Siphonaptera: Fleas are blood-sucking parasites of vertebrates and were outside the scope of this survey. However, the cat flea bit one of the survey team (FGH) in the HDOA insectary at Kahului and therefore made the list.

Siphonaptera: Flea

Order Strepsiptera: Stylopids are highly specialized internal parasites of arthropods. The larvaform females remain with their hosts, whereas the midge–like males emerge to find mates. In spite of their appearance, they are related to beetles. Three adventive species are known from Hawaii. We collected one species associated with its *Polistes* wasp host (see adjacent figure).

Xenos auriferi Pierce
Photo by D.J. Preston

Order Thysanoptera: Thrips are small (body-length ~1-5 mm) elongate insects with thin strap-like wings fringed with long hairs. They have sucking mouthparts and feed on plants or are predators of small arthropods. Nymphs resemble adults. There are 145 species recorded from Hawaii, of which 29 are native, 113 adventive, and three purposefully introduced. Most of our thrips collection has not been identified, but we confirmed the presence of one pest species, the garden thrips (see adjacent figure).



Heliothrips heamorrhoidalis
(Bouche)

Order Thysanura: Silverfish are primitive wingless insects, which are scavengers or omnivores in damp habitats. There are six species recorded for Hawaii, all adventive. We collected specimens of the cosmopolitan household pest in the HDOA insectary at Kahului (see adjacent figure). Like the book louse, its collection surprisingly represents a new island record for Maui, even though, also like the book louse it has certainly been a pest on Maui for a very long time.

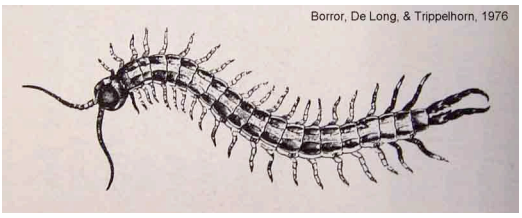
Ctenolepisma longicaudatum (Banks)
Photo by D.J. Preston, 2002

Order Trichoptera: Caddisflies are related to the Lepidoptera, but differ in having the wings clothed in hairs rather than scales, chewing mouthparts, and aquatic larvae. Only three species are known from Hawaii, all adventive. We collected two species, both already reported from Maui.

Cheumatopsyche pettiti (Banks)
Photo by D.J. Preston, 2001

Class CHILOPODA (Centipedes)

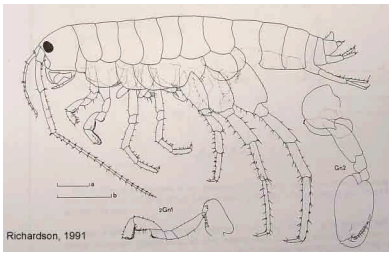
Order Scolopendromorpha: Giant centipedes are fearsome creatures known for their painful bite. The single species in Hawaii is adventive and can attain a length of six inches (15 cm) It was common and active at night within the airport area.



Scolopendra

Class CRUSTACEA (Crabs and relatives)

Order Amphipoda: Sandhoppers are small (body length ~5-15 mm) shrimp-like crustaceans, which are laterally flattened and characteristically jump when disturbed. There are 16 terrestrial species recorded from Hawaii. Twelve of these are native and four are adventive. Two adventive species are usually abundant scavengers in leaflitter in the lowlands of Hawaii, and we expected to find them in this survey. Their rarity was probably caused by the drought. We collected one unusual species under a rock near wet spot #3 and have not been able to identify it.



Amphipoda

Order **Isopoda:** Slaters and pill bugs are small shrimp-like crustaceans, which are dorso-ventrally flattened and run (slaters and sow bugs) or role into a tight ball (pill bugs) when disturbed. They are scavengers and omnivores in a wide variety of habitats, and some are invasive. There are 55 species in Hawaii: 20 natives and 32 adventive. We collected only two alien species during this study; both already recorded from Maui. The low diversity probably was a result of the drought.

Isopod
Photo by D.J. Preston

III. C: Overview of Native Species Collected.

A total of 67 native species were collected, including 59 endemic and 8 indigenous species. The biogeographic status for each species is indicated in the list of species in **TABLE 2,** and the data summarized by major group in **TABLE 3.** Surprisingly, a significant percentage of the native species represent new island records or species new to science. The ratio of new records to previously recorded species could not be determined because species in some native groups would have required a taxonomic revision to determine whether the species collected was recorded from another island or not, and this was beyond the scope of this study. However, at least 23 species appear to represent new records, of which about ten are probably also new species. Thus, the ratio (23/67 = 34%) is similar to that found among the alien species (i.e., 192/520 = 37%). The discovery of new species and new island records among the native arthropods living within the Kahului Airport environs shows that significant gaps remain in our knowledge of island arthropods. Furthermore, since all of the native species, or at least the majority, have been on Maui for millennia, the new records corroborate the hypothesis that a significant lag time can occur between the successful colonization of an alien species and its eventual discovery.

III. D: Notable Native Species Collected.
The Endangered Blackburn Sphinx Moth:
Among the native species found were larvae of Blackburn's sphinx **(*Manduca blackburni*)**, which is one of the largest native insects with a wingspan of five inches (12 cm). Once common, its population declined, and the United States Fish and Wildlife Service recently listed the species as the first officially endangered Hawaiian insect. Since the species was historically known from Sprecklesville near the airport and had been rediscovered there just before we began our survey, we were asked to watch for it and if possible make recommendations on possible management strategies that did not significantly affect airport operations. This we have been able to do.

Manduca blackburni (Butler)
Photograph by B.H. Gagné

We observed (but did not collect) larvae feeding on the weedy alien tree tobacco (*Nicotiana glauca*) in the wind-sheared coastal vegetation zone at the east end of the runway. Possible feeding damage but no larvae were found on tree tobacco within the Kanaha Pond Sanctuary, although it has been found there in recent years (Fern Duval, DLNR, personal communication). We found no evidence of the species in the large patch of potential hosts at the western edge of the study area, but the latter area has been dry. Furthermore, that area does not appear to provide suitable long-term habitat for the moth, since it has had a history of disturbance as agricultural land, is subject to drought, and the moth would be more vulnerable to parasitism than at more coastal sites. The coastal wind-sheared habitat at the east end of the airport area near Sprecklesville appears to act as a refuge for the species. Among the main threats to the species are introduced egg and larval parasites, many of which do not disperse or survive well in wind-swept environments. Adult sphinx moths are strong fliers and able to find hosts even in windy habitats. The species can withstand long periods of drought and persist in seasonally dry climates by aestivating as pupae in the soil. Besides the tree tobacco, the east end of the airport area contains a number of surviving native lowland and strand shrubs along with a mix of invasive alien plants. Most of the native plants in this environment rarely grow higher than two meters (six feet) in this environment, whereas a few of the invasive plants present (notably Christmasberry, *Schinus terebinthifolius*) can become trees. This area at the east end of the runway is within an airport safety zone, and FAA safety regulations require that the stature of the vegetation remains low. Thus the area has been periodically cleared in the past. Since clearing favors the spread of the invasive Christmasberry and other high growing alien plants, the problem of tall vegetation will continually worsen with further clearing, which then would require more and more frequent clearing. To aid the survival of the endangered sphinx moth as well as other rare native plants and animals in the area, we recommend that the area be managed to enhance the low-growing native coastal shrubland. In the long term, this should be easier, cheaper, and environmentally better than periodically mowing or clearing the vegetation. Members of the Native Plant Society on Maui and staff of the US Fish and Wildlife Service agree with the benefits of this plan and have indicated a willingness to assist in maintaining the native plants in this area. The Kanaha Pond Wildlife Sanctuary, a state managed sanctuary also provides suitable habitat for the moth, and the manager (Fern Duval, DLNR, personal communication) is planning to enhance native host plants as well as maintain tree tobacco, which is an alternate alien host.

Coleoptera: A single specimen of a small (about 3 mm long), flightless weevil (*Acalles* species) was collected in a gas aspirator sample at night from a`ali`i *(Dodonaea viscosa)* in Kanaha Pond Wildlife Sanctuary. This is the first specimen of *Acalles* collected in the lowlands in nearly 100 years. It had been believed that the group was wiped out in ant infested areas (Zimmerman, 1948a), but this discovery indicates that some lowland populations survive.

A new species of woodborer in the genus *Plagithmysus* was discovered feeding on native *Chenopodium* shrubs at the airport. The species is closely related to *P. chenopodii* known from Oahu. The genus contains over 130 species and is endemic to Hawaii. It was surprising to find a new lowland species in this native group.

Plagithmysus new species
Photo by D.J. Preston, 2001

Diptera: Ten of the 13 native species of flies collected live in aquatic or semi aquatic habitats, where they are protected from ants and many other threats. At least three species represent new island records, including *Clunio* species A, which is a member of a widespread group of marine littoral midges not previously recorded from Maui.

Heteroptera: Three species of native true bugs were collected, which were not expected to occur within the study area. The koa bug, *Coleotichus blackburniae,* and the native predatory stink bug, *Oechalia cf pacifica*, have become very rare since the late 1960s, which corresponds to the arrival of several alien stink bug parasites (Staples and Cowie, 2001). The *Nysius* seed bug was associated with its native *Chenopodium* host, which is still fairly common along the coast.

Hymenoptera: At least six native wasps were collected. The most noteworthy are the two species of *Ectemnius*. *Ectemnius* are predators catching flies by sallying from a perch and provisioning their nests with them for their larvae. Not found were wasps in the genus *Odynerus* or native bees (*Hylaeus*). Both groups were common and represented by numerous species in the lowlands until recent times. *Odynerus* provision their nests with caterpillars. The bees were important pollinators of native plants.

Lepidoptera: In addition to Blackburn's sphinx discussed above, 20 native moths were collected. The relatively high number indicates that moths as a group have survived habitat destruction and alien species better than most other orders. The most interesting finding was six distinct species of *Hyposmocoma*. *Hyposmocoma* is an endemic genus that contains over 350 species in the islands and represents one of the largest examples of adaptive radiation in the world. They are small to tiny moths with a wingspan between 4 mm and 20 mm. Various species occur in most habitats from sea level to tree line. The larvae of some bore in wood; others are case makers and eat leaves or scavenge on debris and microorganisms on surfaces. Both their cases and wood boring habits would protect them somewhat from ants and other alien

predators. Three of the species were common and together were among the most abundant moths at some sites. A fourth species was collected only a few times, and the other two are represented by a single specimen each. The genus is in need of revision before new collections can be identified, but we believe that the six species from the airport are probably new to science.

The endemic Hawaiian genus *Thyrocopa* is another group of woodborers and scavengers, which was represented by probably two species. Their brownish gray wings span about 20 to 25 mm. They were relatively common in the keawe forest habitat, and their larvae probably are woodborers or scavenge under loose bark.

The family Crambidae was represented by six species, two of which are new island records. The endemic genus *Tamsica* with six endemic species surprisingly has not been reported from Maui before now. *Udea litorea* was previously known from Oahu and Lanai, where it is rare or local. It was relatively common on and around its host plant, naupaka *(Scaevola taccada)* at the east end of the airport. The endemic crambid, *Orthomecyna cf exigua,* was the most abundant moth at some sites. Its larval biology remains unknown.

IV. DISCUSSION

This report represents the completion of the baseline arthropod survey. However, the list of all taxa occurring within the Kahului Airport Environs will be a dynamic changing document as new species will arrive and some established species may be extirpated. Also, species within certain groups have not yet been identified either because a qualified person able to identify species within the group was not available or because identification would require a revision of the group, possibly worldwide, before a species could be properly placed. In addition, many species were missed because of their cryptic habits and also because of the below average rainfall before and during the project, which severely limited the hoped for flush of arthropod activity following the winter rains.

The current list will expand, as additional species are collected and unidentified under the future monitoring program at Kahului Airport. Several usually common species were not found; for example, the Australian cockroach (*Periplaneta australasiae*), the German cockroach (*Blatella germanica*), and the native biting midges in the genus *Dasyhelea* were searched for but not collected. In all, more than 100 alien species were expected to occur within the project area but were not found. As noted some may have been rare or extirpated by the prolonged drought or other ecological factors, but some were missed because of not being at the right place at the right time, especially given the number of species to be sampled. Another factor is the fact that some nonresident species will be collected as they temporarily visit the survey area. Most of the listed species appear to be resident within the project area. However, because the biologies of most arthropods are not known in enough detail, we could not confirm the residency status for many listed species. At least one listed species, the western yellowjacket (*Vespula pensylvanica*) is not resident at the airport, as it nests only above 1000 feet (300 m). Adults are strong fliers and can be found far from their nests.

The discovery of so many new Hawaii and Maui records as well as new species of native insects within the project area underscores the imperfect knowledge available on the status and distribution of arthropods in the islands. The 192 new records among the alien species (37% of the total!) found in this survey, rather than being alarming, confirms the value of biological surveys and monitoring of the areas near ports of entry if quarantine measures are to be improved. The similar proportion (about 35%) of new records among the native species underscores the need for further biological surveys. Before the advent of databases and the Hawaiian arthropod checklist (Nishida, 1997), determining which species had been previously recorded from Maui for such a large survey would have been nearly impossible. Now that the checklist is available, workers are filling in the gaps (e.g., Shelley, 2000).

Some orders appear to be disproportionately well represented in numbers of alien species in Hawaii. This is also true for native species as well (Zimmerman, 1948a), and for both the major factor is the opportunity to travel to Hawaii to found a new population. Most native arthropod species belong to vagile groups able to disperse to Hawaii. Alien species were able to take advantage of several different opportunities (Beardsley, 1979). The household pests and other human associated species arrived with humans. Some species, especially in the orders Coleoptera, Hymenoptera, and Diptera, were purposefully introduced as pollinators or biocontrol agents. Many arrived with their associated hosts that were purposefully introduced; for example, the Homoptera, Heteroptera, Thysanoptera, and some Lepidoptera have cryptic life stages (eggs and pupae) and can travel well-concealed on or in their host plant. Many arrived hidden in high-risk commodities, such as soil or hay. The inadvertent or accidental stowaways travelling passively with transport would be expected to be a sample of the arthropod fauna of the source region, and indeed the number of alien species within each taxonomic group roughly approximates the proportion of species in that group outside Hawaii.

IV.A. Proposed Monitoring Program:

It is recommended that a monitoring program be developed that focuses on completing the list of arthropods occurring within the airport environs, as well as search for newly established species. The monitoring program would employ protocols similar to those used in this survey, except that survey trips would be scheduled about four times a year rather than once a month. The primary method would use one or more malaise traps set to run continuously within the airport area and serviced every three to four weeks. Such a monitoring program also would ensure that personnel experienced in arthropod survey and identification are available to assist rapid response teams when a newly established invasive species is detected. Many species are active only at certain seasons in lowland habitats such as at Kahului Airport; therefore, it would be advantageous to sample during each season and to extend the sampling beyond one year, as vagaries in climate and environment can affect arthropod populations from year to year.

IV.B: Proposed Database:

Now that a working species list is available, the next step is to develop a database that will manage, disseminate, and use the information more efficiently. Computers and software are now available that can handle such a daunting volume of data, and the Biological Resources Division of the U.S. Geological Survey (USGS/BRD) is developing a standard system for handling biological data. One of their information nodes is being developed in Hawaii and will create

biological databases for the Pacific Region. The Hawaii Biological Survey at Bishop Museum is partnering with the Hawaiian Heritage Database, USGS/BRD, and others to host the node in Hawaii. Thus the time is right for developing a database of the species occurring within the airport environs and to link it to the standard national database. A recommended added feature would be to include a web based program to serve as an aid to the identification of the included species. Software programs now exist that greatly facilitate rapid identification of unknown species. Making such a system available on line to quarantine staff as well as other stakeholders means that most species could be accurately and rapidly identified on site. Thus only unusual species or those not in the database would need to be sent to a specialist.

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Table 1: Collection sites sampled for arthropods within the Kahului Airport environs between 1 August 1999 and June 2001. Map Datum is NAD 83.

Site No.	Collection Type	Date	Latitude	Longitude	Habitat	Host(s)
1	Gas Aspirator	4 Aug. 1999	20^0 54'07"N	156^0 26' 33"W	Keawe Forest	Keawe and under-story shrubs
2	Gas Aspirator	4 Aug. 1999	20^0 54'07"N	156^0 26'34"W	Keawe Forest	Keawe and under- story shrubs
3	Gas Aspirator	5 Aug. 1999	20^0 54'38"N	156^0 25'22"W	Strand shrubland	Heliotrope, *Scaevola*, *Schinus*, etc.
4	Gas Aspirator	5 Aug. 1999	20^0 54'37-41"N	156^0 25'21-22"W	Beach and strand	Rocky shore and *Schinus*, *Ricinus*,etc.
5	Gas Aspirator	5 Aug 1999	20^0 54'17-20"N	156^0 26'09-12"W	Roadside	*Schinus, Pluchea*, etc.
6	Gas Aspirator	5 Aug. 1999	20^0 54'24"N	156^0 26'05"W	Dry shrubland	*Pluchea, Waltheri*a, grass
7	Gas Aspirator	5 Aug. 1999	20^0 54'28"N	156^0 26'07"W	Strand	*Paspalum*? grass, strand shrubs
8	Gas Aspirator	6 Aug. 1999	20^0 54'47"N	156^0 25'33"W	Beach	Rocky shoreline
66	Gas Aspirator #1	5.Sept.1999	20^0 53'40"N	156^0 26'45"W	Ornamentals UPS Road & Main drive.	Road edge *Bougainvillia*
9	Gas Aspirator	8 Sept. 1999	20^0 53'58"N	156^0 26'38"W	Roadside and keawe	Keawe, *Pluchea, Abutilon*, etc.
9	Gas Aspirator	8 Sept. 1999	20^0 53'58"N	156^0 26'38"W	Roadside and keawe	*Schinus*
6	Gas Aspirator	8 Sept. 1999	20^0 54'24"N	156^0 26'05"W	Dry shrubland	*Cenchrus*
10	Gas Aspirator	8 Sept. 1999	20^0 54'26"N	156^0 26'05"W	Dry shrubland	*Pluchea*
11	Gas Aspirator	8 Sept. 1999	20^0 54'28"N	156^0 26'08"W	"Cook's Beach"	Coast and flotsam
12	Gas Aspirator	8 Sept. 1999	20^0 54'24"N	156^0 26'00"W	Wetland # 2	*Sesuvium*, *Pluchea* etc.
12	Gas Aspirator	8 Sept. 1999	20^0 54'24"N	156^0 26' 00"W	Wetland # 2 at night	*Sesuvium*, *Pluchea* etc.
13	Gas Aspirator	8 Sept. 1999	20^0 54'24"N	156^0 25'59"W	Wetland # 2 at night	*Sesuvium*, *Pluchea, etc*.
13	Gas Aspirator	8 Sept. 1999	20^0 54'24"N	156^0 25'59"W	Wetland # 2 at night	*Sesuvium*, *Pluchea, etc*.
14	Gas Aspirator	9 Sept. 1999	20^0 54'12"N	156^0 26'16"W	Wetland # 1	Sedges and grass
15	Gas Aspirator	9 Sept. 1999	20^0 54'09"N	156^0 26'23"W	*Leucaena* shrubland	*Leucaena* and grass *(Cenchrus)*
16	Gas Aspirator	9 Sept. 1999	20^0 54'03"N	156^0 26'35"W	Keawe forest and lawn boundary	Keawe, *Leucaena,* grass, herbs
17	Gas Aspirator	9 Sept. 1999	20^0 54'03"N	156^0 26'36"W	Hedge at night	*Leucaena* and vines
18	Gas Aspirator	9 Sept. 1999	20^0 54'02"N	156^0 26'36"W	Lawn at night	Grass and herbs
14	Gas Aspirator	9 Sept. 1999	20^0 54'12"N	156^0 26'16"W	Wetland # 1 at night	Sedges and grass
209	Gas aspirator #2 at Malaise #1 site	11.Sept.1999	20^0 54'22"N	156^0 25'56"W	*Leucaena* shrubland	*Leucaena, Pluchea, Cenchrus, Asystasia, etc.*
121	Gas Aspirator	4 Oct 1999	20º53'36"N	156º26'68"W	Dry Shrubland	*Nicotiana* Mixed weeds.
122	Gas Aspirator	4 Oct 1999	20º53'34"N	156º26'00"W	Dry Shrubland	*Nicotiana* Mixed weeds.
19	Gas Aspirator	4 Oct. 1999	20^0 53'22"N	156^0 26'40"W	Ruderal	*Nicotiana, Cenchrus ciliarus*, barren
20	Gas Aspirator	4 Oct. 1999	20^0 53'20"N	156^0 26'48"W	Ruderal	*Nicotiana, Cenchrus, Saccharum, Ricinus, etc*
21	Gas Aspirator	5 Oct. 1999	20^0 53'45"N	156^0 26'38"W	Hedge	*Hisbiscus* and lawn
22	Gas Aspirator	5 Oct. 1999	20^0 53'46"N	156^0 26'37"W	Ornamental plantings	Cycads, palms, hedge

Table 1. Continued.

Site No.	Collection Type	Date	Latitude	Longitude	Habitat	Host(s)
22	Gas Aspirator	5 Oct. 1999	20^0 53'46"N	156^0 26'37"W	Ornamental plantings	Lilies, hedge
123	Gas Aspirator	5 Oct 1999	20^0 53'58"N	156^0 26'53"W	Keawe woodland	*Chenopodium*
20	Gas Aspirator	6 Oct. 1999	20^0 53'20"N	156^0 26'48"W	Ruderal	*Nicotiana, Cenchrus, Saccharum, Ricinus, etc*
124	Gas Aspirator	6 Oct 1999	20º53'45.5"N	156º26'41"W	Dry Shrubland	*Leucaena, Ricinus, Cenchrus,* Australian saltbush, *Ipomea, Pulchea, Boerhavia, Bidens.*
125	Gas Aspirator	6 Oct 1999	20º53'45"N	156º26'40.5W"	Dry Shrubland	*Leucaena, Ricinus, Cenchrus,* Australian salt bush, *Ipomea, Pulchea, Boerhavia, Bidens.*
126	Gas Aspirator	6 Oct 1999	20º53'45"N	156º26'40"W	Dry Shrubland	*Leucaena, Ricinus, Cenchrus,* Australian salt bush, *Ipomea, Pulchea, Boerhavia, Bidens.*
23	Gas Aspirator	7 Oct. 1999	20^0 54'39"N	156^0 25'33"W	Dry shrubland	*Chenopodium*
24	Gas Aspirator	7 Oct. 1999	20^0 54'34"N	156^0 25'40"W	Wetland # 3	*Pluchea, Hibiscus, etc.*
25	Gas Aspirator	7 Oct.1999	20^0 53'46"N	156^0 27'24"W	Kanaha Res.	Dried mud, sedges, and *Sesuvium*
26	Gas Aspirator	7 Oct.1999	20^0 53'49"N	156^0 27'12"W	Kanaha Res.	Dried mud and sedges
27	Gas Aspirator	7 Oct.1999	20^0 53'51"N	156^0 27'21"W	Kanaha Res.	*Sporobolus*
28-29	Gas Aspirator, 6 samples	2 Nov. 1999	20^0 53'34-37"N	156^0 26'56"-27'02"W	Lawn and ornamental plantings	*Cyanodon, Wedalia, Gossipium, Erythrina,* Bougainvillea, Juniper, weeds, and low herbs
30	Gas Aspirator	2 Nov. 1999	20^0 53'34"N	156^0 27'04"W	Ornamental plantings, at night	*Thevetia, Wedalia, Cyanodon*
31	Gas Aspirator	2 Nov. 1999	20^0 53'33"N	156^0 27'05"W	Ornamental plantings, at night	Bougainvillea, *Wedalia, Cyanodon,*
32	Gas Aspirator	2 Nov. 1999	20^0 53'34"N	156^0 27'06"W	Ornamental plantings, at night	Bougainvillea, *Cyanodon,* weeds
29	Gas Aspirator	2 Nov. 1999	20^0 53'37"N	156^0 27'04"W	Ornamental plantings, at night	*Verbesina*
33	Gas Aspirator	3 Nov.1999	20^0 53'54"N	156^0 27'06"W	Kanaha Res.	*Chenopodium, Pluchea, Sesuvium*, grass, keawe
34	Gas Aspirator	3 Nov.1999	20^0 53'51"N	156^0 27'05"W	Kanaha Res.	*Sesuvium, Sporobolus, Pluchea*
35	Gas Aspirator	3 Nov.1999	20^0 53'42"N	156^0 27'05"W	Kanaha Res.	*Ruderal with keawe, Sporobolus, Sesuvium,*
127	Gas Aspirator	3 Nov. 1999	20^0 53'56"N	156^0 27'16"W	Kanaha Res. At night	*Aalii, Scaevola*
36	Gas Aspirator	4 Nov.1999	20^0 53'41"N	156^0 27'12"W	Kanaha Res.	*Chenopodium*
37	Gas Aspirator	4 Nov.1999	20^0 53'44"N	156^0 27'10"W	Kanaha Res.	Pond margin: sedges and mud cracks
38	Gas Aspirator	4 Nov.1999	20^0 53'47"N	156^0 27'21"W	Kanaha Res.	*Sporobolus virginicus*
39	Gas Aspirator	4 Nov.1999	20^0 53'45"N	156^0 27'29"W	Kanaha Res.	*Sesbanea tomentosa*
40	Gas Aspirator	4 Nov.1999	20^0 53'40"N	156^0 27'23"W	Kanaha Res.	*Bolboschoenus* sedge
41	Gas Aspirator	4 Nov.1999	20^0 53'56"N	156^0 27'15"W	Kanaha Res. at night	*Myoporum* (Naio)

Table 1. Continued.

Site No.	Collection Type	Date	Latitude	Longitude	Habitat	Host(s)
42	Gas Aspirator	4 Nov.1999	20^0 53'56"N	156^0 27'16"W	Kanaha Res. at night	*Dodonaea* (A`ali`i)
43	Gas Aspirator	4 Nov.1999	20^0 53'56"N	156^0 27'23"W	Kanaha Res. at night	*Sporobolus*
44	Gas Aspirator	4 Nov.1999	20^0 53'56"N	156^0 27'19"W	Kanaha Res. at night	*Scaevola*
45	Gas Aspirator	1 Dec. 1999	20^0 53'55"N	156^0 25'45"W	*Leucaena* scrub	*Leucaena, Ricinus, Panicum, Botriochloa, Melinus, Cenchrus*, etc.
46	Gas Aspirator	1 Dec. 1999	20^0 54'00"N	156^0 25'41"W	Lawn	*Cyanodon* & mixed grasses, *Wedalia* & weeds
46	Gas Aspirator	1 Dec. 1999	20^0 54'00"N	156^0 25'41"W	Lawn	*Senna*
47	Gas Aspirator	1 Dec. 1999	20^0 54'01"N	156^0 25'40"W	Sugar cane & ruderal	Sugar cane and ground
48	Gas Aspirator	1 Dec. 1999	20^0 54'14"N	156^0 25'40"W	*Leucaena* scrub	*Leucaena, Ricinus, Cenchrus, Waltheria* etc.
45	Gas Aspirator	2 Dec. 1999	20^0 53'55"N	156^0 25'45"W	*Leucaena* scrub	*Leucaena, Ricinus, Panicum, Botriochloa, Melinus, Cenchrus*, etc.
49	Gas Aspirator	2 Dec. 1999	20^0 53'28"N	156^0 26'10"W	Ruderal & ornamentals	*Leucaena, Hibiscus,* palms, ground
50	Gas Aspirator 1	2 Dec. 1999	20^0 53'54"N	156^0 27'24"W	Kanaha Pond Res. at night	*Scaevola, Sporobulus*
51	Gas Aspirator 2	2 Dec. 1999	20^0 53'56"N	156^0 27'22"W	Kanaha Pond Res. at night	*Dodonaea*
52	Gas Aspirator 3	2 Dec. 1999	20^0 53'56"N	156^0 27'18"W	Kanaha Pond Res. at night	*Myoporum*
42	Gas Aspirator	2 Dec. 1999	20^0 53'56"N	156^0 27'16"W	Kanaha Pond Res. at night	*Dodonaea*
53	Gas Aspirator	3 Feb. 2000	20^0 54'23"N	156^0 25'54"W	Mixed shrub	*Sesuvium portulacastrum*
95	Gas aspirator	2 Feb. 2000	20^0 53'10.5"N	156^0 27'08.5"W	Fallow Cane field w/ ruderal boarders	*Waltheria*
96	Gas aspirator	2 Feb. 2000	20^0 53'09.5"N	156^0 27'09.6"W	Fallow Cane field w/ ruderal boarders	*Pluchea*
97	Gas aspirator	2 Feb. 2000	20^0 53'08.4"N	156^0 27'10.8"W	Fallow Cane field w/ ruderal boarders	*Sida fallax*
98	Gas aspirator	2 Feb. 2000	20^0 53'09.5"N	156^0 27'12"W	Fallow Cane field w/ ruderal boarders	*Sida fallax*
99	Gas aspirator	2 Feb. 2000	20^0 53'09.5"N 156^0 27'12"W to	20^0 53'12"N 156^0 27'10'W	Fallow Cane field w/ ruderal boarders	*Nicotiana, Bidens, Cenchrus, Cyanodon Pluchea, Saccharum, Asystasia, Ricinus, Sida Portulaca Leucaena, etc*
53	GasAspirator	3 Feb. 2000	20^0 54'23"N	156^0 25'54"W	Mixed shrubs	*Atriplex semibacata* = Australian salt bush
53	Gas Aspirator	3 Feb. 2000	20^0 54'23"N	156^0 25'54"W	Bare pond bottom	Dry pond pan w/a few sedges
53	Gas Aspirator	3 Feb. 2000	20^0 54'23"N	156^0 25'54"W	Mixed shrubs	*Pulchea indica, Atriplex semibacata, Soudnus, Solanum americanum, Chenopodium murale*

Table 1. Continued.

Site No.	Collection Type	Date	Latitude	Longitude	Habitat	Host(s)
53	Gas Aspirator	3 Feb. 2000	20^0 54'23"N	156^0 25'54"W	Mixed shrubs	*Marisum javanicus,* in understory of *Pulchea odorata, Leucaena, Pulchea indica, Pulchea* hybrid, etc.
54	Gas Aspirator	4 Feb. 2000	20^0 54'47"N	156^0 25'34"W	Beach at night	Algae and rocks at low tide
8	Gas Aspirator	4 Feb. 2000	20^0 54'47"N	156^0 25'33"W	Beach at night	Algae and rocks at low tide
55	Gas Aspirator	2 Mar. 2000	20^0 53'56"N	156^0 26'52"W	Water margin	Mud
55	Gas Aspirator	2 Mar. 2000	20^0 53'56"N	156^0 26'52"W	Water margin	Sedge
56	Gas Aspirator	2 Mar. 2000	20^0 53'37"N	156^0 26'44"W	*Leucaena* thicket	Mixed alien grasses, *Leucaena*
57	Gas Aspirator	2 Mar. 2000	20^0 53'57"N	156^0 26'53"W	Keawe wood-land at night	*Chenopodium*
58	Gas Aspirator	4 Mar. 2000	20^0 54'42"N	156^0 25'29"W	Native shrub-land at night	Sedge & grasses
59	Gas Aspirator	4 Mar. 2000	20^0 54'42"N	156^0 25'31"W	Native shrub-land at night	*Scaevola*
60	Gas Aspirator	4 Mar. 2000	20^0 54'39"N	156^0 25'34"W	Native shrub-land at night	*Chenopodium*
61	Gas Aspirator	5 Mar.2000.	20^0 53'32"N	156^0 26'37"W	Keawe wood-land at night	*Prosopis pallida* (Keawe)
62	Gas Aspirator	5 Mar.2000.	20^0 53'34"N	156^0 26'38"W	Keawe wood-land at night	Mixed alien grasses, *Solanum americanum, Lycopersicon pimpinellifolium, Amaranthus* sp.
63	Gas Aspirator	5 Mar. 2000.	20^0 53'39"N	156^0 26'42"W	Keawe wood-land at night	*Pulchea symphytifolia.*
42	Gas Aspirator	6 Mar. 2000.	20^0 53'56"N	156^0 27'16"W	Native shrub-land, Kanaha Pond Res.	*Dodonaea viscosa*
42	Gas Aspirator	6 Mar. 2000.	20^0 53'56"N	156^0 27'16"W	Native shrub-land, Kanaha Pond Res.	*Vitex rotundifolia*
50	Gas Aspirator	6 Mar. 2000.	20^0 53'54"N	156^0 27'24"W	Dry Shrubland	*Nicotiana*
128	Gas Aspirator	27 Mar 2000	20^0 54'34"N	156^0 25'40"W	Wetland #3	*Mixed alien grasses, Pluchea*
129	Gas Aspirator	28 Mar 2000	20^0 54'43"N	156^0 25'30"W	Native beach strand	*Sporobolis*
130	Gas Aspirator	28 Mar 2000	20^0 53'55"N	156^0 25'45"W	*Leucaena* scrub	*Leucaena, Ricinus, Panicum, Botriochloa, Melinus, Cenchrus*, etc.
131	Gas Aspirator	29 Mar 2000	20^0 54'45"N	156^0 25'33"W	Beach strand	*Scaevola, Sporobolis, Mixed grasses.*
132	Gas Aspirator	30 Mar 2000	20^0 53'45"N	156^0 26'40"W	Industrial Area/buildings	Lawn, grassed, mixed weeds
133	Gas Aspirator	27 Apr 2000	20^0 54'12"N	156^0 26'16"W	Wetland # 1 day time	Sedges and grass
134	Gas Aspirator	29 Apr 2000	20^0 54'26"N	156^0 26'05"W	Dry shrubland	*Casuarina*
135	Gas Aspirator	30 Apr 2000	20º 54'19"N	156º 26'10"W	Roadside	*Schinus, Pluchea*, etc.
136	Gas Aspirator	1 May 2000	20^0 54'22"N	156^0 25'56"W	*Leucaena* shrubland	*Leucaena, Pluchea, Cenchrus, Asystasia, etc.*
137	Gas Aspirator	30 May 2000	20^0 53'46"N	156^0 26'40"W	Industrial Area/buildings	*Bougainvillia*
138	Gas Aspirator	30 May 2000	20^0 53'46.5"N	156^0 27'01.5"W	Keawe woodland	Keawe, *Pluchea,* low weeds, grasses.

Table 1. Continued.

Site No.	Collection Type	Date	Latitude	Longitude	Habitat	Host(s)
139	Gas Aspirator	30 May 2000	20^0 53'45.5"N	156^0 26'41"W	Ornamentals UPS Road & Main drive.	Planted lawn
140	Gas Aspirator	30 May 2000	20^0 53'40.5"N	156^0 26'45"W	Ornamentals UPS Road & Main drive.	Mixed weeds, castor bean, *Pluchea,* grasses
141	Gas Aspirator	30 May 2000	20º53'42.5"N	156º26'38.5"W	*Leucaena* scrub mixed weeds	*Leucaena, grass, Asystasia.*
142	Gas Aspirator	30 May 2000	20^0 53'40"N	156^0 26'45"W	Ornamentals UPS Road & Main drive.	Road edge *Bougainvillia*
143	Gas Aspirator	30 May 2000	20^0 53'46.5"N	156^0 27'01.5"W	Keawe wood-land, ruderal, wetland margin	*Sesuvium,* Keawe, *Pluchea,*
144	Gas Aspirator	30 May 2000	20^0 53'46.5"N	156^0 27'01.5"W	Keawe wood-land, ruderal, wetland margin	*Sesuvium,* Keawe, *Pluchea,*
145	Gas Aspirator	1 June 2000	20^0 53'48.5"N	156^{0}26'46.7"W	Industrial Buildings	Keawe, grasses, low weeds *Pluchea*
146	Gas Aspirator	2 June 2000	20º53'50"N	156º26'53"W	*Leucaena-Keawe* scrub	Kou tree
147	Gas Aspirator	2 June 2000	20º53'51"N	156º26'53"W	*Leucaena-Keawe* scrub	Roadside weeds
148	Gas Aspirator	2 June 2000	20º53'52"N	156º26'56"W	*Leucaena* scrub mixed weeds	Nicotiana
149	Gas Aspirator	3 June 2000	20^0 53'48"N	156^0 26'28"W	Terminal area	Grass strip, ornamental Pea, shower trees
150	Gas Aspirator	3 June 2000	20^0 53'47"N	156^0 26'27"W	Terminal area	*Philodendron, Defenbachia, Spathodea, Anthurium,* grass, weeds
64	Host inspection	5 Aug. 1999	20^0 54'40"N	156^0 25' 34"W	Dry Shrubland	*Pluchea* flowers & *Chenopodium*
6	Host inspection	5 Aug. 1999	20^0 54'24"N	156^0 26'05"W	"Cook's Beach"	*Scaevola taccada*
11	Host inspection	8 Sept. 1999	20^0 54'28"N	156^0 26'08"W	Keawe forest	*Chenopodium*
65	Host inspection	9 Sept. 1999	20^0 54'11"N	156^0 26'27"W	Ruderal	*Nicotiana*
19	Host inspection	4 Oct. 1999	20^0 53'22"N	156^0 26'40"W	Kanaha Res.	*Sporobolus*
27	Host inspection	7 Oct.1999	20^0 53'51"N	156^0 27'21"W	Kanaha Res.	*Sesuvium, Sporobolus, Pluchea*
34	Host inspection	3 Nov.1999	20^0 53'51"N	156^0 27'05"W	Native shrub-land at night	*Scaevola*
67	Trunk traps	8-10 Sept 1999	20^0 54'24"N	156^0 26'05"W	Dry shrubland	On Klu
6	Trunk traps	8-10 Sept. 1999	20^0 54'26"N	156^0 26'06"W	Dry shrubland	On *Causarina*
68	Trunk traps	9-10 Sept. 1999	20^0 54'07"N	156^0 26'26"W	Keawe forest	On keawe
16	Trunk traps	9-10 Sept. 1999	20^0 54'03"N	156^0 26'35"W	Keawe forest	On keawe
69	Trunk traps	5-7 Oct 1999	20^0 53"45'N	156^0 26'40"W	*Leucaena* scrub	On *Leucaena* and *Erythrina*
10	Pitfall traps	8-10 Sept. 1999	20^0 54'26"N	156^0 26'06"W	Dry shrubland	In compost pile

Table 1. Continued.

Site No.	Collection Type	Date	Latitude	Longitude	Habitat	Host(s)
9a	Pan traps	9-10 Sept. 1999	20^0 54'03"N	156^0 26'35"W	Keawe, Leucaena forest	under keawe
70	Pan traps	4-8 Oct 1999	20^0 54'25"N	156^0 25'58"W	Wetland # 2	Keawe forest/ ground: *Sesuvium*, grass, sand
69	Pan traps	5-7 Oct 1999	20^0 53"45'N	156^0 26'40"W	*Leucaena* scrub and hedge	Under *Leucaena* and *Hibiscus* hedge
71	Pan traps	1-x Dec 1999	20^0 54'14"N	156^0 25'41"W	Roadside	Bare ground beneath *Leucaena*.
151	Pan traps	1 Jun 2000	20^0 53'46.7"N	156^0 26'59.4"W	Keawe woodland	Keawe, *Pluchea*, low weeds, grasses.
72	Bait trap 1	30 Nov -3 Dec. 1999	20^0 54'16"N	156^0 25'42"W	*Leucaena* shrubland	*Leucaena, Panicum, Cenchrus, etc.*
73	Bait trap 2	30 Nov - 3 Dec 1999	20^0 54'22"N	156^0 25'56"W	*Leucaena* shrubland	*Leucaena, Pluchea, Cenchrus, Asystasia, etc.*
73	Bait trap 3	3 Dec. 1999 -1 Feb. 00	20^0 54'22"N	156^0 25'56"W	*Leucaena* shrubland	*Leucaena, Pluchea, Cenchrus, Asystasia, etc.*
74	Bait trap	7 Mar. 2000 to	20^0 53'35"N	156^0 26'37"W	Keawe woodland	Keawe, *Leucaena, Cenchrus, etc.*
75	Bait trap	7 Mar. 2000 to	20^0 53'37"N	156^0 26'41"W	Keawe woodland	Keawe, *Leucaena, Cenchrus, etc.*
152	Bait trap	28Mar.to 30 Apr 00	20^0 54'13"N	156^0 26'17"W	Keawe woodland	on keawe
153	Bait trap	28Mar.to 30 Apr 00	20^0 54'14"N	156^0 26'16"W	Keawe woodland	on keawe
154	Bait trap	31.III. to 29. IV 00	20^0 54'29"N	156^0 25'52"W	nr wetspot 3	Keawe, *Pluchea*, low weeds, grasses.
155	Bait trap	31.III. to 29. IV 00	20^0 54'30"N	156^0 25'50"W	nr wetspot 3	Keawe, *Pluchea*, low weeds, grasses.
156	Bait trap	29.IV. 00 to	20^0 54'26"N	156^0 26'07"W	Keawe woodland	*Causurina*
157	Bait trap	29.IV. 00 to	20^0 54'27"N	156^0 26'05"W	Keawe woodland	*Causurina*
187	Bait trap	29.IV.00	20^0 54'05"N	156^0 26'34"W	Keawe woodland	Keawe
158	Bait trap	30.IV. 00 to	20^0 54'12"N	156^0 26'37"W	Keawe woodland	*Schinus*
76	Malaise trap	4-8 Oct 1999	20^0 54'25"N	156^0 25'58"W	Wetland # 2	Palms, milo, keawe
73	Malaise trap #1	2 Nov. 1999 to 1 Mar. 2000	20^0 54'22"N	156^0 25'56"W	*Leucaena* shrubland	*Leucaena, Pluchea, Cenchrus, Asystasia, etc.*
72	Malaise trap #2	2 Nov. 1999 to 1 Feb. 1999	20^0 54'16"N	156^0 25'42"W	*Leucaena* shrubland	*Leucaena, Panicum, Cenchrus, etc.*
77	Malaise trap #2	1 Feb. 1999 to 1 Mar. 2000	20^0 54'18"N	156^0 25'42"W	*Leucaena* shrubland	*Leucaena, Panicum, Cenchrus, etc.*
73	Malaise trap #1	1 Mar. 2000(on-going)	20^0 54'22"N	156^0 25'56"W	*Leucaena* shrubland	*Leucaena, Pluchea, Cenchrus, Asystasia, etc.*
77	Malaise trap #2	1 Mar. 2000(on-going)	20^0 54'18"N	156^0 25'42"W	*Leucaena* shrubland	*Leucaena, Panicum, Cenchrus, etc.*

Table 1. Continued.

Site No.	Collection Type	Date	Latitude	Longitude	Habitat	Host(s)
78	MV light	5 Oct. 1999	20^0 54'13"N	156^0 26'17"W	Wetland # 1 at night	*Leucaena, Panicum,*sedges, keawe.
76	MV light	6 Oct. 1999	20^0 54'25"N	156^0 25'58"W	Wetland # 2	Palms, milo, keawe
35	MV light	3 Nov.1999	20^0 53'42"N	156^0 27'05"W	Kanaha Res.	*Ruderal with keawe, Sporobolus, Sesuvium,*
79	MV light	4 Nov.1999	20^0 53'42"N	156^0 27'10"W	Kanaha Res.	Open keawe woodland at pond margin,
80	MV light	1 Dec. 1999	20^0 54'29"N	156^0 25'52"W	Wetland / Keawe	*Sesuvium, Paspalum, Pluchea*
81	MV light	2 Dec. 1999	20^0 53'54"N	156^0 27'23"W	Kanaha Pond Res.	*Sporobolus*, Keawe, pond margin
53	MV light	2 Feb. 2000	20^0 54'23"N	156^0 25'54"W	*Leucaena*, wetland margin	*Sesuvium, Leucaena*, *Pluchea,*
82	MV light	3 Feb. 2000	20^0 53'46"N	156^0 27'07"W	Keawe wood-land, ruderal, wetland margin	*Sesuvium,* Keawe, *Pluchea,*
57	MV light	2 Mar. 2000	20^0 53'57"N	156^0 26'53"W	Keawe wood-land, ruderal, wetland margin	Keawe, *Pluchea, Chenopodium*
83	MV light	3 Mar. 2000	20^0 53'57"N	156^0 27'14"W	Kanaha Pond Res.	Keawe, *Sesuvium*, native shrubs
84	MV light	5 Mar. 2000	20^0 53'35"N	156^0 26'38"W	Keawe woodland	Keawe, *Leucaena, Cenchrus, etc.*
163	MV & Blacklight	28Mar 00	20^0 53'35"N	156^0 26'38"W	Keawe woodland	Keawe, *Leucaena, Cenchrus, etc.*
163	MV & Blacklight	29Mar 00	20^0 54'29"N	156^0 25'52"W	near wet spot 3	*Sesuvium,* Keawe, *Pluchea,*
164	MV light	26 Apr 00	20º54'07"N	156º26'28"W	Keawe woodland	Keawe, *Cenchrus*
165	MV light	27 Apr 00	20º54'04"N	156º26'40"W	Keawe woodland	Keawe, *Cenchrus, Asystacia*
166	MV light	30.Apr. 00	20º54'26"N	156º26'05"W	Keawe woodland	*Keawe, Causurina, mixed weeds*
167	MV light	31.May 00	20º53'36"N	156º27'05.2"W	Keawe woodland	*Keawe,* near wetland
168	MV light	2 June 2000	20^0 53'46.5"N	156^0 27'01.5"W	Keawe woodland	Keawe, *Pluchea,* low weeds, grasses.
169	Black light	4 June 2000	20º53'51"N	156º26'54"W	*Leucaena-Keawe* scrub, mixed weeds	*Leucaena-Keawe, grasses.*
69	Ant baits 3 samples	5 Oct. 1999	20^0 53"45'N	156^0 26'40"W	Ruderal and hedge	On ground and leaflitter
19	Ant baits	6 Oct. 1999	20^0 53'22"N?	156^0 26'40"W?	Ruderal	*Nicotiana, Cenchrus ciliarus*, barren
20	Ant baits	6 Oct. 1999	20^0 53'20"N?	156^0 26'48"W?	Ruderal	*Nicotiana, Cenchrus, Saccharum, Ricinus, etc*
48	Ant baits 1	1 Dec. 1999	20^0 54'14"N	156^0 25'40"W	*Leucaena* scrub	Bare ground beneath *Leucaena.*
85	Ant baits 2	1 Dec. 1999	20^0 54'14"N	156^0 25'41"W	Roadside	Bare ground beneath *Leucaena.*
86	Ant baits 3	1 Dec. 1999	20^0 54'13"N	156^0 25'42"W	Tarmac & ruderal	Wood pile
87	Ant baits 4 & 5	1 Dec. 1999	20^0 54'12"N	156^0 25'42"W	Tarmac & ruderal	Wood pile
32	Ant baits	2 Dec. 1999	20^0 53'34"N	156^0 27'06"W	Ornamental plantings	Bougainvillea, *Cyanodon,* weeds
88	Ant baits	2 Dec. 1999	~20^0 53'36"N	~156^0 26'59"W	Lawn and ornamental plantings	Near HDOA office.

Table 1. Continued.

Site No.	Collection Type	Date	Latitude	Longitude	Habitat	Host(s)
89	Ant baits	2 Feb. 2000	20^0 53'09"N	156^0 27'06"W	Fallow Cane field w/ ruderal borders	*Nicotiana, Cenchrus, Cyanodon Pluchea, Saccharum, Asystasia, Ricinus, Leucaena, etc*
90	Ant baits	2 Feb. 2000	20^0 53'08"N	156^0 27'07"W	Fallow Cane field w/ ruderal borders	*Nicotiana, Cenchrus, Cyanodon Pluchea, Saccharum, Asystasia, Ricinus, Leucaena, etc*
91	Ant baits	2 Feb. 2000	20^0 53'07"N	156^0 27'08"W	Fallow Cane field w/ ruderal borders	*Nicotiana, Cenchrus, Cyanodon Pluchea,Saccharum, Asystasia, Ricinus, Leucaena, etc*
92	Ant baits	2 Feb. 2000	20^0 53'06"N	156^0 27'09"W	Fallow Cane field w/ ruderal borders	*Nicotiana, Cenchrus, Cyanodon Pluchea,Saccharum, Asystasia, Ricinus, Leucaena, etc*
93	Ant baits	2 Feb. 2000	20^0 53'05"N	156^0 27'10"W	Fallow Cane field w/ ruderal borders	*Nicotiana, Cenchrus, Cyanodon Pluchea, Saccharum, Asystasia, Ricinus, Leucaena, etc*
94	Ant baits	2 Feb. 2000	20^0 53'06"N	156^0 27'11"W	Fallow Cane field w/ ruderal borders	*Nicotiana, Cenchrus, Cyanodon Pluchea, Saccharum, Asystasia, Ricinus, Leucaena, etc*
100	Ant Baits	4 Feb. 2000	20^0 53'33"N	156^0 26'49"W	Industrial area/buildings	Alien ornamentals in State Nursery misting house.
101	Ant Baits	4 Feb. 2000	20^0 53'34"N	156^0 26'50"W	Industrial area/buildings	Under *Gossypium tomentosum.*
102	Ant Baits	4 Feb. 2000	20^0 53'35"N	156^0 26'49"W	Industrial area/buildings	Under citrus tree.
103	Ant Baits	4 Feb. 2000	20^0 53'35"N	156^0 26'48"W	Industrial area/buildings	Next to pile of Keawe wood/lumber.
104	Ant Baits	3 Mar. 2000	20^0 53'36"N	156^0 26'44"W	Ground	On perimeter of car lot next to airport nursery.
105	Ant Baits	3 Mar. 2000	20^0 53'35"N	156^0 26'42"W	Ground	On perimeter of car lot next to airport nursery
104	Ant Baits	3 Mar. 2000	20^0 53'36"N	156^0 26'44"W	Ground	On perimeter of car lot next to airport nursery.
106	Ant Baits	3 Mar. 2000	20^0 53'32"N	156^0 26'44"W	Ground	On perimeter of car lot next to airport nursery
107	Ant Baits	3 Mar. 2000	20^0 53'35"N	156^0 26'45"W	Ground	Near potted plants within airport nursery area.

Table 1. Continued.

Site No.	Collection Type	Date	Latitude	Longitude	Habitat	Host(s)
108	Beating sheet	3 Feb. 2000	20^0 53'47"N	156^0 26'28"W	Terminal area	Ornamental planting
109	Beating sheet	3 Feb. 2000	20^0 53'48"N	156^0 26'28"W	Terminal area	Ornamental planting
110	Beating sheet	3 Feb. 2000	20^0 53'47"N	156^0 26'27"W	Terminal area	Ornamental planting
110	Beating sheet	3 Feb. 2000	20^0 53'47"N	156^0 26'27"W	Terminal area	Ornamental planting
110	Beating sheet	3 Feb. 2000	20^0 53'47"N	156^0 26'27"W	Terminal area	Ornamental planting
111	Beating sheet	3 Feb. 2000	20^0 53'47"N	156^0 26'29"W	Terminal area	Ornamental planting
109	Beating sheet	3 Feb. 2000	20^0 53'48"N	156^0 26'28"W	Terminal area	Ornamental planting
109	Beating sheet	3 Feb. 2000	20^0 53'48"N	156^0 26'28"W	Terminal area	Ornamental planting
112	Beating sheet	4 Feb. 2000	20^0 53'34"N	156^0 26'47"W	Industrial area/buildings	Next to *Mommordica charantia* on fence, next to large gravel pile.
113	Beating sheet	4 Feb. 2000	20^0 53'30"N	156^0 26'50"W	Industrial area/buildings	*Scaevola coriaceae*
114	Beating sheet	4 Feb. 2000	20^0 53'31"N	156^0 26'49"W	Industrial area/buildings	*Osteomeles anthidydifolia*
115	Beating sheet	4 Feb. 2000	20^0 53'32"N	156^0 26'49"W	Industrial area/buildings	*Bonamia menziesii*
116	Beating sheet	4 Feb. 2000	20^0 53'33"N	156^0 26'50"W	Industrial area/buildings	*Abutilon menziesii*
117	Beating sheet	4 Feb. 2000	20^0 53'41"N	156^0 26'31"W	Industrial area/buildings	*Acacia confusa* = Formosan koa
118	Beating sheet	4 Feb. 2000	20^0 53'39"N	156^0 26'46"W	Industrial area/buildings	*Senna* sp. = shower tree
119	Beating sheet	4 Feb. 2000	20^0 53'38"N	156^0 26'45"W	Industrial area/buildings	*Panicum maximum*
118	Beating sheet	4 Feb. 2000	20^0 53'39"N	156^0 26'46"W	Industrial area/buildings	*Leucana leucocephala*
107	Beating sheet	3 Mar. 2000	20^0 53'35"N	156^0 26'45"W	Plant nursery	Potted plants within airport nursery area.
3	General	5 Aug. 1999	20^0 54'38"N	156^0 25'22"W	Strand shrubland	Heliotrope, *Scaevola*, *Schinus*, etc.
4	General	5 Aug. 1999	20^0 54'37-41"N	156^0 25'21-22"W	Beach and strand	Rocky shore and *Schinus*, *Ricinus*,etc.
6	General 3 samples	5 Aug 1999	20^0 54'24"N	156^0 26'05"W	Dry shrubland	*Pluchea, Waltheri*a, grass, etc.
6	General	4 Oct 1999	20^0 54'24"N	156^0 26'05"W	Dry shrubland	*Pluchea, Waltheri*a, grass, etc.
20	General	4 Oct. 1999	20^0 53'20"N	156^0 26'48"W	Ruderal	*Nicotiana, Cenchrus, Saccharum, Ricinus, etc*
210	General	4 Oct. 1999	20^0 53'22"N	156^0 26'49"W	Ruderal	*Pluchea*
23	General	7 Oct. 1999	20^0 54'39"N	156^0 25'33"W	Dry shrubland	*Chenopodium*
6	General	8 Sept 1999	20^0 54'24"N	156^0 26'05"W	Dry shrubland	*Pluchea, Waltheri*a, grass, etc.
10	General	8 Sept. 1999	20^0 54'26"N	156^0 26'05"W	Dry shrubland	*Pluchea*
11	General	8 Sept. 1999	20^0 54'28"N	156^0 26'08"W	"Cook's Beach"	Coast and flotsam
60	General	3 Feb. 2000	20^0 54'39"N	156^0 25'34"W	Native shrub-land at night	*Nicotiana, Ipomea, Chenopodium,* roadway, etc.
170	General sweeping	4 Feb 2000	20^0 54'43"N	156^0 25'33"W	Beach strand	*Scaevola, mixed grasses*

Table 1. Continued.

Site No.	Collection Type	Date	Latitude	Longitude	Habitat	Host(s)
55	General sweeping 2 samples	2 Mar. 2000	20^0 53'56"N	156^0 26'52"W	Water margin	Sedges
57	General	2 Mar. 2000	20^0 53'57"N	156^0 26'53"W	Keawe wood-land at night	*Chenopodium*
58	General	4 Mar. 2000	20^0 54'42"N	156^0 25'29"W	Native shrub-land at night	Sedge & grasses
59	General	4 Mar. 2000	20^0 54'42"N	156^0 25'31"W	Native shrub-land at night	*Scaevola*
60	General	4 Mar. 2000	20^0 54'39"N	156^0 25'34"W	Native shrub-land at night	*Nicotiana, Ipomea, Chenopodium,* oadway, etc.
120	General sweeping	6 Mar. 2000.	20^0 53'53"N	156^0 27'08"W	Pond margin, Kanaha Pond Res.	*Sesuvium,* sedges
120	General sweeping	6 Mar. 2000.	20^0 53'53"N	156^0 27'08"W	Pond margin, Kanaha Pond Res.	*Chenopodium,* grasses
171	General sweeping	27 Mar. 2000.	20^0 53'56"N	156^0 27'16"W	Kanaha Res.	*a`ali`I & Scaevola*
172	General	27 Mar. 2000.	20^0 54'34"N	156^0 25'40"W	ruderal	*bare ground @ wetspot*
173	General	28Mar.00	20^0 54'43"N	156^0 25'30"W	ruderal	mixed weeds
174	General, night	29 Mar 2000	20^0 54'43"N	156^0 25'32"W	Beach strand	*Scaevola, Sporobolis, Mixed grasses.*
175	General @ night	30Apr 00	20^0 54'26"N	156^0 26'05"W	dry shrubland, keawe	mixed weeds, koa haole
176	General	31 May 2000	20^0 53'46"N	156^0 27'00"W	Keawe woodland	Keawe, mixed shrubs
177	General Ariel net sweeps	1 Jun 2000	20^0 54'45.7"N	156^0 26'58.5"W	Keawe woodland daytime	Keawe, *Pulchea*, *Chenopodium*, grasses, mixed weeds.
178	General	1 June 2000	20º53'46.7"N	156º26'59.4"W	Keawe wood-land daytime	Dead Keawe branches.
211	General	1 June 2000	20º53'49"N	156º26'56"W	Keawe wood-land daytime	Keawe, mixed weeds
179	General	2 June 2000	20º53'48"N	156º25'53"W	*Leucaena-Keawe* scrub	Roadside, mixed weeds
180	General	2 June 2000	20º53'10"N	156º27'10"W	Ruderal	*Waltheria*, mixed weeds
181	General search/ Sweep	3 June 2000	20º53'43"N	156º26'31"W	Terminal Ornamantals	Grass, Shower tree, Ilima,
42	Leaf litter	3.March.2000	20^0 53'56"N	156^0 27'16"W	Kanaha Res. At night	*Aalii* litter
183	Leaf litter	29 Mar 2000	20^0 54'42"N	156^0 25'31"W	Beach strand	*Scaevola leaf litter*
159	Beetle trap	31.III. to 29. IV 00	20^0 54'30"N	156^0 25'51"W	Open keawe woodland / wetspot 3	Keawe, *Schinus*
160	Beetle trap	31.III. to 29. IV 00	20^0 54'31"N	156^0 25'50"W	Woodland / wetspot 3	*Auricaria* , Keawe
161	Beetle trap	29. IV to 2.VI. 00	20^0 54'30"N	156^0 25'51"W	Open keawe woodland / wetspot 3	Keawe, *Schinus*
162	Beetle trap	29. IV to 2.VI. 00	20^0 54'31"N	156^0 25'50"W	Woodland / wetspot 3	*Auricaria* , Keawe
208	Beetle trap	2. VI. to XI. 2000	20^0 54'21"N	156^0 25'56"W	*Leucaena* shrubland	*Leucaena, Cenchrus, Asystasia*
184	Fogging	29.IV. 00	20^0 54'29.5"N	156^0 25'50.5"W	open Keawe woodland	Keawe
185	Fogging	29.IV. 00	20^0 54'39"N	156^0 25'36"W	native shrubland	*Chenopodium*
186	Fogging @ night	29.IV. 00	20^0 54'04"N	156^0 26'35"W	Keawe woodland	Keawe

Table 1. Continued.

Site No.	Collection Type	Date	Latitude	Longitude	Habitat	Host(s)
188	Fogging	29.IV. 00	20^0 54'26"N	156^0 26'06"W	Keawe woodland	*Causurina*
189	Fogging	30 May 2000	20º53'44"N	156º26'40"W	Leucaena scrub	*Leucaena, Ipomea.*
190	Fogging	31 May 2000	20^0 53'45"N	156^0 27'02"W	Keawe woodland	Keawe, *Pluchea,* low weeds, grasses.
191	Fogging	31 May 2000	20^0 53'46.5"N	156^0 27'01.5"W	Keawe woodland	Keawe, *Pluchea,* low weeds, grasses.
192	Fogging	31 May 2000	20^0 53'48.5"N	156^0 27'05.0"W	Keawe woodland	Keawe, *Pluchea,* low weeds, grasses.
193	Fogging	31 May 2000	20º 53'46"N	156º27'00"W	Keawe woodland	Keawe, *Pluchea,* low weeds, grasses.
194	Fogging	1 June 2000	20^0 53' 48"N	156^0 27'57.8"W	Keawe woodland	Keawe, *Pluchea,* low weeds, grasses.
195	***Fogging***	1 June 2000	20º53'46.7"N	156º26'59.4"W	Keawe wood-land daytime	Keawe, *Pulchea, Chenapodium*, grasses, mixed weeds.
196	Fogging	1 June 2000	20º53'46"N	156º26'57.8W"	Keawe wood-land daytime	Keawe, *Pulchea, Chenopodium*, grasses, mixed weeds.
197	Fogging	1 June 2000	20º53'45"N	156º27'02.5W"	Keawe wood-land	Keawe, *Pulchea, mixed weeds.*
198	Fogging	1 June 2000	20º53'48.5"N	156º27'05.0"W	Keawe wood-land	Keawe, *Pulchea, mixed weeds.*
199	Fogging	1 June 2000	20º53'50"N	156º27'00"W	Keawe wood-land	Keawe, *Pulchea, mixed weeds.*
200	Fogging	1 June 2000	20º53'46.5"N	156º27'01.5"W	Keawe wood-land	Keawe, *Pulchea, mixed weeds.*
201	Fogging night	1 June 2000	20º53'52"N	156º26'57"W	open Keawe woodland	*Pluchea, Leucaena*
202	Fogging night	1 June 2000	20º53'51"N	156º26'59"W	open Keawe woodland	*Pluchea, Leucaena*
203	Fogging	2 June 2000	20º53'56"N	156º27'16"W	native shrubs	*Scaevola*
204	Fogging	2 June 2000	20º54'36"N	156º25'37"W	Mixed shrubland	*Chenopodium*
182	Berlese of Bird nest	28 April 2000	20^0 54'26"N	156^0 26'05"W	Dry shrubland	*Pluchea, Casuarina*
205	Berlese #1	3.March.2000	20^0 53'56"N	156^0 27'16"W	Kanaha Res. At night	*Aalii* litter
206	Berlese #2 at Malaise trap #2	31. March.2000	20^0 54'16"N	156^0 25'42"W	*Leucaena* shrubland	*Leucaena, Panicum, Cenchrus, etc.*
207	Berlese #3	28.iv-1.v.2000	20^0 54'26"N	156^0 26'05"W	Dry shrubland	*Pluchea, , mixed weeds.*

TABLE 2. -- List of species of terrestrial arthropods collected within the Kahului Airport environs during the period from 1 August 1999 to November 2000. Names and arrangement follow Nishida (1997 and 2002).

ARTHROPOD FAUNA		Status on	Status and Distribution within Kahului Airport Environs		
SCIENTIFIC NAME	Status[1]	Maui	Veg Type[2]	Relative[3] Abundance	Collection sites and Methods[4]
Phylum: ARTHROPODA Class: ARACHNIDA: Subclass: ACARI (MITES):					
Acaridae					
Tyrophagus putrescentiae (Schrank, 1781) mold mite	adv		G, J		2B-Dodonea leaf litter
Ameroseiidae					
genus? species? unidentified	?	NIR	G, J		2B-Dodonea leaf litter
Anystidae					
Anystis species A	adv?		K		3B-Gas aspirator
Aphelacaridae					
Aphelacarus species A	?	NIR	D		4B-Sida leaf litter
Ascidae					
Asca duosetosa Fox, 1946	adv	NIR	G, J		2B-Dodonea leaf litter
Asca species A	adv?	NIR	B		3B-Berlese of bird nest
Bdellidae					
Bdella distincta (Baker & Balock, 1944)	adv	NIR	G, J,D		2B-Dodonea leaf litter
Bdellodes longirostris (Hermann, 1804)	adv	NIR	D		4B-Malaise #2
Spinibdella species A	?	NIR	G, J, D		2B-Dodonea leaf litter, #2, 4B-Gas aspirator
Camerobiidae					
Neophyllobius species A	?	**NSR**	**F**		3B-Berlese of bird nest
Cheyletidae					
Hemicheyletia bakeri Ehara, 1962	adv	NIR	G,J.B		1B-Gas aspirator-*Sporobolus*, 3B-Gas aspirator, 2B-Dodonea leaf litter, 3A-Berlese of bird nest, 4A-Gas aspirator
Acarocheyla hawaiiensis (Baker, 1949)	end?		D		4A-Malaise #1
Cunaxidae					
Cunaxa new species A?	end?		G.J.B		1B-Gas aspirator-*Sporobolus,* 2B-Dodonea leaf litter, 4B-Gas aspirator, 3B-Berlese of bird nest
Ereynetidae?					
Genus? species? Unidentified	?	NIR	D		4B-Sida leaf litter

Table 2 continued

ARTHROPOD FAUNA		Distri-bution	Status and Distribution within Kahului Airport Environs		
SCIENTIFIC NAME	**Status[1]**		**Veg Type[2]**	**Relative[3] Abundance**	**Collection sites and Methods[4]**
Erythraeidae					
Balaustium new species A	end?		D		4B-Gas aspirator, 4B-Malaise #2 4B-Sida leaf litter
Genus? species? unidentified	?	NIR	D		4A-Gas aspirator #2 at Malaise #1
Eupodidae					
Eupodes new species A	end		D		3B-Gas aspirator, 4A- Gas aspirator
Fusacaridae?					
Genus? species? unidentified	adv?	**NSR**	D		4B-Sida leaf litter
Galumnatidae					
Pergalumna bryani (Jacot, 1934)	adv	**NSR**	G,J		2B-Dodonea leaf litter,4B-Gas aspirator
Laelapidae					
Hypoaspis species A	?		D		4A-Malaise #1
Oribatulidae					
Lucoppia burrowsii (Michael, 1890)	adv		G,J,D		2C-Gas aspirator, 2B-Dodonea leaf litter, 3B-cup trap, 3B-Gas aspirator, 4A, 4B-Gas aspirator
Zygoribatula species A	adv?	NIR	G,J,D		4A-Gas aspirator, 2C-Gas aspirator, 2B-Gas aspirator, 2B-Dodonea leaf litter, 3B-Gas aspirator
Phthiracaridae					
Atropacarus (*A.*) *striculus* (Koch, 1834)	adv		G,J		2B-Dodonea leaf litter
Phytoseiidae					
Genus? species? unidentified	?		D		4B-Gas aspirator
Pyemotidae					
Pyemotes tritici (LaGreze-Fossart & Montagne, 1851)	adv		B		3A-Berlese of bird nest
Scheloribatidae					
Scheloribates castlei Jacot, 1934	end?	NIR	D		4B-Gas aspirator
Scheloribates muiri Jacot, 1934	end	NIR	G,J		2B-Dodonea leaf litter
Scheloribates species A	?	NIR	G,J		2B-Dodonea leaf litter
Scheloribates species B	?	NIR	G,J		2B-Dodonea leaf litter
?Scheloribates species C	?	NIR	B,D		3A-Berlese of bird nest, 4B-Malaise #2, 3B-Gas aspirator
Tarsonemidae					
Tarsonemus ? species A	?		H		3B-Gas aspirator

Table 2 continued

ARTHROPOD FAUNA		Distribution	Status and Distribution within Kahului Airport Environs		
SCIENTIFIC NAME	**Status[1]**	**Maui**	**Veg Type[2]**	**Relative[3] Abundance**	**Collection sites and Methods[4]**
Tenerifiidae					
Genus? species? unidentified	?		D		4B-Sida leaf litter
Tetranychidae					
Genus? species? unidentified	?		G.H,J		4A-Gas aspirator, 4B-Sida leaf litter
Tydeidae					
Lorryia pandana Baker, 1968	ind	**NSR**	D		4A-Gas aspirator, 4B-Sida leaf litter
Pronematus species A	?	NIR	D		4B-Gas asprator nr. Malaise #2
Tydeus tutllei Baker, 1965	adv	NIR	D		4A-Gas aspirator, 4B-Sida leaf litter
Tyroglyphidae					
Genus? species. unidentified	?	NIR	H,D		3B-Gas aspirator
Uropodina, Family?					
Genus ? species? unidentified	?		D		4A-Malaise #1
Subclass: ARANEAE (Spiders)					
Araneidae (Orb weavers)					
Argiope appensa (Walckenaer, 1841) (*yellow garden spider)	adv		B,H	Common	4B-Malaise #2
Gasteracantha cranciformis (Linnaeus, 1758) spinybacked spider	adv	NIR	B,G	scarce	1B-host search
Gasteracantha mammosa C.L. Koch, 1844 (Asian spinybacked spider)	adv		B,G	Common	2B-general 1B-host search
Clubionidae					
Cheiracanthium mordax L. Koch, 1866 (*pale leaf spider)	adv		B,H	Uncommon	3B-Gas aspirator
Dysderidae					
Dysdera crocota C.L. Koch, 1838	adv		B,H	Common	2B Gas aspirator
Gnaphosidae					
Zelotes reformans Chamberlin, 1924	adv	NIR	H	Scarce	4A-On ground
Heteropodidae (Giant crab spiders)					
Heteropoda venatoria (Linnaeus, 1767) Cane spider	adv		B, D	Common	3B-general
Lycosidae (Wolf spiders)					
Lycosa species A (Wolf spider)	end?		H	Scarce	3B-on ground
Oxyopidae (Lynx spiders)					
Oxyopes species A [Kumashiro, et. al., 1990] (Lynx spider)	adv		A-H	Common	On vegetation at most sites. gas aspirator

Table 2 continued

ARTHROPOD FAUNA		Distribution	Status and Distribution within Kahului Airport Environs		
SCIENTIFIC NAME	**Status[1]**	**Maui**	**Veg Type[2]**	**Relative[3] Abundance**	**Collection sites and Methods[4]**
Salticidae (Jumping spiders**)**					
Genus species unidentified	adv		B,H	Common	4A-Malaise #1;
Tetragnathidae (Long-jawed spiders**)**					
Tetragnatha species A	adv?		H	Scarce	2B-Gas aspirator
Theridiidae Cob-web spiders					
Coleosoma cf. floridanum Banks, 1900	adv	NIR			
Theridion melanostictum Cambridge, 1876	adv	NIR			2C,3B,4A,4B-Gas aspirator.
Order: PSEUDOSCORPIONIDA (False scorpions)					
Family?					
Genus? species? unidentified	?	?	B	Local	3C-under bark
Order: SCORPIONES (Scorpions)					
Buthidae					
Isometrus maculatus (DeGeer, 1778) lesser brown scorpion	adv		B	Common	3B-general
Class: INSECTA (insects) **Order: BLATTODEA (Cockroaches)**					
Blaberidae					
Diploptera punctata (Eschscholtz, 1822) beetle cockroach	adv		A	Scarce	4A-general
Pycnoscelus indicus (Fabricius, 1775) (*Surinam cockroach)	adv		H	Common	4A-general
Blatellidae					
Balta species A [probably Kumashiro (1998)	adv		A, B	Scarce	Gas, Fog, general
Blatella lituricolis (Walker) *false German cockroach	adv		F, K	Common	3A, 3B-Gas aspirator, general
Symploce pallens (Stephens, 1835)	adv	NIR		Scarce	Leucaena woodland
Blattidae					
Periplaneta americana (Linnaeus) *American cockroach	adv		F, B	Common	3B, 4A-general
Platyzosteria soror (Brunner, 1865)	adv		A, C	Common	3A, 4A-general
Polyphagidae					
Euthyrrhapha pacifica (Coquebert, 1804) (*Pacific cockroach)	adv		A,B,D	Common	4A-Malaise #1 3A- on road

Table 2 continued

ARTHROPOD FAUNA		Status on	Status and Distribution within Kahului Airport Environs		
SCIENTIFIC NAME	**Status[1]**	**Maui**	**Veg Type[2]**	**Relative[3] Abundance**	**Collection sites and Methods[4]**
Order: COLEOPTERA (Beetles)					
Aderidae (Antlike leaf beetles)					
Xylophilus marquesanus Blair, 1934	adv	NIR	D	Common	2B-Gas Aspirator, 3A, 4B-MV Bulb
Anobiidae (Death-watch beetles)					
Ozognathus species A	adv	NIR	D	Common	2B-Gas Aspirator, 2B-host search; 4B-Black light
Tricorynus sharpi (Pic, 1912)	end		H	Common	2B, 3B-MV bulb,4B-Malaise #2
Anthicidae (Antlike flower beetles)					
Anthicus recens Werner, 1967	adv	NIR	D	Common	3A-Lingren funnels
Anthribidae (Fungus weevils)					
Araecerus constans Perkins, 1900	end	NIR	B		3A-Bait trap
Araecerus fasciculatus (DeGeer, 1775) (*coffee bean weevil)	adv		H,K	Common	4A-Malaise, 2B-host search
Araecerus levipennis Jordan, 1924 (*koa haole seed weevil)	adv		B,D,H, K	Common	3A , 3B, 4A-Gas Aspirator, 4B-Malaise #2 #2
Bostrichidae (Twig borers)					
Amphicerus cornutus (Pallas, 1772) *powderpost bostrichid	adv		B,G,H	Common	1B-MV bulb, 2B-Black light, 4A- Malaise
Sinoxylon conigerum Gerstaecker, 1855	adv		B,C,F		4A-Malaise #1, 4B-Malaise #2
Xylopsocus capucinus (Fabricius, 1781)	adv	NIR	D,F		4A-Malaise #1
Xylopsocus castanoptera (Fairmaire, 1850)	adv	NIR	D,F		4A-Malaise #1, 4A-MV bulb
Brentidae (Primitive weevils)					
Cylas formicarius (Fabricius, 1798) Sweet potato weevil	adv		D, E	Common	2C,4A-Gas aspirator, 2B-host search
Bruchidae (Seed beetles)					
Acanthoscelides macrophthalmus (Schaeffer, 1907)	adv	NIR	A, D	Common	2B-Host search, 3B-Malaise, 4A
Algarobius bottimeri Kingslover, 1972. *kiawe bean weevil	adv		G	Common	1B-general, 2B-MV bulb
Callosobruchus chinensis (Linnaeus, 1758) Chinese bean weevil	adv		B, D	Common	2B,3B-MV bulb
Carydon serratus (Oliver, 1790) Tamarind seed weevil	adv		G	Common	1B-general
Mimosestes amicus (Horn, 1873)	adv		F, D	Common	2B-fogging, 3A-MV bulb, 4B-fogging

Table 2 continued

ARTHROPOD FAUNA		Status on	Status and Distribution within Kahului Airport Environs		
SCIENTIFIC NAME	**Status[1]**	**Maui**	**Veg Type[2]**	**Relative[3] Abundance**	**Collection sites and Methods[4]**
Mimosestes insularis Kingsolver & Johnson, 1978	adv	NIR	B,F		3C-MV bulb
Stator pruininus (Horn, 1873) *pruinose bean weevil	adv		F, D	Common	2B, 3A, 3B-Malaise, 4A-Gas Aspirator,
Buprestidae (Metallic wood-boring beetles)					
Agrilus species A, not *extraneus* Fisher, 1933	adv	**NSR**	F	Uncommon	2C,3B-Gas aspirator
Chrysobothris indica Castlenau & Gory, 1837 flatheaded borer	adv		D	Local	4B-Malaise #2
Cantharidae (Soldier beetles)					
Caccodes oceaniae (Bourgeois, 1884)	adv		D	Local	4B-Malaise #2
Carabidae (Ground beetles)					
Anisotarsus (*Eurytrichus*) *purpurascens* Bates	adv?	**NSR**	B,D		4A-MV bulb
Bembidion niloticum batesi (Putzeys, 1875)	adv?	NIR	B,D		2B-MV bulb, 4A-MV bulb
Gnathaphanus picipes (Macleay, 1864)	adv		B,D		2B-MV bulb
Gnathaphanus upolensis (Csiki, 1915)	adv		B	Common	2B-MV bulb
Metacolpodes buchanani (Hope, 1831)	adv		B	Local	2A-MV bulb
Perigona nigriceps (Dejean, 1831)	adv	NIR	D	Local	2A
Stenolophus ?*limbalis* LeConte, 1860	pur?	NIR	D,F,G		3C-MV bulb, 4A-Malaise #1
Cerambycidae (Long-horned wood borers)					
Ceresium unicolor (Fabricius, 1787)	adv		B		2B-MV bulb
Curtomerus flavus (Fabricius, 1775)	adv		K	Uncommon	2B-Gas aspirator
Placosternus crinicornis (Chevrolat, 1860)	adv		B	Common	4A-Malaise
Plagithmysus new species A (Hawaii longhorned beetle)	end		A	Local	2B-Gas aspirator 2B, 4A Host search-*Chenopodium*
Sybra alternans (Wiedemann, 1825)	adv		All veg. types.	Common	2B-MV bulb, 4A 4B-Malaise 3B-Gas aspirator, 4A-fogging,
Chrysomelidae (Leaf beetles)					
Diachus auratus (Fabricius, 1801) bronze leaf beetle	adv		K	Common	3B-host search
Epitrix hirtipennis (Melsheimer) tobacco flea beetle	adv		H	Common	4A-1st Malaise north of bike path
Lema trilineata White, 1981	adv		A	local	4A-beating vegetation

Table 2 continued

ARTHROPOD FAUNA		Status on	Status and Distribution within Kahului Airport Environs		
SCIENTIFIC NAME	**Status[1]**	**Maui**	**Veg Type[2]**	**Relative[3] Abundance**	**Collection sites and Methods[4]**
Ciidae (Minute tree-fungus beetles)					
Cis species A	end		B	Common	3C-MV bulb
Clambiidae (Fringe-winged beetles)					
Clambus species A not *pubescens* Redtenbacher	adv?	**NSR**	B	Local	3A-Gas aspirator
Cleridae (Checkered beetles)					
Tarsostenus univittatus (Rossi, 1792)	adv	NIR	B,D,F		2C-MV bulb, 4B-Malaise #2
Tillus notatus Klug, 1840	adv		D, K	Common	2B-Malaise, 4B-Gas aspirator
Coccinellidae (Lady beetles)					
Brumoides suturalis (Fabricius, 1798) *threestriped lady beetle	adv	NIR	J	Local	2B-leaf litter sift
Coccinella septempunctata Linnaeus, 1758 (sevenspotted lady beetle)	pur		D,F	Common	3A-general, 4A-host search
Coelophora inaequalis (Fab., 1775) *common Australian lady beetle	pur		H	Common	3B-MV bulb, 4A-Malaise & Gas Aspirator, 2B-host search
Curinus coeruleus (Mulsant, 1850)	pur		A	Common	4A-host search
Delphastus pusillus (Le Conte) spiraling white fly lady beetle	pur		F	Common	4B-Gas aspirator
Diomus debilis (Le Conte, 1852)	pur		G, B	Common	2B, 3B Gas aspirator
Diomus notesens (Blackburn, 1889)	pur		F	Local	3B-Gas aspirator
Hippodamia convergens Guerin-Meneville, 1844 convergent lady beetle	pur		G,H	Common	2C-Gas aspirator
Hyperaspis pantherina Fürsch, 1975	pur		A	Common	4A-host search
Nephaspis species A (near *bicolor)*	pur/adv ?	NIR			
Nephaspis bicolor Gordon, 1982	pur	NIR			
Nephus bilucernarius Mulsant, 1850	pur		B	Local	2B-Gas Aspirator, 2B-host search
Nephus roepkei (Fluiter, 1938)	pur		D	Local	4A-Lingren funnels
Olla v-nigrum (Mulsant, 1866)	pur?		B. A, D	Common	2C-MV bulb 4A-Gas aspirator 4B-Malaise #2 #2
Orcus australasiae (Boisduval, 1835)	pur	NIR?	H	Common	3B-MV bulb
Rodolia cardinalis (Mulsant, 1853) (*vedalia beetle)	pur		D	Local	3B-Malaise, 2B-host search
Scymnus? species A	pur/adv ?	?			
Scymnini: genus?	pur/adv ?	?			
Sticholotis ruficeps Weise, 1902	pur		F, K	Common	3B-Gas Aspirator
Telsimia nitida Chapin, 1926	pur	NIR	F	Common	2B-host search

Table 2 continued

ARTHROPOD FAUNA		Status on	Status and Distribution within Kahului Airport Environs		
SCIENTIFIC NAME	**Status[1]**	**Maui**	**Veg Type[2]**	**Relative[3] Abundance**	**Collection sites and Methods[4]**
Colydiidae (Cylindrical bark beetles)					
Colobicus parilis Pascoe, 1861	adv	NIR	B,D		4A-MV bulb
Corylophidae (Minute fungus beetles)					
Sericoderus ?*pubipennis* Sharp, 1885	end?		B	Local	3B-MV bulb & Lingren funnels
Cucujidae (Flat bark beetles)					
Cryptamorpha desjardinsi (Guerin-Meneville, 1844)	adv		K	Common	3B-host search most MV bulb
Psammoechus insularis Sharp, 1885	adv	NIR	K		3B-MV bulb
Silvanoprus scuticollis (Walker)	adv	**NSR**	F, G		2B-MV bulb, 2C-MV bulb
Curculionidae (Weevils)					
Acalles species A	end		J	Scarce	2B-Gas aspirator
Asynonychus godmanni Crotch, 1867	adv		B, H	Common	3B & 4A-host search
Hypurus bertrandi (Perris, 1852)	adv		E	Local	3A-Gas aspirator, 4A-host search
Lixus mastersi Pascoe, 1874	adv	NIR?	B, A	Common	3B-Gas Aspirator, 4A-host search
Myllocerus species A [Beardsley & Kumashiro, et al., 1990,	adv	NIR		Common	3A-MV bulb, 3A-Gas aspirator
Sitophilus oryzae (Linnaeus, 1763)	adv		C,D,F		4A-Malaise #1
Sphenophorus cariosus Olivier, 1807	adv	NIR	D	Local	4A-host search
Dermestidae (Carpet beetles)					
Attagenus fasciatus (Thunberg, 1795)	adv		D,K	Common	3B-host search, 4A-Lingren funnels
Orphinus terminalis (Sharp, 1885)	ind		B, D	Local	3A-Gas aspir., 3A-Lingren funnels, 4B-Malaise #2
Elateridae (Click beetles)					
Aeolus livens (Le Conte, 1853)	adv	NIR	F, G		2B-MV bulb, 2C-MV bulb
Cardiophorus stolatus Erichson, 1840	adv	NIR	H, B, G	Common	2B-MV bulb, 4A-MV bulb
Conoderus exsul (Sharp, 1877)	adv		D, H	Common	3A, 4A-MV bulb.
Conoderus pallipes (Eschscholtz, 1830)	adv	NIR	H, D	Common	3A-MV bulv, 3B, 4A-Malaise &Gas Aspirator
Lacon modestus (Boisduval, 1835)	adv	NIR			2B-MV bulb
Melanotus ?*similis* (Kirby)	adv	**NSR**	F	Common	2B-general
Melanoxanthus melanocephalus (Fabricius, 1781)	adv		D	Common	4A-Malaise
Simodactylus cinnamomeus (Boisduval, 1835)	adv		H, D	Common	4A-MV bulb
Endomychidae (Handsome fungus beetles)					
Eidoreus minutus Sharp, 1885	end	NIR	D	Common	3A-Lingren funnels

Table 2 continued

ARTHROPOD FAUNA		Status on	Status and Distribution within Kahului Airport Environs		
SCIENTIFIC NAME	**Status[1]**	**Maui**	**Veg Type[2]**	**Relative[3] Abundance**	**Collection sites and Methods[4]**
Hydrophilidae (Water scavenger beetles)					
Cercyon species near *fimbriatus* Mannerheim, 1852	adv	**NSR**	J	local	4A-general
Cercyon quisquilius (Linnaeus, 1761)	pur		D	Local	4B-Malaise #2
Enochrus sayi Gundersen, 1977	adv	NIR	G	Common	2B-MV bulb
Limnoxenus semicylindricus (Eschscholtz, 1882)	end		G	Uncommon	2C-Gas aspirator
Tropisternus lateralis humeralis Motschulsky, 1859	adv		G	Uncommon	2C-Gas aspirator
Laemophloeidae (Flat bark beetles)					
Laemophloeus species A not *L. minutus* Oliver,	adv	NSR	D	Common	3A-Lingren funnels
Languriidae (Lizard beetles)					
Cryptophilus integer (Heer, 1841)	adv	NIR	B	Local	3C, 3A-Lingren funnels
Lathridiidae (Lathridiids)					
Corticaria? *longicollis*? (Zeterstedt, 1838)	adv?	NIR	D	Local	4A-Lingren funnels
Lyctidae					
Trogoxylon aequale (Wollaston, 1867)	adv	NIR	J	Local	2B-host search
Mycetophagidae (Hairy fungus beetles)					
Litargus balteatus Le Conte, 1856	adv?		B, G	Local	2C-MV bulb, 3A-Lingren funnels
Litargus vestitus Sharp, 1879	ind				
Typhaea stercorea (Linnaeus, 1758)	adv		D	Local	4B-Malaise #2
Nitidulidae (Sap beetles)					
Carpophilus dimidiatus (Fabricius, 1792)	adv		K	Local	2B-HDOA Lab.
Carpophilus hemipterus (Linnaeus, 1758)	adv		K	Common	3B-host search
Carpophilus humeralis (Fabricius, 1798)	adv		F, G	Common	3B-Gas Aspirator &, 2C-Gas Aspirator,
Carpophilus marginellus Motschulsky, 1858	adv	NIR	K	Common	3B-host search
Conotelus mexicanus Murray, 1864	adv		K	Common	3B-host search
Haptoncus luteolus (Erichson, 1843)	adv	NIR	F	Common	2B-general
Lasiodactylus ?*tibialis* (Boheman, 1851)	adv	NIR	B	Common	3B-MV bulb
Stelidota species A [Beardsley et al, 1992]	adv	NIR	H,F	Common	2B-general, 4A-MV bulb

Table 2 continued

ARTHROPOD FAUNA		Status on	Status and Distribution within Kahului Airport Environs		
SCIENTIFIC NAME	**Status[1]**	**Maui**	**Veg Type[2]**	**Relative[3] Abundance**	**Collection sites and Methods[4]**
Oedemeridae (False blister beetles)					
Ananca bicolor (Fairmaire, 1849)	adv	NIR	H	Common	1B,3A,3B,4A-(Most MV bulbs)
Platypodidae (Pinhole borers)					
Crossotarsus externedentatus (Fairmaire, 1850)	adv	NIR	H	Common	3B-MV.light
Platypus parallelus (Fabricius,)	adv	**NSR**	B,G		2B-MV bulb
Pselaphidae (Short-winged mold beetles)					
genus + species unidentified	adv	**NSR**	C,F		4B-Malaise #2
Scarabaeidae (Scarab beetles)					
Adoretus sinicus Burmeister, 1855 (Chinese rose beetle)	adv		E, G, H	Common	2C-Gas Aspirator, 3C-MV bulb, 4B-Malaise #2
Aphodius lividus (Olivier, 1789)	adv		E	Common	2C-MV&Blk light bulb,
Ataenius cognatus (Le Conte, 1859)	adv		G	Common	2B-MV bulb
Sciritidae					
Scirtes species A [Beardsley & Mau, 1976]	adv	NIR	H	Common	4A-MV bulb
Scolytidae (Bark beetles)					
Hypothenemus eruditus (Westwood, 1835)	adv		B,D	Common	3A-Lingren funnels
Hypothenemus ?pubescens Hopkins, 1915	adv		B,D	Common	3A-Lingren funnels
Hypothenemus ?*pulverulentus* (Eichhoff) = ?*H. seriatus?*	adv	**NSR?**	B,D	Common	3A-Lingren funnels
Hypothenemus ?*rarinosa* Blandford	adv	**NSR?**	B,D	Common	3A-Lingren funnels
Hypothenemus ?*seriatus* (Eichhoff, 1871)	adv	NIR	B,D	Common	3A-Lingren funnels
Xyleborus affinis Eichhoff, 1867	adv		B,D	Common	3A-Lingren funnels
Staphylinidae (Rove beetles)					
Anotylus species A, not *vinsoni* (Cameron, 1936)	adv	NIR/ NSR.	B, D, H,	Common	2B-general, 4A-MV bulb
Carpelimus species A	adv?	NIR	B,D	Common	3A-Lingren funnels, 4A-MV bulb
Coproporus species A	adv	**NSR**			
Lithocharis species A	adv	NIR	D, H	Common	4A-MV bulb
Lithocharis species B	adv	NIR			
Philonthus discoideus (Gravenhorst, 1802)	adv		B,D,H		4A-MV bulb
Philonthus longicornis Stephens, 1832	adv				
Philonthus turbidus Erichson, 1840	adv		B, H	Common	4A-MV bulb

Table 2 continued

ARTHROPOD FAUNA	Status[1] in	Status on	Status and Distribution within Kahului Airport Environs		
SCIENTIFIC NAME	**Hawaii**	**Maui[2]**	**Veg Type[3]**	**Relative[3] Abundance**	**Collection sites and Methods[4]**
Philothalpus analis (Erichson, 1840)	pur		C,D,F		4A-Malaise #1
Scopaeus species A	adv	NIR	F		3B-Gas aspirator
Stiloderus species A	adv	**NSR**	D,F		3V-MV bulb
Tenebrionidae (Darkling beetles)					
Alphitobius diaperinus (Panzer, 1796)	adv		D,H		4A-MV bulb
Alphitobius laevigatus (Fabricius, 1781)	adv	NIR	D,H		4A-Pitfall trap, 4A-General
Ammophorus insularis (Boheman, 1858)	adv		A	Common	4A-leaf litter
Blapstinus dilatatus Le Conte, 1851	adv	NIR	B	Common	3B-decaying wood
Blapstinus histricus Casey	adv	NIR	D,H		4A-Pitfall trap,
Cnemeplatia? species A	adv	**NSR**	B	Unique specimen	MV2/28.IV. 2000
Gnatocerus maxillosus (Fabricius, 1801)	adv	NIR	D,H		4A-MV bulb
Gonocephalum adpressiforme Kaszab, 1951	adv		D,H		4A-Pitfall trap,
Lobometopon diremptus (Karsch, 1881)	adv		B, D, H	Common	2B & 4A-host search
Lyphia species near *angusta* (Lucas, 1846)	adv	NIR./ NSR	B,D		3B-MV bulb, 4A-Malaise #1
Tribolium species A	adv				
Throscidae					
Trixagus extraneus Fisher, 1942	adv	NIR	D,H		4A-MV bulb
Order: COLLEMBOLA (Springtails)					
Entomobryidae					
Genus species?	?	?	D	Scarce	3A-On ground
Family?					
Genus species?	?				
Order: DERMAPTERA (Earwigs)					
Carcinophoridae					
Euborellia annulipes (Lucas, 1847)	adv		H	Common	3B-MV bulb
Chelisochidae					
Chelisoches morio (Fabricius, 1775)	adv		E	local	2C-General
Labiduridae					
Labidura riparia (Pallas, 1773)	adv		G,H	Locally common	2B-MV bulb

Table 2 continued

ARTHROPOD FAUNA		Status on	Status and Distribution within Kahului Airport Environs		
SCIENTIFIC NAME	**Status[1]**	**Maui**	**Veg Type[2]**	**Relative[3] Abundance**	**Collection sites and Methods[4]**
Order: DIPTERA (Flies)					
Agromyzidae Agromyzid leaf miners)					
Liriomyza species A	adv				
Melanagromyza splendida Frick, 1953	adv				
Pseudonapomyza spicata (Malloch, 1914)	adv				2B-Gas aspirator
Asteiidae (Asteiid flies)					
Loewimyia orbiculata Hardy, 1980	end	NIR	B, H	Local	2B-Gas aspirator
Bombyliidae (Bee flies)					
Anthrax koshunensis Matsumura 1916	adv		B, D, I	Local	4A-Malaise #1 3B- General
Calliphoridae (Blow flies)					
Chrysomya megacephala (Fabricius, 1774)	adv		B,J,E	Scarce	4A-MV light
Cecidomyiidae (Gall gnats)					
Genus species unidentified	?		D, H	Common	3B-Gas aspirator
Ceratopogonidae (Biting midges)					
Atrichopogon jacobsoni (Meijere, 1907)	adv			Common	MV #2, 26.IV.00
Culicoides species A	adv	**NIR/ NSR**	H,D	Scarce	4A-Malaise
Forcipomyia borbonica Clastrier,1959	adv	NIR	H	Scarce	4A-Malaise
Forcipomyia hardyi Wirth & Howarth, 1982	end		B - H	Common	All MV's and Gas aspirators at wet spots.
Chironomidae (Non-biting midges)					
Chironomus hawaiiensis Grimshaw, 1901	end?		H	Common	3B-MV bulb
Clunio species A	end	NIR	I	Common	4A-Gas aspirator
Orthocladius williamsi Hardy, 1960	end	NIR	H	local	3B-MV bulb
Polypedilum nubiferum (Skuse, 1889)	adv		H,G	Common	2B,4A-Gas aspirator
Chloropidae (Eye gnats)					
Chloropsina citrivora Sabrosky, 1976	adv				1B-Gas aspirator
Monochaetoscinella anonyma (Williston, 1896)	adv				2C-Gas aspirator
Monochaetoscinella species A	adv?	NIR/ NSR?			
Rhodesiella sauteri (Duda, 1930)	adv				

Table 2 continued

ARTHROPOD FAUNA		Status on	Status and Distribution within Kahului Airport Environs		
SCIENTIFIC NAME	**Status[1]**	**Maui**	**Veg Type[2]**	**Relative[3] Abundance**	**Collection sites and Methods[4]**
Chyromyidae					
Aphaniosoma species A	?				
Cryptochetidae					
Cryptochetum iceryae (Williston, 1888) cottony cushion scale fly	adv	NIR	D	Local	4A-Malaise #1
Culicidae (Mosquitoes)					
Aedes albopictus (Skuse, 1984)	adv		D, H	Scarce	2B,3B-general
Culex quinquefasciatus Say, 1823	adv		D, H	Common	2B,3B-general
Dolichopodidae (Long-legged flies)					
Asyndetus carcinophilus Parent, 1937	end		B,H		4A-1st Malaise
Chrysosoma globiferum (Wiedemann, 1830)	adv	NIR	B,D	Common	4B-Malaise #2 3B-Gas aspirator
Dolichopus exsul Aldrich, 1922	adv		F	Common	2C-Gas aspirator
Pelastoneurus lugubris Loew, 1861	adv	NIR	H	Common	3B,4B-general
Thambemyia acrosticalis (Parent, 1938)	end		H	Common	3B,4B-general
Drosophilidae (Pomace flies)					
Cacoxenus perspicax (Knab, 1914)	adv				
Chymomyza procnemis (Williston, 1896)	adv		D		4A-Malaise #1
Empididae					
Chersodromia hawaiiensis Melander, 1938	end		H	Common	3B-Gas aspirator
Ephydridae (Shore flies)					
Atissa oahuensis Cresson, 1948	end	NIR			
Brachydeutera species A	adv		H	Scarce	3B-MV bulb
Ceropsilopa coquilletti Cresson, 1922	adv		D, H	Common	3A,4A-Gas aspirator, 3B-MV bulb
Clasiopella uncinata Hendel, 1914	adv	NIR			
Donaceus nigronotatus Cresson, 1943	adv		D,H	Common	3A-Gas aspirator
Ephydra gracilis Packard, 1871	adv	NIR			
Hecamede sp. ? *granifera* (Thomson, 1869)	adv		J	Local	4A-On beach
Hydrellia tritici Coquillett, 1903	adv		F	Common	2C-Gas aspirator
Psilopa girschneri Von Roeder, 1889	adv				
Scatella sexnotata (Cresson, 1926)	ind		H,B,G	Common	3B-Pan trap, 2B- MV bulb, Gas aspirator
Scatella stagnalis (Fallen, 1813)	adv	NIR	H,G		3B-Pan trap, 2B-Gas aspirator
Fanniidae (Little house flies)					
?Euryomma species A	adv	NIR			

Table 2 continued

ARTHROPOD FAUNA		Status on	Status and Distribution within Kahului Airport Environs		
SCIENTIFIC NAME	**Status[1]**	**Maui**	**Veg Type[2]**	**Relative[3] Abundance**	**Collection sites and Methods[4]**
Heleomyzidae					
Spilochroa ornata (Johnson, 1895)	adv	NIR	D	Common	4A-Malaise #1
Lauxaniidae					
Poecilominettia sexseriata Hendel, 1932	adv		D	Common	4A-Malaise #1
Lonchaeidae					
Lamprolonchaea metatarsata (Kertesz, 1901)	adv		D	Scarce	4A-Malaise #1
Lonchopteridae (Spear-winged flies)					
Lonchoptera furcata (Fallen, 1823)	adv		H	Scarce	4A-MV light
Micropezidae (Stilt-legged flies)					
Taeniaptera cf. angulata (Loew, 1866)	adv	NIR	D	Scarce	4B-Malaise trap
Milichiidae					
Desmometopa species probably *inaurata* Lamb, 1914	adv				
Muscidae (House flies)					
Atherigona orientalis Schiner, 1868	adv		D	Common	4A-Malaise #1
Atherigona reversura Villeneuve, 1936	adv		F,K	Common	2C-Gas aspirator
Coenosiinae (Genus species?)	adv	**NSR**	D	Scarce	4B-gas aspirator
Musca sorbens Wiedemann, 1830 Dog-dung fly	adv		F,H	Common	2C,4A-Gas aspirator
Stomoxys calcitrans (Linnaeus, 1758) (Stable fly)	adv		D	Common	4A-Malaise #1
Synthesiomyia nudiseta (Van der Wulp, 1883)	adv		D	Scarce	4A-Malaise #1
Mycetophilidae Fungus gnats					
Leia species A	adv	NIR	D,H	Scarce	4A-Malaise 1
Otitidae (Picture-winged flies)					
Acrosticta apicalis (Williston, 1896)	adv.				
Ceroxys latiusculus (Loew, 1873)	adv	NIR			
Euxesta anonnae (Fabricius, 1794)	adv		B, D	Common	3B-MV bulb, 4A-Malaise #1
Phoridae (Scuttle flies)					
Chonocephalus species A	end?		B,H	Common	4A-Malaise 1
Megaselia scalaris (Loew, 1866) coffin fly	adv		D	Common	4A-Malaise #1
Megaselia species A	?		F,D	Common	2C-Gas aspirator, 4A-Malaise

Table 2 continued

ARTHROPOD FAUNA		Status on	Status and Distribution within Kahului Airport Environs		
SCIENTIFIC NAME	**Status[1]**	**Maui**	**Veg Type[2]**	**Relative[3] Abundance**	**Collection sites and Methods[4]**
Platystomatidae					
Scholastes bimaculatus Hendel, 1914	adv		D	Local	4B-Malaise #2
Psychodidae (Moth flies)					
Psychoda species A	end?		H	Common	3B-MV bulb
Sarcophagidae (Flesh flies)					
Helicobia morionella (Aldrich, 1930)	adv		D	Common	4A-Malaise #1
Sarcophaga africa (Wiedemann, 1824)	adv	NIR?	D	local	2B-MV light
Sarcophaga dux Thomson, 1869	adv		D	Common	4A-Malaise #1
Scatopsidae					
Coboldia fuscipes (Meigen, 1930)	adv				
Scenopinidae (Window flies)					
Scenopinus adventicius Hardy, 1960	adv		H	Common	3B- Gas aspir., 4A-1st Malaise,
Sciaridae (Black fungus gnats)					
Bradysia tritici (Coquillet, 1895)	adv		D,H	Common	3B-Gas aspir.
Sciara? species A	adv		D,H	Common	3B-Gas aspir.
Sepsidae (Black scavenger flies)					
Sepsis biflexuosa Strobl, 1893	adv		D,	Common	4A-Malaise #1
Sepsis thoracica (Robineau-Desvoidy, 1830)	adv		D, H	Common	2B,3B-Gas aspirator
Sphaeroceridae (Small dung flies)					
Leptocera abdominiseta (Duda, 1925)	adv		D,H,B	Common	3B-Gas aspir. 3B- Pan trap
Leptocera species A	adv?		D	Common	4A-Malaise #1
Poecilosomella punctipennis (Wiedemann, 1824)	adv		D	Common	4A-Malaise #1
Thoracochaeta brachystoma (Stenhammar, 1855)	adv		J	local	4A-On beach
Stratiomyidae (Soldier flies)					
Evaza javanensis Meijere, 1911	adv		H,A	Uncommon	4A, 2B-Gas aspirator
Hermetia illucens (Linnaeus, 1758)	adv		I	Uncommon	4A-Gas apsirator
Syrphidae (Hover flies)					
Allograpta obliqua (Say, 1823)	adv		D	Common	4A-Malaise #1
Eristalinus aeneus (Scopoli, 1763)	adv		D	Common	4A-Malaise #1
Eristalinus arvorum (Fabricius, 1787)	adv		H	Common	3B-MV bulb, 4A-Malaise #1
Eumerus aurifrons (Wiedemann,1824)	adv	NIR	D	Common	4A-Malaise #1
Ornidia obesa (Fabricus, 1775)	adv		D	Common	4A-Malaise #1
Simosyrphus grandicornis (Maquart, 1942)	adv		D	Common	4A-Malaise #1

Table 2 continued

ARTHROPOD FAUNA		Status on	Status and Distribution within Kahului Airport Environs		
SCIENTIFIC NAME	**Status[1]**	**Maui**	**Veg Type[2]**	**Relative[3] Abundance**	**Collection sites and Methods[4]**
Syritta orientalis Maquart, 1842	adv		G	Common	2C,4A-Gas aspirator
Syritta species A	adv				2B-Gas aspirator
Toxomerus marginatus (Say, 1823)	adv		D	Common	4A-Malaise #1
Tachinidae (Tachinid flies)					
Actia eucosmae Bezzi, 1926	adv	NIR	D	Common	4A,4B-Malaise
Archytas cyrphis Curran, 1927	pur		D, H	Common	4A-Malaise
Chaetogaedia monticola (Bigot, 1887)	pur		D	Common	4A-Malaise #1
Eucelatoria armigera (Coquillett, 1889)	adv		D	Common	4A-Malaise #1 3A- MV light
Lespesia archippivora (Riley, 1871)	pur		D	Common	3B-MV light, 4A-Malaise #1
Phasioormia pallida Towndsend, 1933	adv	NIR	H,B	Scarce	2B-MV light
Trichopoda pilipes (Fabricius, 1805)	pur		D	Common	4A-Malaise #1
Tephritidae (Fruit flies)					
Acinia picturata (Snow, 1894)	pur		D	Common	4A,4B-Malaise
Bactrocera cucurbitae (Coquillett, 1899) Melon fly	adv		D	Common	4B-Malaise #2
Bactrocera dorsalis (Hendel, 1912) Oriental fruit fly	adv		K	Local	2C-Gas aspir., Bait trap
Tetreuaresta obscuriventris (Loew, 1873)	pur		D	Common	3B-MV bulb, 4B-Gas aspir.
Tethinidae					
Dasyrhicnoessa species A	ind?		G,H	Common	2B,4A-MV bulb
Tipulidae (Crane flies)					
Limonia hawaiiensis (Grimshaw, 1901)	end				
Limonia species A	adv	**NSR**		common	MV 4A-Malaise 1
Styringomyia didyma Grimshaw, 1901	adv		F,H	Common	2C-Gas aspir. 2B-MV light
Order: EMBIIDINA (Webspinners)					
Oligotomidae					
Oligotoma saundersii (Westwood,1837)	adv		B	Common	3B-MV light

Table 2 continued

ARTHROPOD FAUNA		Status on	Status and Distribution within Kahului Airport Environs		
SCIENTIFIC NAME	Status[1]	Maui	Veg Type[2]	Relative[3] Abundance	Collection sites and Methods[4]
Order: HETEROPTERA (True bugs)					
Alydidae					
Alydus pilosulus Herrich-Schaeffer, 1848	adv		C	local	3B-Gas aspir.
Anthocoridae (Minute pirate bugs)					
Physopleurella mundula (White, 1877)	adv		B,C		2B-MV light 3C-Gas aspir.
Cydnidae (Burrower bugs)					
Geotomus pygmaeus (Dallas 1851)	adv		B, D	Common	3C-MV light, 2B-MV light
Microporus shiromai Froeschner 1977	adv	NIR	B	local	3C-MV light
Rhytidoporus indentatus Uhler 1877	adv		B	Scarce	3C-MV light
Genus & species undetermined	adv	NSR?	D	scarce	4A-MV bulb
Lygaeidae (Seed bugs)					
Appolonius ? species A	adv	NIR	B	Common	3B-fogging *Causurina*
Botocudo marianensis (Usinger, 1946)	adv		B	Common	3C-MV bulb
Clerada apicornis Signoret, 1862	adv	NIR	G	Local	2B-MV bulb
Graptostethus manillensis (Stål, 1859)	adv		H	Common	3B-MV bulb
Nysius species A	end		B, D, A.	Common	2B,4A-Gas aspirator, 3B-host searach
Nysius species B	adv?	NIR?	B, D, A.	Common	4A-Gas aspirator, 3B-host searach
Pseudopachybrachius vinctus (Say, 1832)	adv		B,H,F	Common	Sites 78, 2C, 3B-Gas aspirator & MV bulb
Remaudiereana nigriceps (Dallas)	adv		G, D	Common	4A-MV bulb, 2B-Gas aspirator
Tempyra biguttula Stal, 1874	adv	NIR	B	Uncommon	2C-MV bulb
Miridae (Leaf bugs)					
Coridromus variegatus (Montrouzier, 1861)	adv	NIR	A	Local	4A-host search
Rhinacloa forticornis Reuter, 1876	adv		B	Common	2C-MV/black light
Taylorilygus apicalis (Fieber, 1861)	adv		D	Common	4A-MV bulb
Trigonotylus tenuis (Reuter, 1895)	adv	NIR	H	Common	3C-Gas aspirator
Tytthus mundulus (Breddin, 1896)	pur		B	Common	2B-MV bulb
Nabidae (Damsel bugs)					
Nabis capsiformis Germar, 1837)	adv		F	Common	4A0, 3B-Gas aspirator

Table 2 continued

ARTHROPOD FAUNA		Status on	Status and Distribution within Kahului Airport Environs		
SCIENTIFIC NAME	**Status[1]**	**Maui**	**Veg Type[2]**	**Relative[3] Abundance**	**Collection sites and Methods[4]**
Pentatomidae (Stink bugs)					
Brochymena quadripustulata (Fabricius, 1775)	adv	NIR	J	Common	2B-general & gas aspirator
Eysarcoris ventralis (Westwood, 1837)	adv	NIR	A, F	Common	3B-general, 4A- sweep net
Nezara viridula (Linnaeus, 1758)	adv		B,D	Common	3C-Gas aspirator, 2B-MV bulb
Oechalia species near *pacifica* (Stål, 1859)	end		B, D	Local	2B-MV bulb
Plautia stali Scott, 1874)	adv		F, H	Common	4A-Malaise #1, 3B-MV bulb
Thyanta custator accerra McAtee, 1919	adv	NIR	A	Common	4A-host search
Plataspidae (Black stink bugs)					
Coptosoma xanthogramma (White, 1842)	adv		B,H	Common	SITE 53B, 4A-Malaise #1
Reduviidae (Assassin bugs)					
Empicoris rubromaculatus (Blackburn, 1889)	adv		B	Scarce	4A-Malaise #1
Gallobelgicus saevus Bergroth, 1913	adv	NIR	B	Local	3C-MV bulb
Oncocephalus pacificus Kirkaldy	adv		G	Local	4A-Malaise #1, 2B-MV bulb
Sinea rileyi Montandon,	adv	**NSR**	B, D, I	Local	3A-Gas aspirator, 4A-Malaise #1
Zelus renardii Kolenati, 1856	adv		B, D, I	Common	3A,4A-Gas aspirator
Rhopalidae (Scentless plant bugs)					
Liorhyssus hyalinus (Fabricius, 1794)	adv		B, D, I	Common	4A, 3A-Gas aspirator
Niesthrea louisianica Sailer, 1961	adv	NIR	B	Common	2B-general, Gas aspirator
Saldidae (Shore bugs)					
Micracanthia humilis (Say, 1832)	adv	NIR	F	Local	2A, 2B-Gas aspirator
Scutelleridae (Shield-backed bugs)					
Coleotichus blackburniae White, 1881 (Koa bug)	end		F	Uncommon	2C-host search - *Acacia*
Tingidae (Lace bugs)					
Corythucha morrilli Osborn & Drake, 1917	adv	NIR	H	Common	3B-Gas aspirator
Leptodictya tabida (Herrich-Schaeffer, 1840	adv		D, H	Common	4A-Malaise #1, 3B-Gas aspirator

Table 2 continued

ARTHROPOD FAUNA		Status on	Status and Distribution within Kahului Airport Environs		
SCIENTIFIC NAME	**Status[1]**	**Maui**	**Veg Type[2]**	**Relative[3] Abundance**	**Collection sites and Methods[4]**
Order: HOMOPTERA (Hoppers & Scales)					
Aleyrodidae (Whiteflies)					
Aleurodicus dispersus Russell, 1965	adv		B	Common	3C-Gas aspirator
Aphididae (Aphids)					
Aphis species A	adv		F	Common	2C-Gas aspirator
Cercopidae Spittlebugs)					
Clastoptera xanthocephala Germar 1839	adv		D	Common	4A-Malaise #1
Cicadellidae (Leafhoppers)					
Balclutha incisa hospes (Kirkaldy, 1910)	adv		G	Common	2B-MV bulb
Balclutha species near *rubrostriata* (Melichar, 1903)	adv	NIR	B	Local	3C-Gas aspirator
Balclutha species A	end?		B	Local	2B-MV bulb
Carneocephala sagittifera (Uhler, 1895)	adv		F	Common	3B-Gas aspirator
Circulifer tenellus (Baker, 1896)	adv		B	Common	2B-Gas aspirator
Draeculacephala minerva Ball,1927	adv		B	Common	3B-Gas aspirator
Empoasca solana DeLong. 1931	adv		B	Common	3C- MV bulb
Graminella sonora (Ball, 1900)	adv	NIR	B	Common	3B-Gas aspirator
Gyponana germari (Stal, 1864)	adv	NIR	B,F,D	Common	2B-fogging
Penestragania robusta (Uhler, 1877)	adv		D	Common	4A-MV bulb
Scaphytopius loricatus (Van Duzee, 1894)	adv	NIR	B, D	Local	2B-fogging
Sophonia rufofascia (Kuoh & Kuoh, 1983) 2-spotted leafhopper	adv		J	Common	2B-general
Spanbergiella quadripunctata Lawson, 1932	adv	NIR	B	Common	2B-Gas aspirator
Also 6 unidentified spp. of leafhoppers					
Coccidae (Soft scales)					
Ceroplastes cirripediformis Comstock, 1881 (Barnacle scale)	adv		F	Common	3B-host search
Pulvinaria urbicola Cockerell, 1893 (Urbicola soft scale)	adv	NIR	ruderal	local	2C- host search

Table 2 continued

ARTHROPOD FAUNA		Status on	Status and Distribution within Kahului Airport Environs		
SCIENTIFIC NAME	**Status[1]**	**Maui**	**Veg Type[2]**	**Relative[3] Abundance**	**Collection sites and Methods[4]**
Delphacidae (Delphacid planthopper)					
Emoloana sporobolicola (Kirkaldy, 1910	end		H	Locally common	2B-Gas aspirator
Perkinsiella saccharicida Kirkaldy, 1903 (Sugarcane planthopper)	adv		B, D, H	Common	3B-MV bulb, 2B-MV bulb
Sardia rostrata pluto (Kirkaldy, 1906)	adv	NIR	B, D	Common	2B,2C,3C-MV bulb, 2C,3A-Gas aspirator
Sogatella kolophron ? (Kirkaldy, 1907)	adv		B	local	pan trap
Diaspididae (Hard scales)					
Pseudaulacaspis cockerelli (Colley, 1897) (Oleander scale)	adv		K	Common	3B-host search Oleander
Flatidae (Flatid planthoppers)					
Melormenis basalis (Walker, 1851)	adv		H	Common	3C,4A-Gas aspirator, 4A-1st Malaise trap north of bike path, 3A-MV bulb
Margarodidae					
Icerya purchasi Maskell, 1878 cottony cushion scale	adv		E	Common on tree tobbaco	2C-host search Tree tobacco
Membracidae (Treehoppers)					
Spissistilus festinus (Say, 1830)	adv		B	Common	3C-Gas aspirator
Vanduzeea segmentata (Fowler, 1895)	adv		B	Common	3B,3C-Gas aspirator
Pseudococcidae					
Saccharicoccus sacchari (Cockerell, 1895) (Pink sugarcane meallybug)	adv		E	common	2C-host search Sugar cane
Psyllidae (Plant lice)					
Heteropsylla cubana Crawford, 1914	adv		B, D	Common	4A,4B-Malaise
*Heteropsylla *mimosae* Crawford 1914. *Check Id.	adv	NIR	B, D	Common	4A,4B-Malaise
Order: HYMENOPTERA: Bees and Wasps					
Agaonidae (Fig wasps)					
Eupristina verticillata Waterston	pur	NIR			
Josephiella new species A	adv.	NIR			
Anthophoridae (Carpenter bees)					
Ceratina arizonensis Cockerell, 1898	adv	NIR			
Xylocopa sonorina Smith, 1874	adv		D, B	Common	4B-Malaise #2
Aphelinidae					
Encarsia species A	adv/ pur?				

Table 2 continued

ARTHROPOD FAUNA		Status on	Status and Distribution within Kahului Airport Environs		
SCIENTIFIC NAME	**Status[1]**	**Maui**	**Veg Type[2]**	**Relative[3] Abundance**	**Collection sites and Methods[4]**
Aphidiidae					
Aphidius gifuensis Ashmead, 1906	adv	NIR			
Lysiphlebus testaceipes (Cresson, 1880)	pur		B, D	Common	4A-Malaise #1
Apidae (Honey bees)					
Apis mellifera Linnaeus, 1758 (Honey bee)	pur		D	Common	4B-Malaise #2
Bethylidae					
Epyris species A	adv	NIR			
Goniozus species possibly *columbianus* Ashmead	adv	**NSR**			
Braconidae					
Acrophasmus immigrans (Beardsley , 1961)	adv	NIR			
Agathis species A	adv	NIR	D	Common	4A-Malaise #1
Apanteles opacus (Ashmead, 1905)	adv	NIR	D	Common	4B-Malaise trap
Ascogaster species A	adv?	**NSR**	D	Scarce	MV-5X99
Glyptapanteles militaris (Walsh, 1861)	pur		D	Common	4B-Malaise trap
Glyptapanteles species A	adv	**NSR**	D	Common	4A,4B-Malaise trap
Glyptocolastes texanus Ashmead, 1900	adv	NIR			
Heterospilus prosopidis Viereck	pur		B,H	Common	3B-sweep net, 4A,4B-Malaise
Heterospilus species A	adv	NIR			
Parallorhogas pallidiceps (Perkins, 1910)	adv				
Phanerotoma species A	adv	NIR			
?Phanerotoma species B	adv	NIR			
Spathius prusias Nixon, 1943	adv	NIR	K	Common	2B-Black light, 4A-Malaise #1
Stenocorse bruchivora (Crawford, 1910)	pur		D	Common	4A-Malaise #1
Urosigalphus bruchi Crawford, 1907	adv		D,H	Common	3B-sweep net, 4A-Malaise #1
Chalcididae (Chalcids)					
Brachymeria obscurata (Walker, 1874)	adv		A	Common	4A-general
Brachymeria podagrica (Fabricius, 1787)	adv	NIR			
Invreia species near *philippiensis* Masi, 1929	adv	NIR			

Table 2 continued

ARTHROPOD FAUNA		Status on	Status and Distribution within Kahului Airport Environs		
SCIENTIFIC NAME	**Status[1]**	**Maui**	**Veg Type[2]**	**Relative[3] Abundance**	**Collection sites and Methods[4]**
Diapriidae					
Trichopria drosophilae (Perkins, 1910)	end	NIR			
?Genus, ?species (unreported)	?	**NSR**			
Dryinidae					
Anteon coriaceus (Perkins, 1905)	adv	NIR			
Eucoilidae					
Ganaspidium utilis Beardsley, 1988	pur				
Eulophidae					
Euplectrus species A	adv?	**NSR?**	D, H	Local	3B-Gas aspirator
Horismenus species A	adv	**NSR**	D	Common	4A-Malaise #1
Eupelmidae					
Brasema cushmani (Crawford, 1908)	pur		D	Common	4B-Malaise #2
Eupelmus swezeyi (Crawford, 1915)	adv	NIR	G	Common	1B-Gas aspirator, 3B-Malaise trap
Eurytomidae					
?*Eurytoma* species A (unreported)	adv?	**NSR**	D	Local	4A-Malaise #1
Evaniidae (Ensign wasps)					
Evania appendigaster Linnaeus, 1758	adv	NIR	F, D	Common	Airport Nursery 4A-Malaise #1
Formicidae (Ants)					
Anoplolepis gracilipes (F. Smith, 1857)	adv		B	Common	2C-Gas aspirator
Camponotus variegatus (F. Smith, 1858)	adv		D	Common	2C-Ant bait
Ochetellus glaber (Mayr, 1862)	adv				
Paratrechina bourbonica (Forel, 1886)	adv		H	local	3B-Gas aspirator
Paratrechina longicornis (Latreille, 1802)	adv		H	Common	3C-Gas aspirator, 2C-Ant bait, 4A-1st Malaise trap north of bike path.
Pheidole megacephala (Fabricius, 1793)	adv		H	Common	3B-MV bulb
Plagiolepis alluaudi Emery, 1894	adv		E	Common	2C-Ant bait
Solenopsis geminata (Fabricius, 1804)	adv		E	Common	2C-Ant bait
Tapinoma melanocephalum (Fabricius, 1793)	adv		E	Common	2C-Ant bait
Technomyrmex albepes (F. Smith, 1861)	adv		E	Common	2C-Ant bait
Halictidae					
Dialictus species near *navadensis* (Crawford, 1907)	adv		B, D	Common	2B-Black light, 4A-Malaise #1

Table 2 continued

ARTHROPOD FAUNA		Status on	Status and Distribution within Kahului Airport Environs		
SCIENTIFIC NAME	**Status[1]**	**Maui**	**Veg Type[2]**	**Relative[3] Abundance**	**Collection sites and Methods[4]**
Ichneumonidae (Ichneumons)					
Anomalon californicum (Cresson, 1879)	adv	NIR	D	Common	4A,4B-Malaise trap
Barichneumon californicus Heinrich, 1971	adv	NIR	D	Common	4A-Malaise #1
Casinaria infesta (Cresson, 1872)	adv				
Diplazon latatorius (Fabricius, 1781)	adv		D	Common	4B-Malaise trap
Echthromorpha agrestoria fuscator (Fabricius, 1793)	end		D	Common	4A,4B-Malaise trap
Gelis albipalpus [species near?] (Thomson, 1884)	adv	NIR			
Hypsicera sp. A not *femoralis* (Fourcroy)	adv	**NSR**	D		4B-Malaise trap
Hypsicera sp. B different from above	adv	**NSR**			
Pimpla punicipes Cresson, 1873	adv		D	Common	4A,4B-Malaise trap
Pristomerus hawaiiensis Perkins, 1910	end?		D	Common	4A,4B-Malaise trap
Trathala flavoorbitalis (Cameron, 1907)	adv				
Venturia sp. not *canescens* (Gravenhorst, 1829)	adv	NIR			
Megachilidae (Leaf cutter bees)					
Chalicodoma umbripennis (F. Smith 1853)	adv				
Megachile timberlakei Cockerell, 1920	adv		B,H	Local	3B-Malaise trap
Mymaridae (Fairyflies)					
Gonatocerus californicus Girault, 1911	adv				
Gonatocerus dolichocerus Ashmead, 1887	adv				
Gonatocerus species A	adv	**NSR**			
Stephanodes reduvioli (Perkins, 1905)	adv				
Pompilidae (Spider wasps)					
Anoplius toluca (Cameron, 1893)	adv				
Paracyphononyx pedestris (F. Smith, 1855)	adv	NIR			
Pteromalidae					
Lariophagus texanus Crawford, 1910	pur		D	Common	4A-Malaise #1
Pachyneuron species possibly *aphidis* (Bouché)	adv	**NSR**			
New Genus, new sp. Cleonyminae (unreported)	adv?	NIR/ NSR			

Table 2 continued

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SCIENTIFIC NAME	**Status[1]**	**Maui**	**Veg Type[2]**	**Relative[3] Abundance**	**Collection sites and Methods[4]**
Scelionidae					
Telenomus vulcanus Perkins, 1910	end?	NIR	D	Common	4A-Malaise #1
Scoliidae					
Campsomeris marginella modesta (F. Smith,)	pur		D, E	Common	4B-Malaise #2; General on bare ground
Sphecidae					
Ampulex compressa (Fabricius,1781)	pur		D	Common	2C,3A-general
Chalybion bengalense (Dahlbom, 1845)	adv	NIR			
Dicranorhina luzonensis (Rohwer, 1919)	adv	NIR			
Dolichurus stantoni (Ashmead, 1904)	pur		B	Common	2B-Night fogging & yellow pan trap
Dryudella immigrans (Williams, 1946)	adv	NIR	D	Common	4A-Malaise #1
Ectemnius mandibularis (F. Smith, 1879)	end		H	Common	3B,4A-sweep net
Ectemnius molokaiensis (Perkins, 1899)	end		D	Local	4A,4B-Malaise
Isodontia mexicana (Sausure, 1867)	adv	NIR	D	Common	3B-Gas aspirator
Nitela species A	adv	NIR			
Pison hospes F. Smith, 1879	adv		D	Common	4A-Malaise #1
Rhopalum species A	adv	NIR			
Sceliphron caementarium (Drury, 1770)	adv				
Sceliphron madraspatanum (Fabricius, 1781)	adv	NIR			
Tachysphex morosus (F. Smith, 1859)	adv	NIR	H	Common	4B-Malaise #2
Trypoxylon bicolor F. Smith, 1856	adv		D, F	Common	2C-sweep net, 4A-Malaise #1
Trypoxylon philippinensis Ashmead, 1904	adv				
Torymidae					
Megastigmus transvaalensis (Hussey, 1956)	Adv	NIR			
Podagrion mantis Ashmead, 1886	Adv	NIR			

Table 2 continued

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SCIENTIFIC NAME	**Status[1]**	**Maui**	**Veg Type[2]**	**Relative[3] Abundance**	**Collection sites and Methods[4]**
Vespidae					
Delta campaniforme esuriens (Saussure, 1852)	adv	NIR	B, D	Common	4A-Gas aspirator 4B-Malaise #2
Delta curvatum (Saussure, 1854)	adv		F	Uncommon	4B-Malaise #2
Delta pyriforme philippinense (Bequaert, 1928)	adv	NIR	F	Uncommon	2C-Ag. Offices (observed only).
Pachodynerus nasidens (Latreille, 1832)	adv		D, H	Common	3B-general
Polistes aurifer Saussure, 1853	adv		B, D	Common	4A-Malaise #1
Polistes exclamans Viereck, 1906	adv	NIR	B, D, H	Common	4A-Gas aspirator
Polistes olivaceus (DeGeer, 1773)	adv		B, D	Common	2B-general
Vespula pensylvanica (Saussure, 1857) (Western yellow jacket)	adv		D	Transient visitor	4B-Malaise #2
Order ISOPTERA (Termites)					
Kalotermitidae					
*Cryptotermes brevis (*Walker, 1853) (Drywood termite)	adv		B, D	Common	3B-MV bulb
Rhinotermitidae					
Coptotermes formosanus Shiraki, 1909 (Formosan termite)	adv		F	Common	2C-Ag. Lab.
Order: LEPIDOPTERA (Moths & butterflies)					
Cosmopterigidae					
Anatrachyntis incertulella (Walker 1864) the Pandanus flower moth	adv		H,B,D	Scarce	2B,4A- MV light
Asymphorodes dimorpha (Busck 1914)	adv		B,D,H	Common	3A,3B,3C,4A-Most MV lights
Asymphorodes triaula (Meyrick 1935)	adv	NIR			Most MV lights
Hyposmocoma species A	end		B,D,H	Common	Most MV lights
Hyposmocoma species B	end		B, D	Uncommon	2B- MV light
Hyposmocoma species C	end		H,G	Common	1B,2B,4A- MV light
Hyposmocoma species D	end		B	Common	3A,3B,3C- MV light
Hyposmocoma species E	end		B	Scarce	3A-MV light
Hyposmocoma species F	end		H,D	Scarce	4A- MV light
Ithome concolorella (Chambers 1875) (Keawe flower moth)	adv		B	Common	Most MV lights
Pyroderces badia (Hodges 1962)	adv	NIR	H,D	Scarce	4A- MV light
Pyroderces rileyi (Walsingham 1882) the pink cornworm	adv		H,D	Uncommon	2B,4A- MV light

Table 2 continued

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Crambidae					
Euchromius ocelleus (Haworth, 1811)	adv	NIR	B, D,H	Uncommon	2B,4A-MV light
Eudonia species A	end		A, J	Scarce	4A- MV light
Hellula undalis (Fabricius, 1781)	adv		B, D,H	Common	3B,3A,3C,4A MV light
Herpetogramma licarsisalis (Walker, 1859) (Grass webworm)	adv			Common	4A,3B,3A- MV light
Mestolobes species A	end		B,D,H	Common	2B,3B,3A,4A- MV light
Nomophila noctuella (Denis & Schiffermueller, 1775)	adv		B, D,C	Uncommon	2B,4A- MV light
Omiodes localis (Butler, 1879)	end		B,D,H	Uncommon	3B,4A- MV light
Omphisa anastomosalis (Guenee, 1854)	adv		B, D	Uncommon	2B-MV light 4A-Malaise #1
Orthomecyna species near exigua (Butler, 1879)	end		H,B, D	Common	Most MV lights
Spoladea recurvalis (Fabricius,1775) (Beet webworm)	adv		B, D,	Common	2B,3C,4A- MV light
Synclita obliteralis (Walker, 1859)	adv	NIR	H,B,D	Uncommon	2B,4A- MV light
Tamsica floricolens (Butler, 1883)	end	NIR	B,D,H	Common	Most MV lights
Udea litorea (Butler, 1883)	end	NIR	A, J	Local	4A- MV light, on *Scaevola*
Genus species?	adv	**NSR**	D	Scarce	3A- MV light
Gelechiidae					
Autosticha pelodes (Meyrick 1883)	adv	NIR	B	Uncommon	2B,3B-MV light
Genus species A (near *Autosticha*)	adv	**NSR**	B	Uncommon	2C,3C-MV light
Dichomeris acuminata (Staudinger 1876)	adv	NIR	B	locally common	3B,3C- MV light
Dichomeris aenigmatica (Clarke 1962) the sourbush moth	pur		D,B	Scarce	2B-Fogging
Keiferia lycopersicella (Walsingham 1928) the tomato pinworm	adv		B	Scarce	2B-MV light
Pectinophora sp. prob. *gossypiella* (Saunders, 1843), pink bollworm	adv		D,H	Scarce	4A- MV light
Phthorimaea operculella (Zeller 1873) the potato tuberworm	adv		B,H	Scarce	2C- MV light
Stoeberhinus testaceus Butler, 1881	adv		B,D	Common	1B,3C,3A,4A,2B- MV light
Geometridae (Inchworms)					
Anacamptodes fragilaria (Grossbeck, 1909) (Koa haole moth)	adv		D	Common	2B,3A,3B,4A- MV light
Cyclophora nanaria (Walker, 1861)	adv		B,D	Common	3A,3B,3C- MV light

Table 2 continued

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Disclisioprocta stellata (Guenee 1857) Bouganvillea looper	adv		K	Common	2B- larvae on *Bouganvillea*
Macaria abydata Guenee, 1857 (Koa haole looper)	adv		D	Common	@ all MV sites
Scopula personata ?(Prout,)	adv	NIR	H,D,B	Common	3A,3C,4A,2B- MV light
Hesperiidae (Skippers)					
Hylephila phyleus (Drury, 1770) firey skipper	adv		E,C,A	common	3A,3B,2B-flying
Lycaenidae (Blues)					
Brephidium exilis (Boisduval, 1852)	adv	NIR	A,C,H, J	Common	3A,3B,2B-flying
Lampides boeticus (Linnaeus, 1767) bean butterfly	adv		D	Common	3A,3B,2B-flying
Lyonetidae					
Bedellia cf. orchilella Walsingham 1907; sweet potato leafminer	adv		B,D	Scarce	2B-Fogging
Noctuidae (Noctuids)					
Achaea janata (Linnaeus, 1758) (Croton moth)	adv		B,D,H	Common	2B-4B-Most MV lights, malaise
Agrotis ipsilon (Hufnagel, 1767) (Greasy cutworm)	adv		B, D	Common	2B, 3C, 4B- MV lights, malaise
Agrotis species near *dislocata* (Walker, 1856)	end		B	Scarce	3C- MV lights
Amyna natalis (Walker, 1858)	adv	NIR	B, D,	Common	2B, 3B,4B-MV lights, malaise
Ascalapha odorata (Linnaeus, 1758) (Black witch)	adv		B, D	Uncommon	3A,2C MV light
Athetis thoracica (Moore, 1884)	adv		B,D	Common	2B-4B-Most MV lights, malaise
Chrysodeixis eriosoma (Doubleday, 1843)	adv		B,D	Common	2B-4B-Most MV lights, malaise
Condica illecta (Walker, 1865)	adv.		B	Uncommon	2B-MV light
Ctenoplusia albostriata Brener & Gray	adv	**NSR**	B	Scarce	2B-MV light
Elaphria nucicolora (Guenee, 1852)	adv		B, D	Common	2B,3C,3A-MV lights
Eublemma accedens (Felder & Rogenhofer, 1874)	adv	NIR	B, D	Common	4A-Malaise #1, 1B,3A,3C,4A- MV lights
Hypena laceratalis Walker, 1858 (Lantana looper)	pur		B, D	Common	2B,3A,3C,4A- MV lights

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SCIENTIFIC NAME	**Status[1]**	**Maui**	**Veg Type[2]**	**Relative[3] Abundance**	**Collection sites and Methods[4]**
Leucania loreyimima Rungs, 1953	adv	NIR	B	Uncommon	1B,2B-MV light
Leucania cf. scottii Butler, 1886	adv	NIR	B	Uncommon	2B-MV light
Leucania cf. striata Leech, 1900	adv		B	Uncommon	2B-MV light
Lycophotia porphyrea (Denis & Schiffermueller, 1775) (Black cutworn))	adv		B	Uncommon	4A- On *Chenopodium* at night
Melipotis indomita (Walker, 1857)	adv		B,D	Common	2B,2C,3A,3B-MV lights, 4A-malaise
Polydesma boarmoides Guenee, 1852	adv		B	Scarce	2C-MV light
Pseudaletia unipuncta (Haworth, 1809)	adv		B, D	Common	2B-4B-Most MV lights, malaise
Schrankia species A	end		B	Local	2B,2C-MV light
Simplicia caeneusalis (Walker, 1858)	adv		B,D	Common	2B,3B- MV light
Spodoptera mauritia (Boisduval, 1833)	adv		B	Scarce	2B-MV light
Trichoplusia ni (Huebner 1802) (Cabbage looper)	adv		B	Uncommon	2B-MV light
Nymphalidae (Brush-footed butterflies)					
Agraulis vanillae (Linnaeus, 1758) (Gulf fritillary)	adv		B, D, E	Uncommon	3B,2C-observed only
Danaus plexippus (Linnaeus, 1758) (Monarch)	adv		B,K	Common	2C,3A (observed only)
Vanessa cardui (Linnaeus, 1758) (Painted lady)	adv		D,E	Common	2C,4A-General
Oecophoridae					
Ethmia nigroapicella (Saalmueller,1880) (Kou moth)	adv		K,B	Uncommon	2B- MV light
Thyrocopa species A	end		B	Local	3B,3C- MV light
Thyrocopa species B	end		B,D	Local	3B,2B,4A,3A- MV light
Olethreutidae (leafrollers)					
Crocidosema blackburni ? (Butler, 1910)	end?		B,H	Scarce	2B,4A- MV light
Crocidosema lantana Busck 1910	pur		B	Uncommon	2B,3C- MV light
Crocidosema species near *leprara* (Walsingham 1907)	end	NIR	H,F	Common	1B,2B,4A-MV light
Cryptophlebia illepida (Butler, 1882)	end?		B, D	Common	2B,4A-MV bulb,
Cryptophlebia ombrodelta (Lower, 1898)	adv		B,D	Common	2B,3B,3C- MV light

Table 2 continued

ARTHROPOD FAUNA		Status on	Status and Distribution within Kahului Airport Environs		
SCIENTIFIC NAME	**Status[1]**	**Maui**	**Veg Type[2]**	**Relative[3] Abundance**	**Collection sites and Methods[4]**
Papilionidae (Swallowtails)					
Papilio xuthus Linnaeus, 1767) (Citrus swallowtail)	adv		K	Common	2C-On host (citrus)
Pieridae Whites)					
Pieris rapae (Linnaeus, 1758) (Cabbage white)	adv		B	Common	2C- Flying
Plutellidae					
Plutella xylostella (Linnaeus, 1758) (Diamond-back moth)	adv		D,H	Scarce	4A- MV light
Psychidae (Bagworms)					
Brachycyttarus griseus De Joannis, 1929	adv	NIR	F	Common	2C-Larval cases on lawn
Pterophoridae (Plume moths)					
Stenoptiloides species A	adv		B, D	Uncommon	2B,3C-MV light
Pyralidae					
Elasmopalpus lignosellus (Zeller, 1848)	adv		E	Scarce	2C-General collecting
Ephestiodes gilvescentella Ragonot 1887	adv		B,D	common	Most MV lights
Sphingidae (Hawk moths)					
Agrius cingulata (Fabricius, 1775) (Sweet potato hornworm)	adv		J,B	Uncommon	2B-MV light 4A-larva on *Ipomea*
Deilephila nerii (Linnaeus, 1758) (Oleander hawk moth)	adv		K	Local	3B-reared Oleander hedge
Hippotion rosetta (Swinhoe, 1892)	adv	NIR	A, B, D	Common	D – H Malaise traps 1 & 2
Hyles lineata (Fabricius 1775) (White-lined sphinx)	ind /adv?		A,J	Scarce	4A-At night
Manduca blackburni (Butler, 1880) (Blackburn sphinx)	end		A,J	U.S.A. Endangered species	4A-Larvae on tree tobacco (not collected)
Tineidae (Clothes moths)					
Dryadaula terpsichorella (Busck 1910)	adv		B,D	Common	4A,3A-MV light
Erechthias minuscula (Walsingham, 1907)	adv		B, D	Common	4A,2B,3A- MV light
Erechthias simulans (Butler, 1882)	adv	NIR	B, D	Uncommon	4A,3A,2B,3C- MV light; 2C-In HDOA Quarantine room
Monopis meliorella (Walker 1863)	adv	NIR	B	Scarce	3C- MV light

Table 2 continued

ARTHROPOD FAUNA		Status on	Status and Distribution within Kahului Airport Environs		
SCIENTIFIC NAME	**Status[1]**	**Maui**	**Veg Type[2]**	**Relative[3] Abundance**	**Collection sites - Methods[4]**
Opogona aurisquamosa (Butler 1881)	adv		D	Uncommon	3A- MV light
Opogona omoscopa (Meyrick, 1893)	adv		B	Local	2B,3C- MV light
Phereoeca (?) alutella (Rebel 1892)	adv		F	Scarce	2C- In office
Trichophaga mormopis Meyrick, 1935	adv		B, D	Uncommon	2B-MV bulb
Genus species	adv	?		Uncommon	1B,3A-MV light
Tortricidae (Leafrollers)					
Bactra venosana (Zeller, 1847)	pur		H,G	Common	1B,2B,4A-MV bulb
Episimus utilis Zimmerman, 1978	pur		B	Scarce	4A- MV light
Lorita scarificata (Meyrick, 1917)	adv	NIR	B,D	Common	Most MV lights
Platynota stultana Walsingham, 1884	adv	NIR	B,D	Common	Most MV lights
Order: MANTODEA (Mantids)					
Mantidae					
Hierodula patellifera (Serville, 1839)	adv		D	Common	B 17
Tenodera australasiae (Leach, 1815)	adv		D, A	Common	4A-Egg cases on fence, General collecting
Order: NEUROPTERA (lacewings)					
Chrysopidae (Green lacewings)					
Chrysoperla comanche (Banks, 1938)	adv		H	Common	3B-MV bulb
Coniopterygidae (Dusty-wings)					
Coniocompsa zimmermani Kimmins, 1953	adv		B	Scarce	Gas aspirator
Hemerobiidae (Brown lacewings)					
Micromus bellulus? (Perkins, 1899)	end				
Micromus timidus Hagen, 1853	pur		B, H	Local	2B-MV bulb
Order: ODONATA (Dragonflies and Damselflies)					
Aeshnidae (Darners)					
Anax junius (Drury, 1770) (Green darner)	ind		D, H	Common	3B, 1B, 2B-sweep net
Coenagrionidae (Narrow-winged damselflies)					
Ischnura ramburii (Selys-Longchamps, 1850)	adv		H	Common	2B-Gas aspirator, sweep net

Table 2 continued

ARTHROPOD FAUNA		Status on	Status and Distribution within Kahului Airport Environs		
SCIENTIFIC NAME	**Status[1]**	**Maui**	**Veg Type[2]**	**Relative[3] Abundance**	**Collection sites and Methods[4]**
Libellulidae (Skimmers)					
Orthemis ferruginea (Fabricius,1775)	adv		H	Common	3B-sweep net
Pantala flavescens (Fabricius, 1798) (Globe skimmer)	ind		H	Common	Commonly observed
Order: ORTHOPTERA (Grasshoppers & Crickets)					
Acrididae (Short-horned grasshoppers)					
Oedaleus abruptus (Thunberg, 1815)	adv		C	Common	3B, 4B-gas aspirator, sweep net
Schistocerca nitens (Thunberg, 1815)	adv		C, I	Common	3B, 4B-gas aspirator, sweep net
Gryllidae (Crickets)					
Gryllodes sigillatus (Walker, 1869)	adv		D	Common	2B,3A,3B-MV bulb
Gryllus bimaculatus DeGeer, 1773	adv				
Modicogryllus siamensis Chopard, 1961	adv		H,C	local	4A- MV light
Trigonidomorpha sjostedti Chopard 1926	adv		D	Scarce	Gaspirator, irrigated sites.
Pyrgomorphidae					
Atractomorpha sinensis Bolivar, 1905	adv		J	Common	4A-Gas aspirator
Tettigoniidae (Katydids)					
Elimaea punctifera (Walker, 1869)	adv	NIR	D	Common	4A-Malaise #1
Euconocephalus nasutus (Thunberg, 1815)	adv		C	Common	3B-MV bulb
Order: PSOCOPTERA (Bark lice)					
Liposcelidae					
Liposcelis c.f. divinatorius (Mueller, 1776) book louse	adv	NIR	B,F	Common	2C-in HDOA Insectary.
4+ species unidentified					
Order: SIPHONAPTERA (Fleas)					
Pulicidae (Common fleas)					
Ctenocephalides felis? (Bouche, 1835)	adv		F	Scarce	2C-in HDOA Insectary.
Order: STREPSIPTERA (Stylopids)					
Stylopidae					
Xenos auriferi Pierce, 1911	adv		B,D,H	Common	4A-recovered from *Polistes aurifer*

Table 2 continued

ARTHROPOD FAUNA		Status on	Status and Distribution within Kahului Airport Environs		
SCIENTIFIC NAME	Status[1]	Maui	Veg Type[2]	Relative[3] Abundance	Collection sites and Methods[4]
Order: THYSANOPTERA (Thrips)					
Thripidae					
Heliothrips heamorrhoidalis (Bouche, 1833)	adv		K	Common	2C-Gas aspirator
Order: THYSANURA (Silverfish)					
Lepismatidae					
Ctenolepisma longicaudatum Escherich, 1905	adv	NIR	F	Common	2C-in buildings
Order: TRICHOPTERA (Caddisflies)					
Hydropsychidae					
Cheumatopsyche pettiti (Banks, 1908)	adv		H	Common	3B-MV bulb @ all MV sites
Hydroptilidae					
Oxyethira maya Denning, 1947	adv		G	Common	2B-MV bulb
Class: CRUSTACEA (Crabs etc.) Order: AMPHIPODA (Sandhoppers, scuds)					
Talitridae?					
Genus species	?		H	Local	4A-On ground
Order: ISOPODA (Sowbugs, slaters)					
Porcellionidae					
Porcellio laevis Latreille, 1804	adv		A	Common	4A-On ground
Scyphacidae					
Alloniscus oahuensis Budde-Lund, 1879	adv.		H, I	Local	4A-pan trap
Class: CHILOPODA (Centipedes) Order: SCOLOPENDROMORPHA (Giant centipedes)					
Scolopendridae					
Scolopendra subspinipes Leach, 1815 giant centipede	adv		B	Common	3B-On ground at night

Table 2 continued

[1] = **Status**: End=endemic to HIs, Ind=indigenous to HIs, Adv=adventive,
Pur=purposefully introduced, ?=Unknown,

[2] = **Habitat**-Vegetation Types :

A = Wind sheared dune vegetation.
B = Keawe/mixed understory.
C = Open grassland.
D = Koa Haole shrub/mixed understory.
E = Cane fields and ruderal borders.
F = Airfield /terminal/industrial.
G = Kanaha Pond (water area).
H = Wetlands.
I = Unvegetated littoral.
J = Native beach strand.
K = Non-native ornamentals

[3] = A subjective measure of abundance within the airport environs:
'Common' = found at many sites or commonly seen;
'Local' = common but restricted to one or few areas;
'Scarce' = only one or a few specimens seen.

[4] = See **Table 1** for collection sites. The alpha-numeric codes refer to areas shown on Figure 2 where specimens were collected

TABLE 3: Numbers and geographic status of species within the major Arthropod groups collected within the Kahului Airport environs.

Taxon	Total Species	ID Species	Geographic Status*				
			End	Ind	Pur	Adv	Unk
Arachnida (Spiders & relatives)	**53**	**41**	**7**	**1**	**-**	**26**	**19**
• Acari (Mites)	38	29	6	1	-	13	18
• Araneae (Spiders)	13	12	1	-	-	12	-
• Pseudoscorpionida (False scorpions)	1	-	-	-	-	-	1
• Scorpiones (Scorpions)	1	-	-	-	-	1	-
Insecta (Insects)	**567**	**540**	**52**	**7**	**47**	**444**	**17+**
• Blattodea (Cockroaches)	8	8	-	-	-	8	-
• Coleoptera (Beetles)	141	135	8	2	22	109	-
• Collembola (Springtails)	2+	-	-	-	-	-	2+
• Dermaptera (Earwigs)	3	3	-	-	-	3	-
• Diptera (Flies)	103	101	12	2	6	80	3
• Embiidina (Webspinners)	1	1	-	-	-	1	-
• Heteroptera (True bugs)	39	38	3	-	1	35	-
• Homoptera (Hoppers & scales)	36	30	2	-	-	28	6
• Hymenoptera (Bees & wasps)	100	98	6	-	12	80	2
• Isoptera (Termites)	2	2	-	-	-	2	-
• Lepidoptera (Moths & butterflies)	102	100	20	1	5	76	-
• Mantodea (Mantids)	2	-	-	-	-	2	-
• Neuroptera (Lacewings)	4	4	1	-	1	2	-
• Odonata (Dragonflies & damselflies)	4	4	-	2	-	2	-
• Orthoptera (Grasshoppers & crickets)	9	9	-	-	-	9	-
• Psocoptera (Bark lice)	5	1	-	-	-	1	4+
• Siphonaptera (Fleas)	1	1	-	-	-	1	-
• Strepsiptera (Stylopids)	1	1	-	-	-	1	-
• Thysanoptera (Thrips)	1	1	-	-	-	1	-
• Thysanura (Silverfish)	1	1	-	-	-	1	-
• Trichoptera (Caddisflies)	2	2	-	-	-	2	-
Chilopoda (Centipedes)	**1**	**1**	**-**	**-**	**-**	**1**	**-**
• Scolopendromorpha (Giant centipedes)	1	1	-	-	-	1	-
Crustacea (Crabs and relatives)	**3**	**2**	**-**	**-**	**-**	**2**	**1**
• Amphipoda (Sandhoppers)	1	-	-	-	-	-	1
• Isopoda (Sow bugs & slaters)	2	2	-	-	-	2	-
All **Arthropoda** (Arthropods)	**624**	**584**	**59**	**8**	**47**	**473**	**37+**
Percentage of total # species	**100%**	**94%**	**9%**	**1%**	**7%**	**76%**	**6%**

* Most unidentified species are included in the unknown category; however, a few belong to known native or alien groups and therefore, could be categorized. Also, the origins of a few identified species remain obscure, and these are listed under unknown. See Table 2.

TABLE 4 -- List of new island and new state records for Maui among alien species of arthropods collected within the Kahului Airport environs during the period from 1 August 1999 to November 2000. Names and arrangement follow Nishida 1997 and 2002.

SCIENTIFIC NAME	Status[1]	New record	Date first reported in HI
Phylum: ARTHROPODA **Class: ARACHNIDA:** **Subclass: ACARI (MITES):**			
Ascidae			
Asca duosetosa Fox, 1946	adv	New island record	
Asca species A	adv	New island record	
Bdellidae			
Bdella distincta (Baker & Balock, 1944)	adv	New island record	1963
Bdellodes longirostris (Hermann, 1804)	adv	New island record	1963
Cheyletidae			
Hemicheyletia bakeri Ehara, 1962	adv	New island record	1983
Fusacaridae?			
Genus? species?	adv?	**New State record**	
Galumnatidae			
Pergalumna bryani (Jacot, 1934)	adv	**New State record**	
Oribatulidae			
Zygoribatula species A	adv?	New island record	1998
Tydeidae			
Tydeus tutllei Baker, 1965	adv	New island record	2000
Subclass: ARANEAE (Spiders)			
Araneidae (Orb weavers)			
Gasteracantha cranciformis (Linnaeus, 1758) spinybacked spider	adv	New island record?	1954
Gnaphosidae			
Zelotes reformans Chamberlin, 1924	adv	New island record	
Theridiidae Cob-web spiders			
Coleosoma cf. floridanum Banks, 1900	adv	New island record	1952
Theridion melanostictum Cambridge, 1876	adv	New island record	1997
Class: INSECTA (Insects) **Order: BLATTODEA (Cockroaches)**			
Blatellidae			
Symploce pallens (Stephens, 1835)	adv	New island record	1899
Order: COLEOPTERA (Beetles)			
Aderidae			
Xylophilus marquesanus Blair, 1934	adv	New island record	1922
Anobiidae			
Ozognathus sp.	adv	New island record	1988

Table 4. Continued

SCIENTIFIC NAME	Status[1]	New record	Date first reported in HI
Anthicidae			
Anthicus recens Werner, 1967	adv	New island record	1967
Bostrichidae			
Xylopsocus capucinus (Fabricius, 1781)	adv	New island record	1940
Xylopsocus castanoptera (Fairmaire, 1850)	adv	New island record	1885
Bruchidae			
Acanthoscelides macrophthalmus (Schaeffer, 1907)	adv	New island record	1991
Mimosestes insularis Kingsolver & Johnson, 1978	adv	New island record	1996
Buprestidae			
Agrilus species A, not A. *extraneus* Fisher, 1933.	adv	**New State record**	
Carabidae			
Anisotarsus (*Eurytrichus*) *purpurascens* Bates	adv?	**New State record**	
Bembidion niloticum batesi (Putzeys, 1875)	adv?	New island record	1936
Perigona nigriceps (Dejean, 1831)	adv	New island record	1922
Stenolophus ?*limbalis* LeConte, 1860	pur?	New island record	1929
Clambiidae			
Clambus species A not *C. pubescens* Redtenbacher	adv?	**New State record**	
Cleridae			
Tarsostenus univittatus (Rossi, 1792)	adv	New island record	1885
Coccinellidae			
Brumoides suturalis (Fabricius, 1798)	adv	New island record	1974
Nephaspis bicolor Gordon, 1982	pur	New island record	1982
Nephaspis species A, near N. bicolor	pur/adv?	New island record	-
Orcus australasiae (Boisduval, 1835)	pur	New island record?	
Telsimia nitida Chapin, 1926	pur	New island record	1936
Colydiidae			
Colobicus parilis Pascoe, 1861	adv	New island record	1908
Cucujidae			
Psammoechus insularis Sharp, 1885	adv	New island record	1885
Silvanoprus scuticollis (Walker)	adv	**New State record**	
Curculionidae			
Lixus mastersi Pascoe, 1874	adv	New island record?	1992
Myllocerus species A [Beardsley & Kumashiro, et al.1990]	adv	New island record	1990
Sphenophorus cariosus Olivier, 1807	adv	New island record	1957
Elateridae			
Aeolus livens (Le Conte, 1853)	adv	New island record	
Cardiophorus stolatus Erichson, 1840	adv	New island record	1972
Conoderus pallipes (Eschscholtz, 1830)	adv	New island record	1963

Table 4. Continued

SCIENTIFIC NAME	Status[1]	New record	Date first reported in HI
Elateridae (continued)			
Lacon modestus (Boisduval, 1835)	adv	New island record	1885
Melanotus ?*similis* (Kirby)	adv	**New State record**	
Hydrophilidae			
Cercyon species near *C. fimbriatus* Mannerheim, 1852	adv	**New State record**	
Enochrus sayi Gundersen, 1977	adv	New island record	1932
Laemophloeidae			
Laemophloeus species A, not *L. minutus* Oliver	adv	**New State record**	
Languridae			
Cryptophilus integer (Heer, 1841)	adv	New island record	1885
Lathridiidae			
Corticaria? *longicollis*? (Zeterstedt, 1838)	adv?	New island record	
Lyctidae			
Trogoxylon aequale (Wollaston, 1867)	adv	New island record	
Nitidulidae			
Carpophilus marginellus Motschulsky, 1858	adv	New island record	1959
Haptoncus luteolus (Erichson, 1843)	adv	New island record	1960
Lasiodactylus ?*tibialis* (Boheman, 1851)	adv	New island record	1996
Stelidota species A [Beardsley et al, 1992]	adv	New island record	1992
Oedemeridae			
Ananca bicolor (Fairmaire, 1849)	adv	New island record	1885
Platypodidae			
Crossotarsus externedentatus (Fairmaire, 1850)	adv	New island record	1885
Platypus parallelus (Fabricius,)	adv	**New State record**	
Pselaphidae			
genus + species unidentified.	adv	**New State record**	
Sciritidae			
Scirtes species A [Beardsley & Mau]	adv	New island record	1976
Scolytidae			
Hypothenemus ?*rarinosa* Blandford	adv	**New State record?**	
Hypothenemus ?*pulverulentus* (Eichhoff) = *H. seriatus?*	adv	**New State record?**	
Hypothenemus ?*seriatus* (Eichhoff, 1871)	adv	New island record	1960
Staphylinidae			
Anotylus species A not *A. vinsoni* (Cameron, 1936)	adv	New island record/ **New State record?**	
Carpelimus species A	adv?	New island record	1975
Coproporus species A	adv	**New State record**	
Lithocharis species A	adv	New island record	
Lithocharis species B	adv	New island record	

Table 4. Continued

SCIENTIFIC NAME	Status[1]	New record	Date first reported in HI
Scopaeus species A	adv	New island record	1975 [but collected 1902!]
Stiloderus species A	adv	**New State record**	
Tenebrionidae			
Alphitobius laevigatus (Fabricius, 1781)	adv	New island record	1885
Blapstinus dilatatus Le Conte, 1851	adv	New island record	
Blapstinus histricus Casey, 1890	adv	New island record	1917
Cnemeplatia? species A	adv	**New State record**	
Gnatocerus maxillosus (Fabricius, 1801)	adv	New island record	
Lyphia sp. nr. *angusta* (Lucas, 1846)	adv	New island record/ **New State record?**	
Throscidae			
Trixagus extraneus Fisher, 1942	adv	New island record	1917
Order: DIPTERA (Flies)			
Ceratopogonidae			
Culicoides species	adv	New island record/ **New State record?**	2000
Forcipomyia borbonica Clastrier,1959	adv	New Island record	1960
Chloropidae			
Monochaetoscinella species A	adv?	New island record/ **New State record?**	-
Cryptochetidae			
Cryptochetum iceryae (Williston, 1888) cottony cushion scale fly	adv	New island record	1966
Dolichopodidae			
Chrysosoma globiferum (Wiedemann, 1830)	adv	New island record	1901
Pelastoneurus lugubris Loew 1861	adv	New Island record	1994
Ephydridae			
Clasiopella uncinata Hendel, 1914	adv	New island record	1952
Ephydra gracilis Packard, 1871	adv	New island record	1947
Scatella stagnalis (Fallen, 1813)	adv	New island record	1967
Fanniidae			
?Euryomma species A	adv	New island record	-
Heleomyzidae			
Spilochroa ornata (Johnson, 1895)	adv	New island record	1998
Micropezidae			
Taeniaptera cf. angulata (Loew, 1866)	adv	New island record	1956
Muscidae			
Coenosiinae (Genus species?)	adv	**New State record**	-
Mycetophilidae			
Leia species A	adv	New island record	1986
Otitidae			
Ceroxys latiusculus (Loew, 1873)	adv	New island record	1956

Table 4. Continued

SCIENTIFIC NAME	Status[1]	New record	Date first reported in HI
Sarcophagidae			
Sarcophaga africa (Wiedemann, 1824)	adv	New island record?	
Syrphidae			
Eumerus aurifrons (Wiedemann,1824)	adv	New island record	1934
Tachinidae			
Actia eucosmae Bezzi, 1926	adv	New island record	1975
Phasioormia pallida Townsend, 1933	adv	New island record	1993
Tipulidae			
Limonia species A	adv	**New State record**	-
Order: HETEROPTERA (True bugs)			
Cydnidae			
Microporus shiromai Froeschner 1977	adv	New island record	-
Genus & species undetermined	adv	**New State record**?	-
Lygaeidae			
Appolonius ? species A	adv	New island record	1976
Clerada apicornis Signoret, 1862	adv	New island record	1878
Nysius species B	adv?	New island record?	
Tempyra biguttula Stal, 1874	adv	New island record	1908
Miridae (Leaf bugs)			
Coridromus variegatus (Montrouzier, 1861)	adv	New island record	1994
Trigonotylus tenuis (Reuter, 1895)	adv	New island record	
Pentatomidae			
Brochymena quadripustulata (Fabricius, 1775)	adv	New island record	1963
Eysarcoris ventralis (Westwood, 1837)	adv	New island record	
Thyanta custator accerra McAtee, 1919	adv	New island record	
Reduviidae			
Gallobelgicus saevus Bergoth, 1913	adv	New island record	1978
Sinea rileyi Montandon	adv	**New State record**	
Rhopalidae			
Niesthrea louisianica Sailer, 1961	adv	New island record	1995
Saldidae			
Micracanthia humilis (Say, 1832)	adv	New island record	1993
Tingidae			
Corythucha morrilli Osborn & Drake, 1917	adv	New island record	1954
Order: HOMOPTERA (Hoppers and Scales)			
Cicadellidae			
Balclutha species near *B. rubrostriata* (Melichar, 1903)	adv	New island record	
Graminella sonora (Ball, 1900)	adv	New island record	
Gyponana germari (Stal, 1864)	adv	New island record	

Table 4. Continued

SCIENTIFIC NAME	Status[1]	New record	Date first reported in HI
Scaphytopius loricatus (Van Duzee, 1894)	adv	New island record	
Spanbergiella quadripunctata Lawson, 1932	adv	New island record	
Coccidae			
Pulvinaria urbicola Cockerell, 1893	adv	New island record	1909
Delphacidae			
Sardia rostrata pluto (Kirkaldy, 1906)	adv	New island record	1977
Psyllidae			
Heteropsylla mimosae? Crawford, 1914	adv	New island record?	1978
Order: HYMENOPTERA: (Bees and Wasps)			
Agaonidae			
Eupristina verticillata Waterston, 1921	pur	New island record	1939
Josephiella new species A.	adv	New island record	2000
Anthophoridae			
Ceratina arizonensis Cockerell, 1898	adv	New island record	1953
Aphidiidae			
Aphidius gifuensis Ashmead, 1906	adv	New island record	1961
Bethylidae			
Epyris species A	adv	New island record	-
Goniozus sp. poss. *columbianus* Ashmead	adv	**New State record**	
Braconidae			
Acrophasmus immigrans (Beardsley , 1961)	adv	New island record	1961
Agathis species A	adv	New island record	
Apanteles opacus (Ashmead, 1905)	adv	New island record	1990
Ascogaster species A	adv	**New State record**	
Glyptapanteles species A	adv	**New State record**	
Glyptocolastes texanus Ashmead, 1900	adv	New island record	1948
Heterospilus species A	adv?	New island record	-
Phanerotoma species A	adv	New island record	-
?Phanerotoma species B	adv	New island record	-
Spathius prusias Nixon, 1943	adv	New island record	1962
Chalcididae			
Brachymeria podagrica (Fabricius, 1787)	adv	New island record	1948
Invreia sp. nr. *philippinensis* (Masi, 1922)	adv	New island record	1954
Diapriidae			
?Genus, ?species	?	**New State record**	
Dryinidae			
Anteon coriaceus (Perkins, 1905)	adv	New island record	1962
Eulophidae			
Euplectrus species A	adv?	**New State record?**	
Horismenus species A	?	**New State record**	

Table 4. Continued

SCIENTIFIC NAME	Status[1]	New record	Date first reported in HI
Eupelmidae			
Eupelmus swezeyi (Crawford, 1915)	adv	New island record	1915
Eurytomidae			
?*Eurytoma* species A	adv?	**New State record**	
Evaniidae			
Evania appendigaster Linnaeus, 1758	adv	New island record	1901
Ichneumonidae			
Anomalon californicum (Cresson, 1879)	adv	New island record	1947
Barichneumon californicus Heinrich, 1971	adv	New island record	1978
Gelis albipalpus [sp.nr.] (Thomson, 1884)	adv	New island record	1980
Hypsicera species A not *H. femoralis* (Fourcroy)	adv	**New State record**	
Hypsicera species B	adv	**New State record**	
Venturia species A *not* V. canescens (Gravenhorst)	adv	New island record	1960
Mymaridae			
Gonatocerus species A	adv	**New State record**	
Pompilidae			
Paracyphononyx pedestris (F. Smith, 1855)	adv	New island record	1965
Pteromalidae			
Pachyneuron species A poss. *P. aphidis* (Bouché)	adv	**New State record**	
New Genus, new sp. Cleonyminae	adv?	New island record New State record?	-
Sphecidae			
Chalybion bengalense (Dahlbom, 1845)	adv	New island record	1948
Dicranorhina luzonensis Rohwer, 1919	adv	New island record	1946
Dryudella immigrans (Williams, 1946)	adv	New island record	1940
Isodontia mexicana (Sausure, 1867)	adv	New island record	1963
Nitela species A	adv	New island record	2000
Rhopalum species A	adv	New island record	2000
Sceliphron madraspatanum (Fabricius, 1781)	adv	New island record	1981
Tachysphex morosus (F. Smith, 1859)	adv	New island record	1948
Torymidae			
Megastigmus transvaalensis (Hussey, 1956)	adv	New island record	1923
Podagrion mantis Ashmead, 1886	adv	New island record	1944

Table 4. Continued

SCIENTIFIC NAME	Status[1]	New record	Date first reported in HI
Vespidae			
Delta campaniforme esuriens (Saussure, 1852)	adv	New island record	-
Delta pyriformis philippinense (Bequaert, 1928)	adv	New island record	1948
Polistes exclamans Viereck, 1906	adv	New island record	-
Order: LEPIDOPTERA (Moths & butterflies)			
Cosmopterigidae			
Asymphorodes triaula (Meyrick 1935)	adv	New island record	1978
Pyroderces badia (Hodges 1962)	adv	New island record	1978
Crambidae			
Euchromius ocelleus (Haworth, 1811)	adv	New island record	1882
Synclita obliteralis (Walker, 1859)	adv	New island record	1943
Genus? species?		**New State record**	
Gelechiidae			
Autosticha pelodes (Meyrick 1883)	adv	New island record	1877
Genus species (near *Autosticha*)	adv	**New State record**	
Dichomeris acuminata (Staudinger 1876)	adv	New island record	1952
Geometridae			
Scopula personata (Prout,)	adv	New island record/ **New State record**?	-
Lycaenidae			
Brephidium exilis (Boisduval, 1852)	adv	New island record	1978
Noctuidae			
Amyna natalis (Walker, 1858)	adv	New island record	1946
Ctenoplusia albostriata Brener & Gray	adv	**New State record**	
Eublemma accedens (Felder & Rogenhofer, 1874)	adv	New island record	1962
Leucania loreyimima Rungs, 1953	adv	New island record	1974
Leucania cf. scottii Butler, 1886	adv	New island record	1957
Psychidae			
Brachycyttarus griseus De Joannis, 1929	adv	New island record	1986
Sphingidae			
Hippotion rosetta (Swinhoe, 1892)	adv	New island record	1999
Tineidae			
Erechthias simulans (Butler, 1882)	adv	New island record	1882
Monopis meliorella (Walker 1863)	adv	New island record	1923
Tortricidae			
Lorita scarificata (Meyrick, 1917)	adv	New island record	
Platynota stultana Walsingham, 1884	adv	New island record	1991

Table 4. Continued

SCIENTIFIC NAME	Status[1]	New record	Date first reported in HI
Order: ORTHOPTERA (Grasshoppers and crickets)			
Tettigoniidae (Katydids)			
Elimaea punctifera (Walker, 1869)	adv	New island record	pre 1900
Order: PSOCOPTERA (Bark lice)			
Liposcelidae			
Liposcelis c.f. divinatorius (Mueller, 1776) book louse	adv	New island record	1948, but present pre 1900
Order: THYSANURA (Silverfish)			
Lepismatidae			
Ctenolepisma longicaudatum Escherich, 1905	adv	New island record	pre 1900

[1]=Status: Adv=adventive, Pur=purposefully introduced, ?=questionable record.

Table 5: Numbers of alien species representing new state records and new island records among the major Arthropod groups collected within the Kahului Airport environs.

Taxon	Total # Alien Species	Previously Recorded on Maui	New Island Records	New State Records
Arachnida (Spiders & relatives)	**26**	**13**	**11**	**2**
• Acari (Mites)	13	4	7	2
• Araneae (Spiders)	12	8	4	-
• Pseudoscorpionida (False scorpions)	?	-	-	-
• Scorpiones (Scorpions)	1	1	-	-
Insecta (Insects)	**491**	**312**	**147**	**32**
• Blattodea (Cockroaches)	8	7	1	-
• Coleoptera (Beetles)	131	69	48	14
• Collembola (Springtails)	?	-	-	-
• Dermaptera (Earwigs)	3	3	-	-
• Diptera (Flies)	86	66	18	2
• Embiidina (Webspinners)	1	1	-	-
• Heteroptera (True bugs)	36	20	14	2
• Homoptera (Hoppers & scales)	28	20	8	-
• Hymenoptera (Bees & wasps)	92	44	37	11
• Isoptera (Termites)	2	2	-	-
• Lepidoptera (Moths & butterflies)	81	60	18	3
• Mantodea (Mantids)	2	2	-	-
• Neuroptera (Lacewings)	3	3	-	-
• Odonata (Dragonflies & damselflies)	2	2	-	-
• Orthoptera (Grasshoppers & crickets)	9	8	1	-
• Psocoptera (Bark lice)	1	-	1	-
• Siphonaptera (Fleas)	1	1	-	-
• Strepsiptera (Stylopids)	1	1	-	-
• Thysanoptera (Thrips)	1	1	-	-
• Thysanura (Silverfish)	1	-	1	-
• Trichoptera (Caddisflies)	2	2	-	-
Chilopoda (Centipedes)	**1**	**1**	**-**	**-**
• Scolopendromorpha (Giant centipedes)	1	1	-	-
Crustacea (Crabs & relatives)	**2**	**2**	**-**	**-**
• Amphipoda (Sandhoppers)	?	-	-	-
• Isopoda (Sow bugs & slaters)	2	2	-	-
All **Arthropoda** (Arthropods)	**520**	**328**	**158**	**34**
Percentage of total # of alien species	**100%**	**63%**	**30%**	**7%**

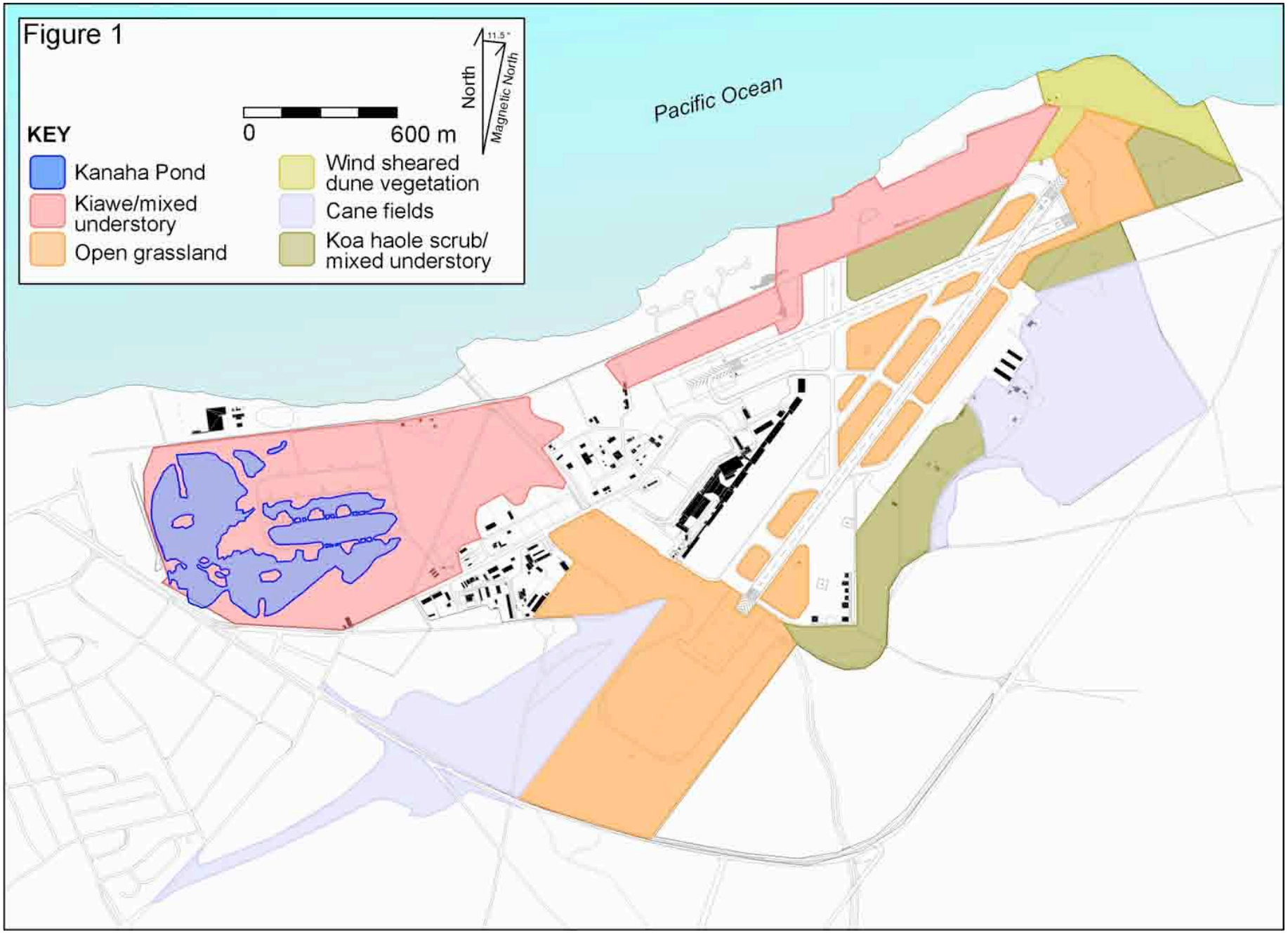
Figure 1
KEY
Kanaha Pond
Kiawe/mixed understory
Open grassland
Wind sheared dune vegetation
Cane fields
Koa haole scrub/ mixed understory
0
600 m
North
Magnetic North
11.5°
Pacific Ocean

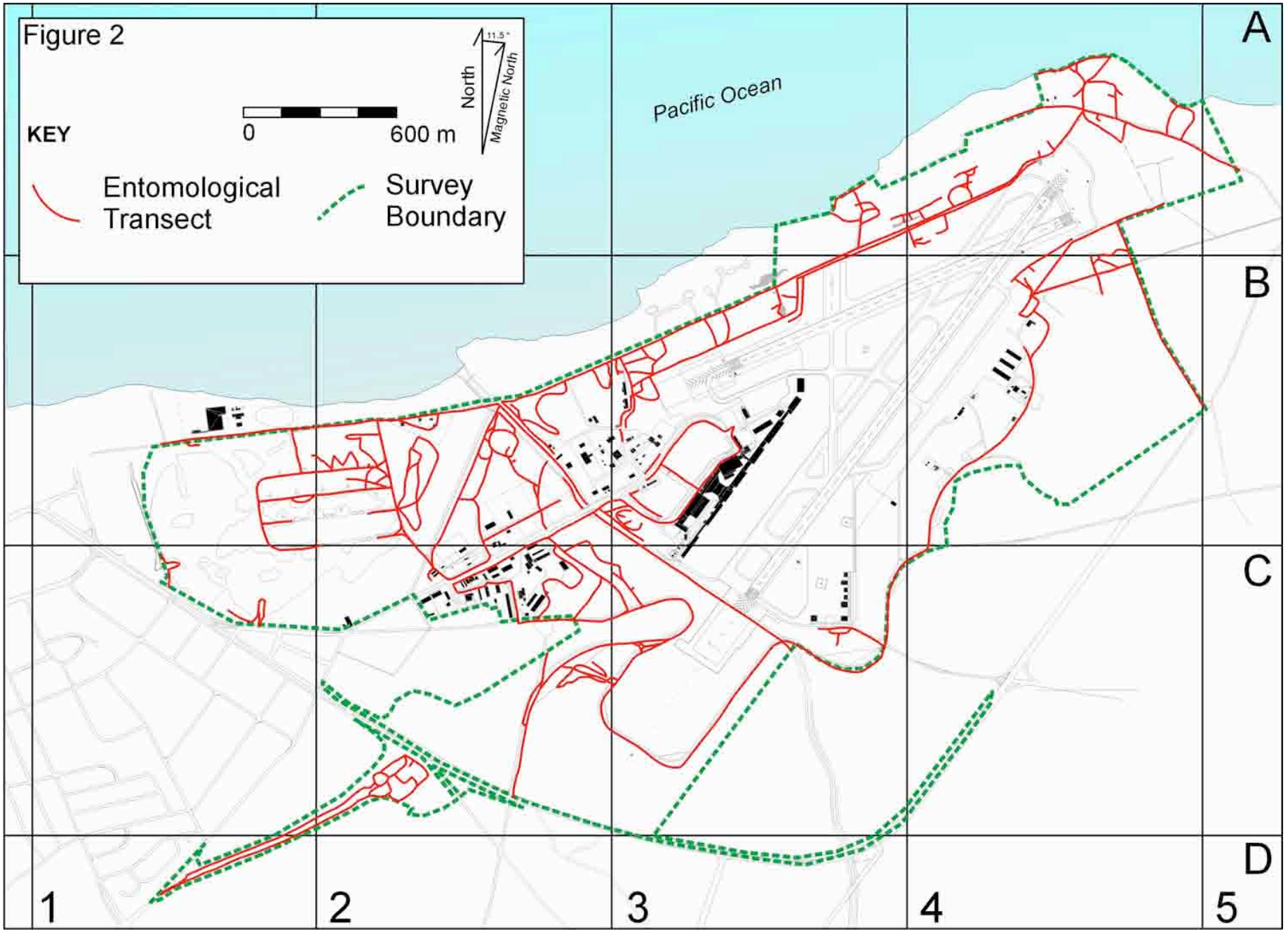
Figure 2
KEY
0
600 m
North
Magnetic North
11.5°
Entomological Transect
Survey Boundary
Pacific Ocean
A
B
C
D
1
2
3
4
5

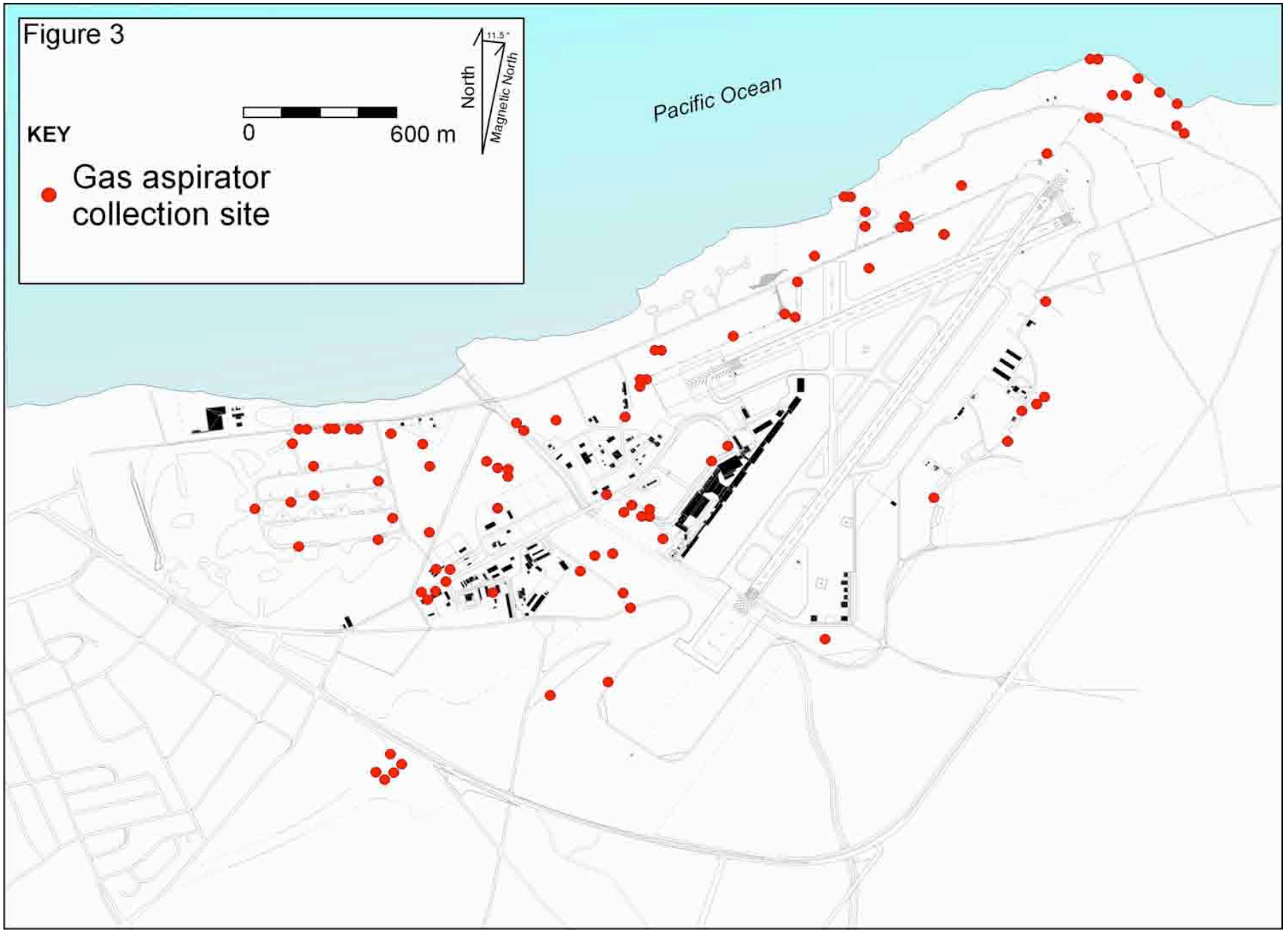
Figure 3
KEY
Gas aspirator collection site
0
600 m
North
Magnetic North
11.5°
Pacific Ocean

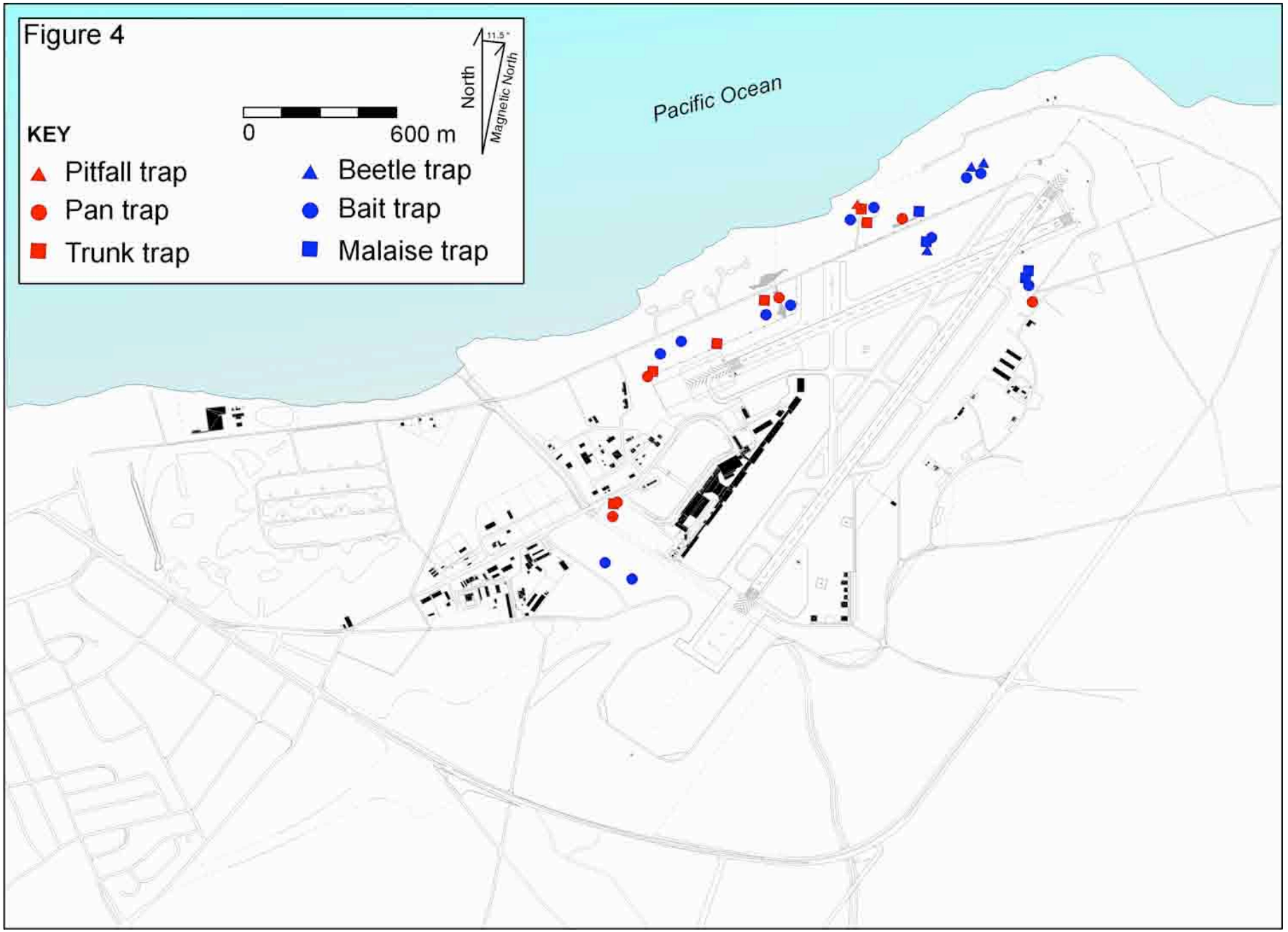
Figure 4
KEY
Pitfall trap
Pan trap
Trunk trap
Beetle trap
Bait trap
Malaise trap
0
600 m
North
Magnetic North
11.5°
Pacific Ocean

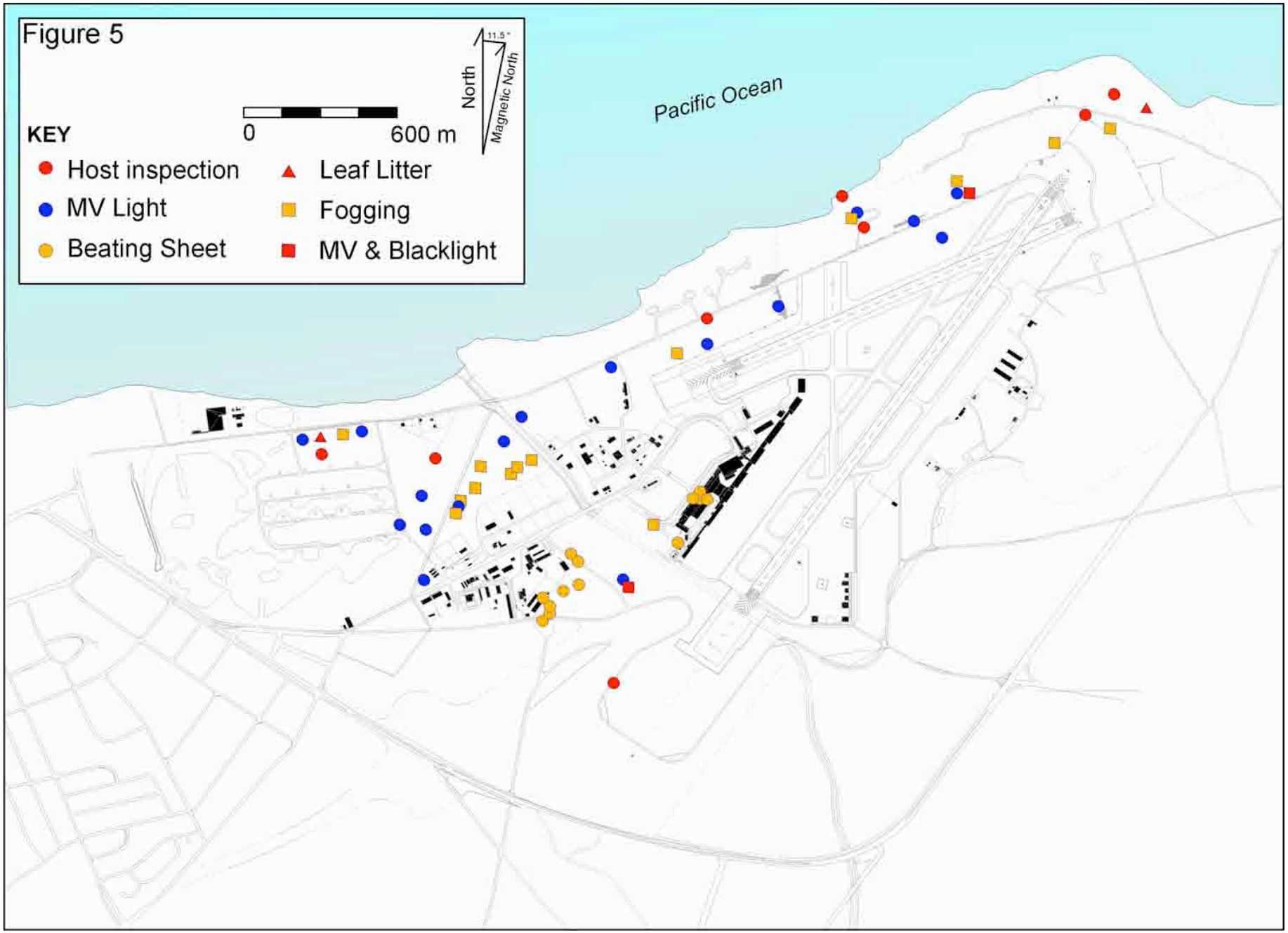
Figure 5
KEY
0
600 m
North
11.5 °
Magnetic North
Host inspection
MV Light
Beating Sheet
Leaf Litter
Fogging
MV & Blacklight
Pacific Ocean

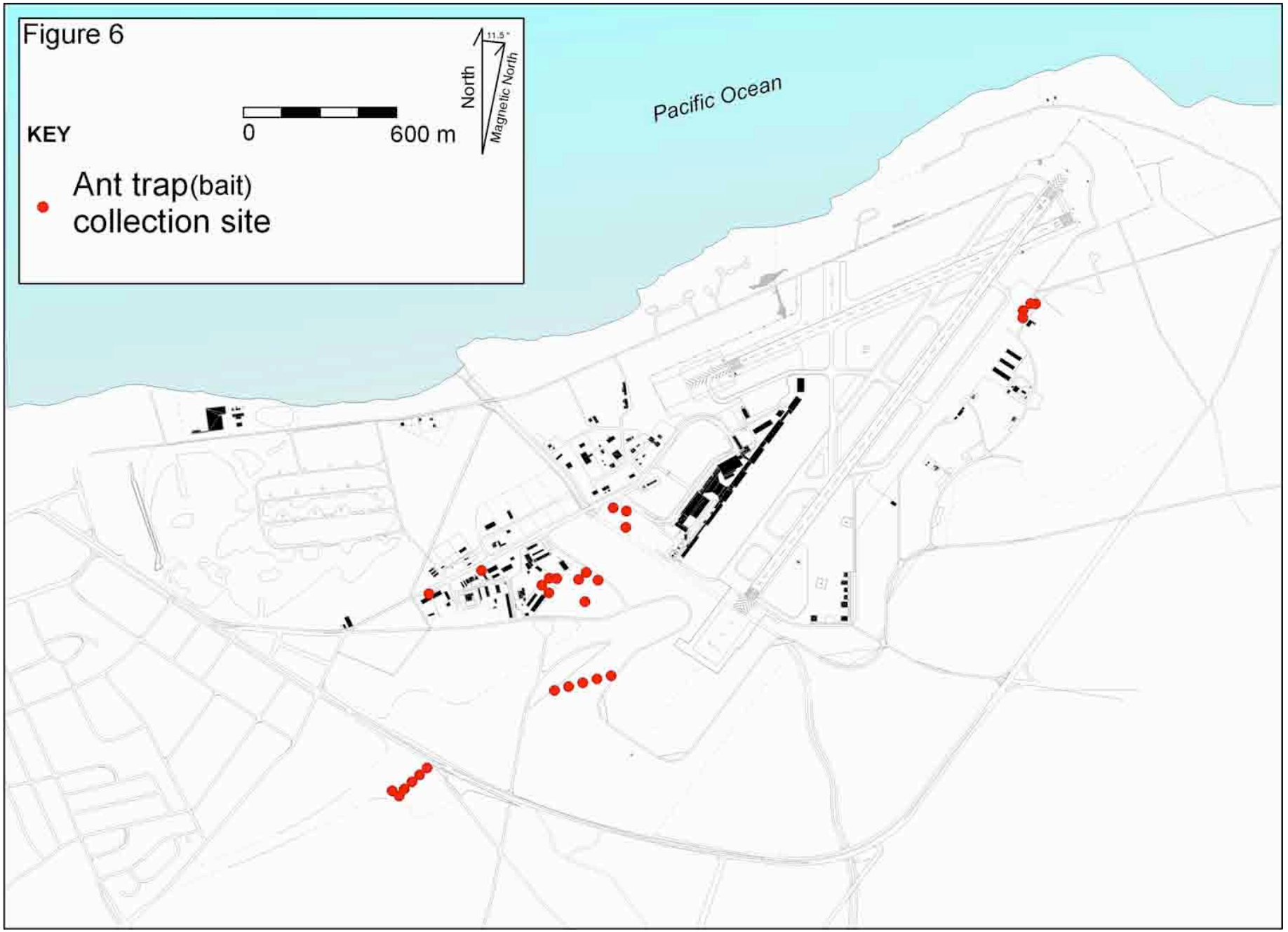
Figure 6
KEY
0
600 m
North
Magnetic North
11.5°
Ant trap(bait)
collection site
Pacific Ocean

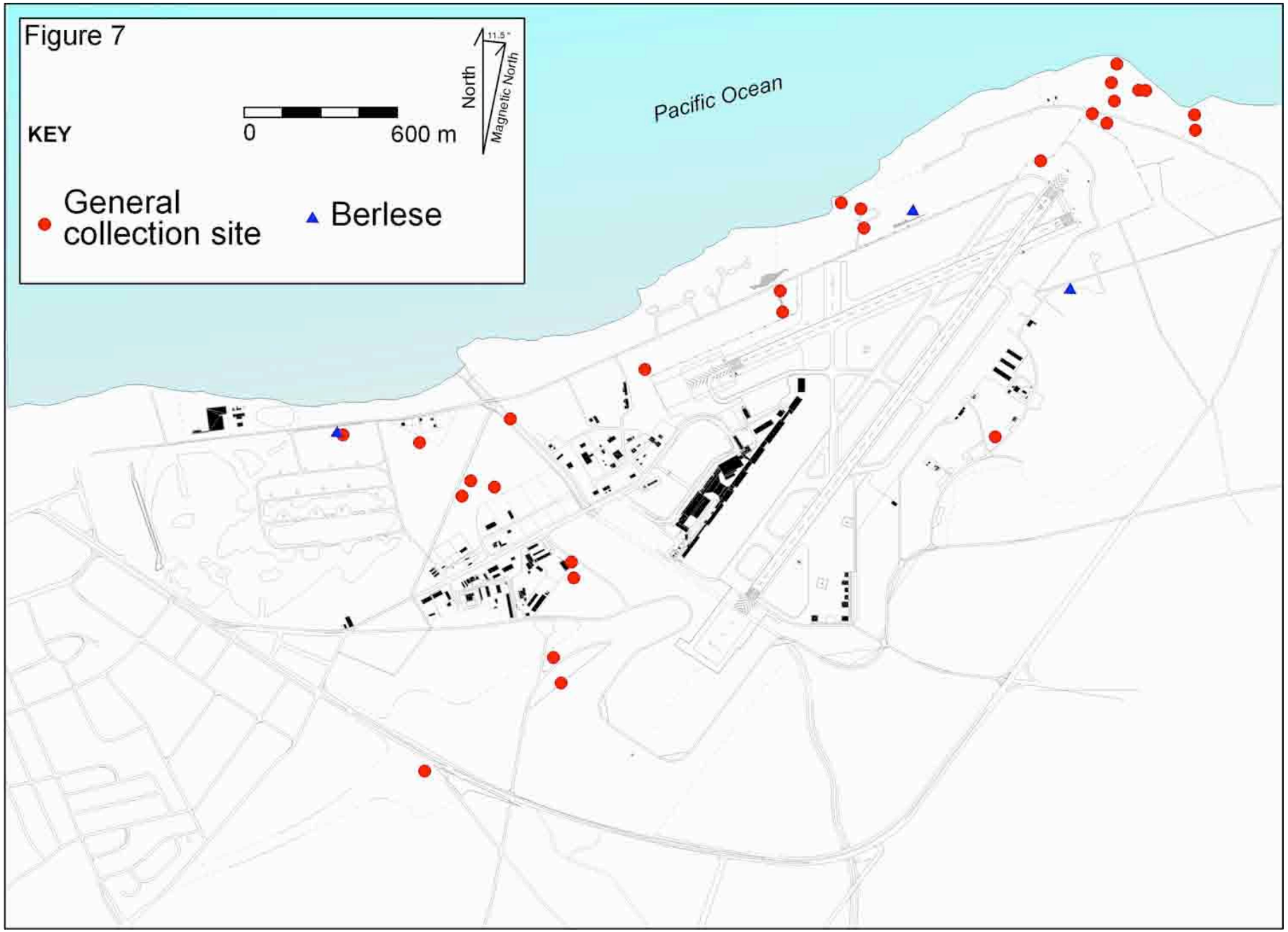
Figure 7
KEY
0
600 m
North
Magnetic North
11.5°
General collection site
Berlese
Pacific Ocean