Proc. Hawaiian Entomol. Soc. (2003) 36:135–143

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SCIENTIFIC NOTE

Nontarget Arthropods Captured in Cue-lure Baited Bucket Traps at Area-Wide Pest Management Implementation Sites in Kamuela and Kula, Hawaiian Islands

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Introduction

An area-wide integrated pest management (AWPM) program began in the Hawaiian Islands in October, 1999 to demonstrate the feasibility of suppressing populations of three economically important species of fruit flies (oriental fruit fly (*Bactrocera dorsalis* (Hendel), melon fly (*Bactrocera cucurbitae* (Coquillett), and Mediterranean fruit fly (*Ceratitis capitata* (Wiedemann)) (Faust and Chandler 1998; Chandler and Faust 1998). These species of fruit flies were accidentally introduced in the Hawaiian Islands (Back and Pemberton 1917, 1918; van Zwaluwenberg 1947; and Vargas and Nishida 1985). Melon fly population suppression with existing technologies (Steiner et al. 1970; Liquido 1991; McInnis et al. 1994; Purcell and Messing 1996; Peck and McQuate 2000; Vargas et al. 2000; Vargas et al. 2001) began in January 2002. Male annihilation using cue-lure and a toxicant (Cunningham and Steiner 1972) is one of the technologies being employed to suppress male melon flies.

Past concerns in Hawaii about the impact of fruit fly lures on nontarget species (USDA-APHIS 1985), especially endemic Hawaiian species, have prompted research on methyl eugenol and protein hydrolysate bait (Asquith and Messing 1992, Asquith and Kido 1994, Kido et. al 1996, Asquith and Burny 1998, and Howarth and Howarth 2000). In a preliminary study by Loope and Medeiros (1992), nontarget insects, including native Hawaiian *Drosophila*, were captured in cue-lure traps.

The objective of this study was to collect, identify, and categorize field-collected nontarget arthropods captured in cue-lure baited bucket traps in the AWPM implementation sites.

Materials and Methods

Each bucket trap (Uchida et al. 1996) was loaded with 2 ml of cue-lure on a wick and a toxicant (DDVP vapor tape; Hercon Environmental Company, Emigsville, PA 17318-0467; 10.75 % active ingredients) attached inside each trap. Traps were serviced at 2 to 4 week intervals. Captured arthropods were collected in a paper bag, separated from melon flies, stored in alcohol, and prepared for identification. Identifications were made to the lowest taxonomic level possible by the senior (G. K. U.) and fourth (B. R. K.) authors.

Ten traps were placed throughout each AWPM implementation site in Kula, Maui Island and Kamuela, Hawaii Island (Figs. 1 & 2) adjacent cultivated and uncultivated melon fly host plants in and around farms, where other bucket traps were in place for monitoring and suppression of male melon flies. Implementation sites in Kula and Kamuela were divided into a forty- and forty-two-block grid, respectively, with each block one km² in size. The

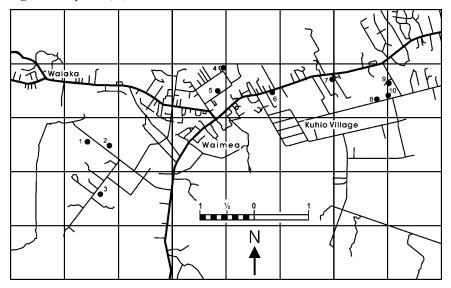


Figure 1. Trap sites (10) in Kula, Hawaii Island, Hawaii.

Kula (244-1158 m elevation) and Kamuela sites (695-1088 m elevation) are disturbed habitats consisting of farms, pastures, houses, and nonnative forests. Traps were sampled from November 7, 2001 to January 15, 2002 at Kamuela and November 21, 2001 to January 23, 2002 at Kula.

Results and Discussion

In Table 1, identified specimens are grouped by resident status (Nishida 2002) as adventive (Nishida 2002), endemic, indigenous (Eldredge and Miller 1995), beneficial (Borror et al. 1976), or purposely introduced (Funasaki et al. 1988). The known distributions of captured species are provided (Nishida 2002). The feeding habit groupings used are saprophagous, phytophagous, and zoophagous (Borror et al. 1976).

The nontarget taxa captured at both sites were representative of four classes, ten orders, 42 families, and 39 determined species (Table 1). Traps at the Kula site captured about 1.1 individuals per day (total = 70 specimens), whereas traps in Kamuela captured about 34.3 individuals per day (total = 2,368 specimens). On a per day basis, cue-lure baited traps captured relatively low numbers of individuals, but over a period of time this number increased many fold for some species. But, as with methyl eugenol baited traps targeting oriental fruit flies, it is necessary to lower the environmental risk by reducing the number of captured species (Howarth and Howarth 2000).

Among all captured arthropods at both sites, there were 36 adventive, ten endemic, zero indigenous, three purposely introduced, zero beneficial, and 33 undetermined species. Kamuela and Kula sites are highly altered environments with very few endemic plants. The low trap catch of endemic species probably reflects a reduced density of native arthropods due to the mixed agriculture-residential nature of the sites, the prevalence of invasive weeds, and the distance from any large areas of native habitat. Endemic species were 2.4% of the total captured.

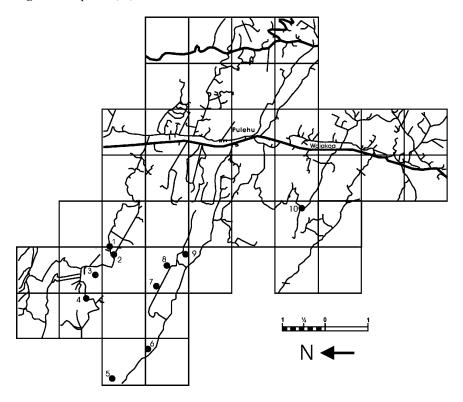


Figure 2. Trap sites (10) in Kamuela, Hawaii Island, Hawaii.

Among the total number of captured species at both sites with known feeding habits, 57.3% were saprophagous, 24.4% zoophagous, and 9.8% phytophagous; and in terms of the total number of captured individuals at both sites, 92.5% were saprophagous, 5.7% phytophagous, and 1.8% zoophagous. The high percentage of saprophagous species and individuals indicated that captured rotting insects were attractive to nontarget insects. Loope and Medeiros (1992) hypothesized that captured rotting insects and recommended that oriental fruit flies be excluded from traps in future experiments. Kido et al. (1996) found that insects in riparian stream habitats were attracted to methyl eugenol, but there was a secondary attraction to dead captured insects. Researchers have added ethylene glycol to traps as a preservative to remove the influence of rotting insects and determined that protein hydrolysate bait and methyl eugenol were attractive to nontarget insects (Asquith and Kido 1994, Asquith and Messing 1992, Asquith and Burny 1998, and Howarth and Howarth 2002). However, G. K. U. (unpublished data) found evidence that ethylene glycol also is attractive to nontarget insects and discovered mineral oil to be a better substitute.

Attraction of nontarget species to cue-lure baited traps shows a need for future improvements in trap design to reduce the number of captured arthropods and mitigate the effect of rotting insects. A proposed solution to reduce the catch of nontarget species is to use open bottomed male annihilation devices or monitoring traps with mineral oil to suppress the rotting of both target and nontarget insects.

| | Residency | Feeding habit ² | Known | No. captured | | |
|-------------------------------|---------------------|-------------------------------|---------------------------------------|--------------|---------|-------|
| | status ¹ | | Hawaiian distribution ³ | Kula | Kamuela | Total |
| ARACHNIDA | | | | | | |
| Araneae | | | | | | |
| Family? | | | | | | |
| sp. A? | ? | Z | Н | 0 | 1 | 1 |
| sp. B? | ? | Z | Н | 0 | 3 | 3 |
| sp. C? | ? | Z | Н | 0 | 1 | 1 |
| spp.? | ? | Z | Н | 0 | 10 | 10 |
| Salticidae | | | | | | |
| Phidippus audax (Hentz) | А | Z | K, O, M, H | 0 | 2 | 2 |
| sp.? | ? | Z | Н | 0 | 1 | 1 |
| spp.? | ? | Ζ | Н | 3 | 0 | 3 |
| ELLIPURA | | | | | | |
| Collembola | | | | | | |
| Family? | | | | | | |
| sp.? | ? | S | Μ | 1 | 0 | 1 |
| INSECTA | | | | | | |
| Coleoptera | | | | | | |
| Anobiidae | | | | | | |
| Ozognathus sp. | | | | | | |
| poss. <i>exiguus</i> (Gorham) | А | S | O, M | 43 | 0 | 43 |
| Tricorynus sharpi (Pic) | Е | S | O, M | 1 | 0 | 1 |
| Bruchidae | | | -, | | | |
| Acanthoscelides macrophtha | almus | | | | | |
| (Schaeffer) | А | Р | O, M | 31 | 0 | 31 |
| Coccinellidae | | - | 0,111 | 01 | 0 | 01 |
| Coelophora inaequalis | | | | | | |
| (Fabricius) | PI | Z | K, O, Mo, L, M, H | 0 | 1 | 1 |
| sp. A? (larvae) | ? | Z | М | 3 | 0 | 3 |
| sp. B? | ? | Z | M | 2 | 0 0 | 2 |
| <i>Telsimia nitida</i> Chapin | PI | Z | K, O, Mo, L, M, H | 3 | Ő | 3 |
| Mycetophagidae | | 2 | 11, 0, 110, 2, 11, 11 | 5 | 0 | 5 |
| Typhaea stercorea (L.) | А | S | K, O, M, H | 1 | 0 | 1 |
| Nitidulidae | 11 | 5 | 11, 0, 11, 11 | • | 0 | • |
| Carpophilus hemipterus (L.) |) A | S | K, O, Mo, L, M, | 1 | 0 | 1 |
| <i>C. mutilatus</i> Erichson | A | S | 0 | 7 | 0 | 7 |
| Nesopetinus scottianus Shar | | S | Н | 0 | 1 | 1 |
| Scolytidae | Ь Г | 5 | 11 | 0 | 1 | 1 |
| Xylosandrus compactus | | | | | | |
| (Eichhoff) | А | S | K, O, Mo, L, M, H | 3 | 0 | 3 |
| Staphylinidae | л | 3 | к, О, 100, Е, 101, П | | 0 | 3 |
| sp. A? | ? | Z | Н | 0 | 1 | 1 |
| | 1 | L | п | U | 1 | |

Table 1. Nontarget species of arthropods captured in cue-lure baited fruit fly traps in the AIPM implementation sites on the islands of Maui (Kula) and Hawaii (Kamuela), November, 2001–January, 2002.

| Speciesdistribution ³ Kula KaDiptera Anthomyiidae Delia echinata (Seguy)A??M,H7Culicidae sp.?AZM3Drosophilidae (Williston)ASO,Mo, L, M, H4Drosophila (Sophophora) ananassae DoleschallASK, O, H11D. hydei SturtevantASK, O, Mo, L, M, H3D. (Sophophora) melanogaster MeigenASK, O, Mo, L, Kh, M, H10D. (Sophophora) simulans SturtevantASK, O, Mo, L, Kh, M, H10D. Sp.?SM4D. spp.??SM4D. spp.??SM1sp. B???M1sp. C???M1Lonchaeidae Lamprolonchaea metatarsata (Kertesz)ASK, O, Mo, L, M, H7Micropezidae sp.?ASM1Micropezidae sp.?ASM1Muscidae Atherigona orientalis SchinerASK, O, Mo, L, M, H13Muscidae MuscidaeASK, O, Mo, L, M, H1Micropezidae sp.??SM1Micropezidae sp.?SM110PhoridaeASK, O, Mo, L, M, H1MuscidaeASK, O, Mo, L, M, H2Notogramma cimiciforme LoewASK, O, Mo, L, M, H2 </th <th rowspan="2">Family st</th> <th>Residency status¹</th> <th rowspan="2">Feeding habit ²</th> <th></th> <th colspan="3">No. captured</th> | Family st | Residency status ¹ | Feeding habit ² | | No. captured | | |
|---|----------------------------|----------------------------------|-------------------------------|---------------------------------------|--------------|---------|-------|
| Anthomyiidae Delia echinata (Seguy)A??M, H7Culicidae sp.?AZM3Drosophilidae Chymomyza procnemis (Williston)ASO, Mo, L, M, H4Drosophila (Sophophora) ananassae DoleschallASK, O, H11D. hydei SturtevantASK, O, Mo, L, M, H3D. (Sophophora) melanogaster MeigenASK, O, Mo, L, M, H10D. (Sophophora) | | status | | Hawaiian distribution ³ | Kula | Kamuela | Total |
| Delia echinata (Seguy)A??M, H7Culicidaesp.?AZM3DrosophilidaeChymomyza procnemis(Williston)ASO, Mo, L, M, H4Drosophila (Sophophora)ananassae DoleschallASK, O, H11D. hydei SturtevantASK, O, Mo, L, M, H3D. (Sophophora)melanogaster MeigenASK, O, Mo, L, Kh, M, H10D. (Sophophora)simulans SturtevantASK, O, Mo, L, M, H1D. sp.?SM4D. spp.??SM2Family???M1sp. A???M1sp. C???M1LonchaeidaeLamprolonchaeaT1Lamprolonchaeametatrastat (Kertesz)ASK, O, Mo, M, H1LonchaeidaeSMo, L, M, H77MicropezidaeSMo, L, M, H1936MuscidaeSSM1MuscidaeSSK, O, Mo, L, M, H3MuscidaeSSK, O, Mo, L, M, H1MycetophilidaeSSM10PhoridaeSSM10PhoridaeMagaselia nr.branneipalpata BeyerSM6M. species no. 2 (Hardy 1964) ??M3030< | era | | | | | | |
| Culicidae sp.? A Z M 3 Drosophildae Chymomyza procnemis (Williston) A S O, Mo, L, M, H 4 Drosophila (Sophophora) ananassae Doleschall A S K, O, Mo, L, M, H 3 D. (Sophophora) melanogaster Meigen A S K, O, Mo, L, M, H 10 D. (Sophophora) melanogaster Meigen A S K, O, Mo, L, Kh, M, H 10 D. (Sophophora) simulans Sturtevant A S K, O, Mo, L, Kh, M, H 10 D. Sp. ? ? S M 4 D. sp. ? ? S M 2 Family? sp. A? ? ? ? M 1 sp. B? ? ? M 1 sp. C? ? ? M 1 sp. C? ? ? M 1 sp. C? ? ? M 1 Lonchaeidae Lamprolonchaea metatarsata (Kertesz) A S K, O, Mo, M, H 1 Lonchaeidae Lamprolonchaea sp.? A S M 1 Milcropezidae sp.? A S M 1 Milchiidae Desmometopa inaurata Lamb A S K, O, Mo, L, M, H 3 Musca domestica Linnaeus A S K, O, Mo, L, M, H 2 Notogramma ciniciforme Loew A S K, O, Mo, L, M, H 2 Notogramma ciniciforme Loew A S K, O, Mo, L, M, H 2 Notogramma ciniciforme Loew A S K, O, Mo, L, M, H 2 Notogramma ciniciforme Loew A S K, O, Mo, L, M, H 2 Notogramma ciniciforme Loew A S K, O, Mo, L, M, H 2 Notogramma ciniciforme Loew A S K, O, Mo, L, M, H 3 sp.? A S M 10 Phoridae Megaselia nr. brunneipalpata Beyer E S M, 6 M, species no. 2 (Hardy 1964) ? M, H 35 M, scalaris (Loew) A S K, O, Mo, L, M, H 2 M, scalaris (Loew) A S K, O, Mo, L, M, H 2 M, spp.? ? S M 6 M, species no. 2 (Hardy 1964) ? M, M 30 S M 30 | Anthomyiidae | | | | | | |
| sp.?AZM3DrosophilidaeChymomyza procnemis(Williston)ASO, Mo, L, M, H4Drosophila (Sophophora)ananassae DoleschallASK, O, Mo, L, M, H3D. (Sophophora)melanogaster MeigenASK, O, Mo, L, Kh, M, H10D. (Sophophora)simulans SturtevantASK, O, Mo, L, M, H1D. sp.?SM4D. sp.??SM4D. sp.??SM1sp.R???M1sp. C???M1LonchaeidaeII11Lonchaea polita SayASM, L, M, H7MicropezidaeIII1sp.?ASK, O, Mo, L, M, H1MuscidaeIII1MuscidaeIII1MycetophilidaeIIIsp.??SM, H1MycetophilidaeIIISp.?ASK, O, Mo, L, M, H2MotogrammaIIIIcimiciforme LoewASK, O, Mo, L, M, H2MotogrammaIIIImetatarstia InnaeusASK, O, Mo, L, M, H2ItidaeIIIIIMycetophi | Delia echinata (Seguy) | A? | ? | М, Н | 7 | 2 | 9 |
| $\begin{array}{c c c c c c c c c c c c c c c c c c c $ | Culicidae | | | | | | |
| $\begin{array}{c} Chymomyza proceenis \\ (Williston) A S O, Mo, L, M, H 4 \\ Drosophila (Sophophora) \\ ananassae Doleschall A S K, O, Mo, L, M, H 3 \\ D. hydei Sturtevant A S K, O, Mo, L, M, H 3 \\ D. (Sophophora) \\ melanogaster Meigen A S K, O, Mo, L, Kh, M, H 10 \\ D. (Sophophora) \\ simulans Sturtevant A S K, O, Mo, L, M, H 1 \\ D. sp. ? S M 4 \\ D. spp.? ? S M 2 \\ Family? \\ sp. A? ? ? M 1 \\ sp. B? ? ? M 1 \\ sp. C? ? ? M 1 \\ sp. C? ? ? M 1 \\ Lonchaeidae \\ Lamprolonchaea \\ metatarsata (Kertesz) A S K, O, Mo, M, H 1 \\ Lonchaea polita Say A S O, M, H 2 \\ L. striatifrons Malloch A S Mo, L, M, H 7 \\ Micropezidae \\ sp.? A S M 1 \\ Mulchidae \\ Atherigona orientalis Schiner A S K, O, Mo, L, M, H 1 \\ Mycetophilidae \\ spp.? R S M 1 \\ Muscidae \\ Atherigona orientalis Schiner A S K, O, Mo, L, M, H 1 \\ Mycetophilidae \\ spp.? A S M, H 0 \\ Otitidae \\ Exxesta annonae (Fabricius) A S K, O, Mo, L, M, H 2 \\ Notogramma \\ cimiciforme Loew A S K, O, Mo, L, M, H 2 \\ Megaselia nr. \\ brunneipalpata Beyer E S M, H 0 \\ Phoridae \\ Megaselia nr. \\ brunneipalpata Beyer E S M, H 0 \\ Muscalors (Loew) A S K, O, Mo, L, M, H 2 \\ M, spp.? ? S M 0 \\ M, Spp.? S M 0 \\ M, Spp.? R S M 0 \\ M, Spp.? R M 0 \\ M M 0 \\ M, Spp.? R M 0 \\ M M M \\ M M M M$ | sp.? | А | Z | М | 3 | 0 | 3 |
| $\begin{array}{c} Chymomyza procnemis \\ (Williston) A S O, Mo, L, M, H 4 \\ Drosophila (Sophophora) \\ ananasae Doleschall A S K, O, Mo, L, M, H 3 \\ D. hydei Sturtevant A S K, O, Mo, L, M, H 1 \\ D. hydei Sturtevant A S K, O, Mo, L, Kh, M, H 10 \\ D. (Sophophora) \\ melanogaster Meigen A S K, O, Mo, L, M, H 1 \\ D. sp. Sp. ? S M 4 \\ D. spp.? ? S M 2 \\ Family? \\ sp. A? ? ? M 1 \\ sp. B? ? ? M 1 \\ sp. C? ? ? M 1 \\ Lonchaeidae \\ Lamprolonchaea \\ metatarsata (Kertesz) A S K, O, Mo, M, H 1 \\ Lonchaeidae \\ Lamprolonchaea \\ sp.? A S M 1 \\ Milichiidae \\ Desmometopa inaurata Lamb A S K, O, Mo, L, M, H 1 \\ Mycetophilidae \\ spp.? R S M 1 \\ Muscidae \\ Atherigona orientalis Schiner A S K, O, Mo, L, M, H 1 \\ Mycetophilidae \\ spp.? R S M 1 \\ Muscidae \\ Atherigona orientalis Schiner A S K, O, Mo, L, M, H 1 \\ Mycetophilidae \\ spp.? A S M, H 0 \\ Otitidae \\ Euxesta annonae (Fabricius) A S K, O, Mo, L, M, H 1 \\ Mycetophilidae \\ spp.? A S M 10 \\ Phoridae \\ Megaselia nr. \\ brunneipalpata Beyer E S M, H 0 \\ Muscilaer S M, F, O, Mo, L, M, H 2 \\ Muscilaer S M, F, O, Mo, L, M, H 2 \\ Muscilae \\ Megaselia nr. \\ brunneipalpata Beyer E S M, H 0 \\ Otitidae \\ Megaselia nr. \\ brunneipalpata Beyer E S M, H 2 \\ M, spc:es no. 2 (Hardy 1964) ? P \\ M, K calaris (Loew) A S K, O, Mo, L, M, H 2 \\ M, spp.? ? S M 30 \\ \end{array}$ | Drosophilidae | | | | | | |
| (Williston)ASO, Mo, L, M, H4Drosophila (Sophophora)ananassae DoleschallASK, O, Mo, L, M, H3ananassae DoleschallASK, O, Mo, L, M, H3D. (Sophophora)melanogaster MeigenASK, O, Mo, L, M, H10D. (Sophophora)simulans SturtevantASK, O, Mo, L, M, H10D. (Sophophora)simulans SturtevantASK, O, Mo, L, M, H1D. sp.?SM4D. sp.???SM2Family???M1sp. B???M1LonchaeidaeLamprolonchaeaI1Lonchaea polita SayASK, O, Mo, L, M, H7MitchiidaeII11Desmometopa inaurata LambASK, O, Mo, L, M, H1MycetophilidaeSS, O, Mo, L, M, H33sp.?Sp.??SM, H000OtitidaeSK, O, Mo, L, M, H2Notogrammacimiciforme LoewASK, O, Mo, L, M, H2PhoridaeMegaselia nr.MSM10 <td>Chymomyza procnemis</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> | Chymomyza procnemis | | | | | | |
| ananassae DoleschallASK, O, H11D. hydei SturtevantASK, O, Mo, L, M, H3D. (Sophophora)melanogaster MeigenASK, O, Mo, L, Kh, M, H10D. (Sophophora)simulans SturtevantASK, O, Mo, L, Kh, M, H10D. sp.?SM4D. sp.?SM4D. sp.???SM2Family?sp. A???M1sp. B???M1LonchaeidaeLamprolonchaeaT1Lonchaea polita SayASO, M, H2L. striatifrons MallochASMO, L, M, H7Micropezidaesp.?ASK, O, Mo, L, M, H1MycetophilidaeSK, O, Mo, L, M, H11MycetophilidaeSK, O, Mo, L, M, H33Musca domestica LinnaeusASK, O, Mo, L, M, H2NotogrammaCimiciforme LoewASK, O, Mo, L, M, H2Notogramma1010PhoridaeMegaselia nr.SM, H14444354543543530 <td></td> <td>А</td> <td>S</td> <td>O, Mo, L, M, H</td> <td>4</td> <td>0</td> <td>4</td> | | А | S | O, Mo, L, M, H | 4 | 0 | 4 |
| ananassae DoleschallASK, O, H11D. hydei SturtevantASK, O, Mo, L, M, H3D. (Sophophora)melanogaster MeigenASK, O, Mo, L, Kh, M, H10D. (Sophophora)simulans SturtevantASK, O, Mo, L, Kh, M, H10D. sp.?SM4D. sp.?SM4D. sp.???SM2Family?sp. A???M1sp. B???M1LonchaeidaeLamprolonchaeaT1Lonchaea polita SayASO, M, H2L. striatifrons MallochASMO, L, M, H7Micropezidaesp.?ASK, O, Mo, L, M, H1MycetophilidaeSK, O, Mo, L, M, H11MycetophilidaeSK, O, Mo, L, M, H33Musca domestica LinnaeusASK, O, Mo, L, M, H2NotogrammaCimiciforme LoewASK, O, Mo, L, M, H2Notogramma1010PhoridaeMegaselia nr.SM, H14444354543543530 <td>Drosophila (Sophophora)</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> | Drosophila (Sophophora) | | | | | | |
| D. hydei SturtevantASK, O, Mo, L, M, H3D. (Sophophora)melanogaster MeigenASK, O, Mo, L, Kh, M, H10D. (Sophophora)simulans SturtevantASK, O, Mo, L, M, H1D. sp.?SM4D. sp.?SM4D. sp.??SM1sp. A???M1sp. B???M1sp. C???M1Lonchaeidaemetatarsata (Kertesz)ASK, O, Mo, M, HLonchaea polita SayASO, M, H2sp.?ASM1Micropezidaesp.?ASMsp.?ASK, O, Mo, L, M, H1936MuscidaeSK, O, Mo, L, M, H1MyscetophilidaeSK, O, Mo, L, M, Hspp.??SM, H0OtitidaeSK, O, Mo, L, M, Hsp.?ASK, O, Mo, L, M, H2NotogrammaSK, O, Mo, L, M, H2cimiciforme LoewASM, H10PhoridaeSM, H14M. runs nr. heterodact/la BeyerESM, H14M. runs nr. heterodact/la BeyerESM6M. species no. 2 (Hardy 1964) ??M, H35M. scalaris (Loew)A< | | А | S | K. O. H | 11 | 5 | 16 |
| D. (Sophophora) melanogaster MeigenASK, O, Mo, L, Kh, M, H10D. (Sophophora) simulans SturtevantASK, O, Mo, L, M, H1D. sp.?SM4D. sp.???SM2Family? sp. A???M1sp. B???M1sp. C???M1Lonchaeidae Lamprolonchaea metatarsata (Kertesz)ASK, O, Mo, M, H1Lonchaea polita SayASO, M, H2sp.?ASM1Micropezidae sp.?ASM1Muscidae Lamprolonchaea sp.?ASK, O, Mo, L, M, H1936Muscidae Atherigona orientalis SchinerASK, O, Mo, L, M, H1Mycetophilidae spp.???SM, H0Otitidae Euxesta annonae (Fabricius)ASK, O, Mo, L, M, H2Notogramma cimiciforme LoewASK, O, Mo, L, M, H2Megaselia nr. brunneipalpata BeyerESM, H14M. runs nr. heterodactyla BeyerE SM66M. species no. 2 (Hardy 1964) ??M, H35M. scalaris (Loew)ASK, O, Mo, L, M, H2M. spo.??SM30 | | | | | | 0 | 3 |
| melanogaster MeigenASK, O, Mo, L, Kh, M, H10D. (Sophophora)simulans SturtevantASK, O, Mo, L, Kh, M, H1D. sp.?SM4D. sp.???SM2Family?sp. A???M1sp. B???M1sp. C???M1LonchaeidaeItamprolonchaeaItamprolonchaeaItamprolonchaeametatarsata (Kertesz)ASK, O, Mo, L, M, H7MicopezidaeSSM1Desmometopa inaurata LambASK, O, Mo, L, M, H1936MuscidaeASK, O, Mo, L, M, H1MycetophilidaeSSM, H0otitidaeItanaeusASK, O, Mo, L, M, H2Notogramma??SM10PhoridaeASK, O, Mo, L, M, H2MuscidaeASM, H10PhoridaeASM, H14M. runs nr. heterodactyla BeyerESM6M. species no. 2 (Hardy 1964) ??M30M. spp.??SM30 | - | | | , -, -,,,, | | | |
| $\begin{array}{c c c c c c c c c c c c c c c c c c c $ | | А | S | K.O. Mo.L. Kh.M. F | Ŧ 10 | 3 | 13 |
| simulansSturtevantASK, O, Mo, L, M, H1D. sp.?SM4D. spp.??SM2Family?sp. A???M1sp. B???M1sp. C???M1LonchaeidaeImage: Constraint of the system of the syste | | | 2 | 11, 0, 110, 2, 111, 11, 1 | | 5 | 10 |
| $\begin{array}{c ccccccccccccccccccccccccccccccccccc$ | | Δ | S | коматмн | 1 | 1 | 2 |
| D. spp.??SM2Family?sp. A???M1sp. B???M1sp. C???M1LonchaeidaeLamprolonchaeametatarsata (Kertesz)ASK, O, Mo, M, H1Lonchaea polita SayASMo, L, M, H7Micropezidaesp.?ASM1sp.?ASM1Milichiidae1Desmometopa inaurata LambASK, O, Mo, L, M, H1936MuscidaeSK, O, Mo, L, M, H1Mycetophilidae </td <td></td> <td></td> <td></td> <td></td> <td></td> <td>0</td> <td>4</td> | | | | | | 0 | 4 |
| Family?sp. A???M1sp. B???M1sp. C???M1LonchaeidaeLamprolonchaeametatarsata (Kertesz)ASK, O, Mo, M, H1Lonchaea polita SayASO, M, H2LSK, O, Mo, M, H1Lonchaea polita SayASO, M, H2LSMo, L, M, H7Micropezidaesp.?ASM11MilichiidaeDesmometopa inaurata LambASK, O, Mo, L, M, H1936MuscidaeASK, O, Mo, L, M, H11Mycetophilidaespp.??SM, H0oUtitdaeSK, O, Mo, L, M, H2Motogrammacimiciforme LoewASK, O, Mo, L, M, H2Megaselia nr.brunneipalpata BeyerESM, H14M. runs nr. heterodactyla BeyerESM6M5M. species no. 2 (Hardy 1964) ??M, H35M30 | - | | | | | 0 | 2 |
| sp. A????M1sp. B???M1sp. C???M1LonchaeidaeImage: C??M1LonchaeidaeImage: C?ASK, O, Mo, M, H1Lonchaea polita SayASO, M, H2L. striatifrons MallochASMo, L, M, H7MicropezidaeImage: C?ASM1sp.?ASM1MilchidaeImage: C?ASK, O, Mo, L, M, H1936Desmometopa inaurata LambASK, O, Mo, L, M, H1936MuscidaeImage: C?SM, H1MycetophilidaeImage: C?SM, H0Spp.??SM, H0OtitidaeImage: Cimiciforme LoewASK, O, Mo, L, M, H2Megaselia nr.Image: Cimiciforme LoewASM, H10PhoridaeImage: Cimiciforme LoewASM, H14M. runs nr. heterodactyla BeyerESM6M. species no. 2 (Hardy 1964) ??M, H35M. scalaris (Loew)ASK, O, Mo, L, M, H2M. spp.??SM30 | | - | 5 | 141 | 2 | 0 | 2 |
| sp. B? ? ? M 1 sp. C? ? ? M 1 Lonchaeidae Lamprolonchaea metatarsata (Kertesz) A S K, O, Mo, M, H 1 Lonchaea polita Say A S O, M, H 2 L. striatifrons Malloch A S Mo, L, M, H 7 Micropezidae sp.? A S M 1 Milichiidae Desmometopa inaurata Lamb A S K, O, Mo, L, M, H 1936 Muscidae Atherigona orientalis Schiner A S K, O, Mo, L, M, H 1936 Muscidae Atherigona orientalis Schiner A S K, O, Mo, L, M, H 1 Mycetophilidae spp.? ? S M, H 0 Otitidae Euxesta annonae (Fabricius) A S K, O, Mo, L, M, H 2 Notogramma cimiciforme Loew A S K, O, Mo, L, M, H 2 Notogramma cimiciforme Loew A S M 10 Phoridae Megaselia nr. brunneipalpata Beyer E S M, H 14 M. runs nr. heterodactyla BeyerE S M 6 M. species no. 2 (Hardy 1964) ? ? M, H 35 M. scalaris (Loew) A S K, O, Mo, L, M, H 2 M. spp.? ? S M 30 | - | 2 | 9 | м | 1 | 0 | 1 |
| sp. C? ? ? M 1 Lonchaeidae Lamprolonchaea metatarsata (Kertesz) A S K, O, Mo, M, H 1 Lonchaea polita Say A S O, M, H 2 L. striatifrons Malloch A S Mo, L, M, H 7 Micropezidae sp.? A S M 1 Milichiidae Desmometopa inaurata Lamb A S K, O, Mo, L, M, H 1936 Muscidae Atherigona orientalis Schiner A S K, O, Mo, L, M, H 3 Musca domestica Linnaeus A S K, O, Mo, L, M, H 1 Mycetophilidae spp.? ? S M, H 0 Otitidae Euxesta annonae (Fabricius) A S K, O, Mo, L, M, H 2 Notogramma cimiciforme Loew A S K, O, Mo, L, M, H 2 Notogramma cimiciforme Loew A S M 10 Phoridae Megaselia nr. brunneipalpata Beyer E S M, H 14 M, runs nr. heterodactyla BeyerE S M 6 M, species no. 2 (Hardy 1964) ? ? M, H 35 M, scalaris (Loew) A S K, O, Mo, L, M, H 2 M, spp.? ? S M 30 | - | | | | | 0 | 1 |
| Lonchaeidae Lamprolonchaea metatarsata (Kertesz) A S K, O, Mo, M, H 1 Lonchaea polita Say A S O, M, H 2 L. striatifrons Malloch A S Mo, L, M, H 7 Micropezidae sp.? A S M 1 Milichiidae Desmometopa inaurata Lamb A S K, O, Mo, L, M, H 1936 Muscidae Atherigona orientalis Schiner A S K, O, Mo, L, M, H 1936 Muscidae Atherigona orientalis Schiner A S K, O, Mo, L, M, H 1 Mycetophilidae spp.? ? S M, H 0 Otitidae Euxesta annonae (Fabricius) A S K, O, Mo, L, M, H 2 Notogramma cimiciforme Loew A S K, O, Mo, L, M, H 2 Notogramma cimiciforme Loew A S M 10 Phoridae Megaselia nr. brunneipalpata Beyer E S M, H 14 M. runs nr. heterodactyla BeyerE S M 6 M. species no. 2 (Hardy 1964) ? ? M, H 35 M. scalaris (Loew) A S K, O, Mo, L, M, H 2 M. spp.? ? S M 30 | | | | | | 0 | 1 |
| Lamprolonchaeametatarsata (Kertesz)ASK, O, Mo, M, H1Lonchaea polita SayASO, M, H2L. striatifrons MallochASMo, L, M, H7Micropezidae </td <td>1</td> <td><u>'</u></td> <td><i>!</i></td> <td>M</td> <td>1</td> <td>0</td> <td>1</td> | 1 | <u>'</u> | <i>!</i> | M | 1 | 0 | 1 |
| metatarsata (Kertesz)ASK, O, Mo, M, H1Lonchaea polita SayASO, M, H2L. striatifrons MallochASMo, L, M, H7Micropezidae </td <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> | | | | | | | |
| Lonchaea polita SayASO, M, H2L. striatifrons MallochASMo, L, M, H7Micropezidaesp.?ASM1MilichiidaeDesmometopa inaurata LambASK, O, Mo, L, M, H1936MuscidaeAtherigona orientalis SchinerASK, O, Mo, L, M, H3Musca domestica LinnaeusASK, O, Mo, L, M, H1Mycetophilidaespp.??SM, H0OtitidaeCimiciforme LoewASK, O, Mo, L, M, H2NotogrammaASK, O, Mo, L, M, H2OrbidaeASM10PhoridaeMegaselia nr.Journeipalpata BeyerESM, H14M. runs nr. heterodactyla BeyerESM66665506M. species no. 2 (Hardy 1964) ???M, H3530303030 | * | | G | | 1 | 0 | |
| L. striatifrons MallochASMo, L, M, H7Micropezidaesp.?ASM1MilichiidaeDesmometopa inaurata Lamb ASK, O, Mo, L, M, H1936MuscidaeAtherigona orientalis SchinerASK, O, Mo, L, M, H3Musca domestica LinnaeusASK, O, Mo, L, M, H1Mycetophilidaespp.??SM, H0OtitidaeCiniciforme LoewASK, O, Mo, L, M, H2NotogrammaASK, O, Mo, L, M, H2orinciforme LoewASK, O, Mo, L, M, 33sp.?ASM10PhoridaeMegaselia nr.brunneipalpata BeyerESM, H14M. runs nr. heterodactyla BeyerESM66665506M. species no. 2 (Hardy 1964) ???M, H3530303030 | . , , | | | | | 0 | 1 |
| Micropezidaesp.?ASM1MilichiidaeDesmometopa inaurata Lamb ASK, O, Mo, L, M, H1936MuscidaeAtherigona orientalis Schiner ASK, O, Mo, L, M, H3Musca domestica Linnaeus ASK, O, Mo, L, M, H1Mycetophilidaespp.??SM, H0OtitidaeEuxesta annonae (Fabricius) ASK, O, Mo, L, M, H2Notogrammacimiciforme LoewASK, O, Mo, L, M, 3sp.?ASM10PhoridaeMegaselia nr.brunneipalpata Beyer ESM, H14M. runs nr. heterodactyla BeyerESM6M. species no. 2 (Hardy 1964) ??M, H35M. scalaris (Loew)ASK, O, Mo, L, M, H2M. spp.??SM30 | | | | , , | | 0 | 2 |
| sp.?ASM1MilichiidaeDesmometopa inaurata Lamb ASK, O, Mo, L, M, H1936MuscidaeAtherigona orientalis Schiner ASK, O, Mo, L, M, H3Musca domestica Linnaeus ASK, O, Mo, L, M, H1Mycetophilidaespp.??SM, H0OtitidaeEuxesta annonae (Fabricius) ASK, O, Mo, L, M, H2Notogrammacimiciforme LoewASK, O, Mo, L, M, 3sp.?ASM10PhoridaeMegaselia nr.brunneipalpata BeyerESM, H14M. runs nr. heterodactyla BeyerESM6M. species no. 2 (Hardy 1964) ??M, H35M. spp.??SM30 | | А | S | Mo, L, M, H | 7 | 0 | 7 |
| MilchiidaeDesmometopa inaurata Lamb ASK, O, Mo, L, M, H1936MuscidaeAtherigona orientalis Schiner ASK, O, Mo, L, M, H3Musca domestica Linnaeus ASK, O, Mo, L, M, H1Mycetophilidaespp.??SM, H0spp.??SM, H0Otitidae2Euxesta annonae (Fabricius) ASK, O, Mo, L, M, H2NotogrammaSM10Phoridae10Phoridae </td <td>1</td> <td></td> <td>a</td> <td></td> <td></td> <td>0</td> <td></td> | 1 | | a | | | 0 | |
| Desmometopa inaurata Lamb A MuscidaeSK, O, Mo, L, M, H1936MuscidaeAtherigona orientalis Schiner A Musca domestica Linnaeus ASK, O, Mo, L, M, H3Musca domestica Linnaeus ASK, O, Mo, L, M, H1Mycetophilidaespp.??SM, H0spp.??SM, H0Otitidae2Euxesta annonae (Fabricius) A NotogrammaSK, O, Mo, L, M, H2cimiciforme Loew A Sp.?SK, O, Mo, L, M, 33sp.?ASM10Phoridae4Megaselia nr.4M. runs nr. heterodactyla BeyerESM6M. species no. 2 (Hardy 1964) ??M, H35M. scalaris (Loew)ASK, O, Mo, L, M, H2M. spp.??SM30 | | A | S | М | I | 0 | 1 |
| MuscidaeAtherigona orientalis Schiner ASK, O, Mo, L, M, H3Musca domestica Linnaeus ASK, O, Mo, L, M, H1Mycetophilidaespp.??SM, H0otitidaeSK, O, Mo, L, M, H2Euxesta annonae (Fabricius) ASK, O, Mo, L, M, H2NotogrammaSK, O, Mo, L, M, H2cimiciforme LoewASK, O, Mo, L, M, 3sp.?ASM10PhoridaeMegaselia nr.brunneipalpata BeyerESM, HM. runs nr. heterodactyla BeyerESM6M. species no. 2 (Hardy 1964) ??M, H35M. scalaris (Loew)ASK, O, Mo, L, M, H2M. spp.??SM30 | | | | | | | |
| Atherigona orientalis SchinerASK, O, Mo, L, M, H3Musca domestica LinnaeusASK, O, Mo, L, M, H1Mycetophilidaespp.??SM, H0OtitidaeEuxesta annonae (Fabricius)ASK, O, Mo, L, M, H2Notogrammacimiciforme LoewASK, O, Mo, L, M, H2PhoridaeMegaselia nr.brunneipalpata BeyerESM, H14M. runs nr. heterodactyla BeyerESM6M. species no. 2 (Hardy 1964) ??M, H35M. scalaris (Loew)ASK, O, Mo, L, M, H2M. spp.??SM30 | * | nb A | S | K, O, Mo, L, M, H | 1936 | 1 | 1937 |
| Musca domestica LinnaeusASK, O, Mo, L, M, H1Mycetophilidaespp.??SM, H0OtitidaeEuxesta annonae (Fabricius)ASK, O, Mo, L, M, H2Notogrammacimiciforme LoewASK, O, Mo, L, M, 3.sp.?ASM10PhoridaeMegaselia nrbrunneipalpata BeyerESM, H14M. species no. 2 (Hardy 1964) ??.M, H35M. scalaris (Loew)ASK, O, Mo, L, M, H2M. spp.??SM30 | | | | | | | |
| Mycetophilidaespp.??SM, H0OtitidaeEuxesta annonae (Fabricius)ASK, O, Mo, L, M, H2Notogrammacimiciforme LoewASK, O, Mo, L, M, 33sp.?ASM10PhoridaeMegaselia nrbrunneipalpata BeyerESM, H14M. runs nr. heterodactyla BeyerESM6M. species no. 2 (Hardy 1964) ??M, H35M. scalaris (Loew)ASK, O, Mo, L, M, H2M. spp.??SM30 | 8 | | | | | 1 | 4 |
| spp.??SM, H0OtitidaeEuxesta annonae (Fabricius)ASK, O, Mo, L, M, H2Notogrammacimiciforme LoewASK, O, Mo, L, M, 3sp.?ASM10PhoridaeMegaselia nr.brunneipalpata BeyerESM, H14M. runs nr. heterodactyla BeyerESM6M. species no. 2 (Hardy 1964) ??M, H35M. scalaris (Loew)ASK, O, Mo, L, M, H2M. spp.??SM30 | | A | S | K, O, Mo, L, M, H | 1 | 1 | 2 |
| OttidaeSK, O, Mo, L, M, H2Euxesta annonae (Fabricius)ASK, O, Mo, L, M, H2Notogrammacimiciforme LoewASK, O, Mo, L, M, 3sp.?ASM10PhoridaeMegaselia nr.brunneipalpata BeyerESM, HM. runs nr. heterodactyla BeyerESM6M. species no. 2 (Hardy 1964) ??M, H35M. scalaris (Loew)ASK, O, Mo, L, M, H2M. spp.??SM30 | | | | | | | |
| Euxesta annonae (Fabricius)ASK, O, Mo, L, M, H2Notogrammacimiciforme LoewASK, O, Mo, L, M, 3sp.?ASM10PhoridaeMegaselia nr.brunneipalpata BeyerESM, H14M. runs nr. heterodactyla BeyerESM6M. species no. 2 (Hardy 1964) ??M, H35M. scalaris (Loew)ASK, O, Mo, L, M, H2M. spp.??SM30 | | ? | S | М, Н | 0 | 6 | 6 |
| Notogrammacimiciforme LoewASK, O, Mo, L, M,3sp.?ASM10PhoridaeMegaselia nr.brunneipalpata BeyerESM, H14M. runs nr. heterodactyla BeyerESM6M. species no. 2 (Hardy 1964) ??M, H35M. scalaris (Loew)ASK, O, Mo, L, M, H2M. spp.??SM30 | | | | | | | |
| cimiciforme LoewASK, O, Mo, L, M,3sp.?ASM10PhoridaeMegaselia nr.10brunneipalpata BeyerESM, H14M. runs nr. heterodactyla BeyerESM6M. species no. 2 (Hardy 1964) ??M, H35M. scalaris (Loew)ASK, O, Mo, L, M, H2M. spp.??SM30 | Euxesta annonae (Fabricius | s) A | S | K, O, Mo, L, M, H | 2 | 0 | 2 |
| sp.? A S M 10 Phoridae Megaselia nr. brunneipalpata Beyer E S M, H 14 M. runs nr. heterodactyla BeyerE S M 6 M. species no. 2 (Hardy 1964) ? ? M, H 35 M. scalaris (Loew) A S K, O, Mo, L, M, H 2 M. spp.? ? S M 30 | Notogramma | | | | | | |
| PhoridaeMegaselia nr.brunneipalpata BeyerESM, H14M. runs nr. heterodactyla BeyerESM6M. species no. 2 (Hardy 1964) ??M, H35M. scalaris (Loew)ASK, O, Mo, L, M, H2M. spp.??SM30 | cimiciforme Loew | А | S | K, O, Mo, L, M, | 3 | 0 | 3 |
| Megaselia nr.SM, H14brunneipalpata BeyerESM, H14M. runs nr. heterodactyla BeyerESM6M. species no. 2 (Hardy 1964) ??M, H35M. scalaris (Loew)ASK, O, Mo, L, M, H2M. spp.??SM30 | sp.? | А | S | Μ | 10 | 0 | 10 |
| brunneipalpata BeyerESM, H14M. runs nr. heterodactyla BeyerESM6M. species no. 2 (Hardy 1964) ??M, H35M. scalaris (Loew)ASK, O, Mo, L, M, H2M. spp.??SM30 | horidae | | | | | | |
| M. runs nr. heterodactyla BeyerE S M 6 M. species no. 2 (Hardy 1964) ? ? M, H 35 M. scalaris (Loew) A S K, O, Mo, L, M, H 2 M. spp.? ? S M 30 | <i>Megaselia</i> nr. | | | | | | |
| M. runs nr. heterodactyla BeyerE S M 6 M. species no. 2 (Hardy 1964) ? ? M, H 35 M. scalaris (Loew) A S K, O, Mo, L, M, H 2 M. spp.? ? S M 30 | | Е | S | М, Н | 14 | 0 | 14 |
| M. species no. 2 (Hardy 1964) ? ? M, H 35 M. scalaris (Loew) A S K, O, Mo, L, M, H 2 M. spp.? ? S M 30 | | eyerE | S | | 6 | 0 | 6 |
| M. scalaris (Loew) A S K, O, Mo, L, M, H 2 M. spp.? ? S M 30 | | | | | | 0 | 35 |
| <i>M</i> . spp.? ? S M 30 | | | | | | 0 | 2 |
| 11 | | | | | | 0 | 30 |
| Psycodidae | | | ~ | | | - | |
| Psychoda alternata Say A S K, O, Mo, M, H 3 | | А | S | K. O. Mo. M. H | 3 | 0 | 3 |

Table 1 (continued).

| Family Speciesstatus' attus'habit 2 mit the distribution 3Hawaiian distribution 3Kula Kamuela T $P. sp. A?$?SM20 $P. sp. B?$?SM10SarcophagidaeSarcophagidaeSarcophagidae00SarcophagidaeSarcophagidaeSarcophagidae00SarcophagidaePsectrosciara brevicornisJohannsenAS0, Mo, M, H20SciaridaeJohannsenAS0, Mo, M1600sp.??SM101SprindaeCopestylum tamaulipanum (Townsend)ASK, O, Mo, L, M, H10TipulidaeCopestylum tamaulipanum (Townsend)ASK, O, Mo, L, M, H102HeteropteraMiridaePR, O, Mo, M, H12Reduviidae2Guerin-MenevilleAPK, O, Mo, L, M, H300Homoptera sp.??PM311Sophonia rufofascia (Kuoh and Kuoh)APK, O, Mo, L, M, H01sophonia rufofascia (Kuoh and Kuoh)APK, O, Mo, L, M, H890Hymeoptera Bethylidae Epyrins sp.??ZM20Chalcididae Dirhinius anthracia WalkerPIZO, Mo, M, H10Eupelmidae Lapelmidae?ZM10 <th>CLASS Order</th> <th>Residency</th> <th rowspan="2">Feeding habit ²</th> <th rowspan="2"></th> <th colspan="3">No. captured</th> | CLASS Order | Residency | Feeding habit ² | | No. captured | | |
|--|---------------------------------------|---|-------------------------------|-------------------|--------------|---------|------|
| P, sp. B??SM10Sarcophagidae Sarcophage pregrina (Robineau-Desvoidy)ASK, O, Mo, L, M, H20Scatopsidae Psectrosciara brevicornis JohannsenASO, Mo, M160sp.??SM10Sciaridae Lycoriella hoyti (Hardy)ESO, Mo, M, H191sp.??SM01Syrphidae Copestylum tamaulipanum | Family | status ¹ | | | Kula | Kamuela | Tota |
| P, sp. B??SM10Sarcophagidae Sarcophag pergerina (Robineau-Desvoidy)ASK, O, Mo, L, M, H20Scatopsidae Psectrosciara brevicornis JohannsenASO, Mo, M160sp.??SM10Scatopsidae Psectrosciara brevicornis JohannsenASO, Mo, M, H191 $Lycoriella hoyti (Hardy)$ ESO, Mo, M, H1911sp.??SM011Syrphidae Copestylum tamaulipanum (Townsend)ASK, O, Mo, L, M, H10Tipulidae Limonia sp.?E?H02Heteroptera Miridae 'Guerin-MenevilleAPK, O, Mo, M, H12Reduviidae Zelus renardii KolenatiAZK, O, Mo, L, M, H30Homoptera sp.???PM31Cicadellidae sp.??PM31Sophonia rufofascia (Kuoh and Kuoh)APK, O, Mo, L, M, H890Hymenoptera Bethylidae Epyrys sp.??ZM20Chalcididae Dirhinus anthracia WalkerPIZO, Mo, M, H10Eupelmuidae Eupelmuidae Eupelmuidae?ZM10 | <i>P</i> . sp. A? | ? | S | М | 2 | 0 | 2 |
| Sarcophagidae Sarcophag peregrina (Robineau-Desvoidy)ASK, O, Mo, L, M, H20Scatopsidae Psectrosciara brevicornis JohannsenASO, Mo, M160sp.??SM10Sciaridae Lycoriella hoyti (Hardy)ESO, Mo, M, H191sp.??SM01Syrphidae Copestylum tamaulipanum (Townsend)ASK, O, Mo, L, M, H10Tipulidae Limonia sp.?E?H02Heteroptera Miridae ?Kalania sp.?E?H02Pycnoderes quadrimaculatus Guerin-MenevilleAZK, O, Mo, M, H12Reduvidae Zelus renardii KolenatiAZK, O, Mo, L, M, H30Homoptera Miridae ?Ridae Guerin-MenevilleAPK, O, Mo, L, M, H30Homoptera Aphididae sp.??PM31Cicadellidae sp.?APH01Sophonia rufofascia (Kuoh and Kuoh)APK, O, Mo, L, M, H01Psyllidae Heteropsylla cubana Crawford APK, O, Mo, L, M, H890Hymenoptera Bethylidae Epyris sp.??ZM20Chalcididae Dirhinus anthracia WalkerPIZO, Mo, M, H10Eupelmidae Eupelmidae?ZM10 | | ? | S | М | 1 | 0 | 1 |
| Sarcophaga peregrina (Robineau-Desvoidy)ASK, O, Mo, L, M, H20Scatopsidae Psectrosciara brevicornis JohannsenASO, Mo, M, M160sp.??SM10Sciaridae Lycoriella hoyti (Hardy)ESO, Mo, M, H191sp.??SM01Syrphidae Copestylum tamaulipanum (Townsend)ASK, O, Mo, L, M, H10Tipulidae Limonia sp.?E?H02Heteroptera Miridae Guerin-MenevilleAZK, O, Mo, M, H12Reduviidae Zelus renardii KolenatiAZK, O, Mo, L, M, H30Homoptera Aphididae sp.??PM31(Kuoh and Kuoh)APK, O, Mo, L, M, H01Psyllidae de tetropsylla cubana Crawford APK, O, Mo, L, M, H890Hymenoptera Bethylidae Lepelmus anthracia Walker PIZO, Mo, M, H10Chalcididae Sp.??ZM20Chalcididae Sp.??ZM20Chalcididae Sp.??ZM20 | Sarcophagidae | | | | | | |
| (Robineau-Desvoidy)ASK, O, Mo, L, M, H20ScatopsidaePsectrosciara brevicornisJohannsenASO, Mo, M160sp.??SM100SciaridaeDifferenceDifferenceLycoriella hoyti (Hardy)ESO, Mo, M, H191sp.?SyrphidaeCopestylum tamaulipanumTownsend)ASK, O, Mo, L, M, H10TipulidaeTipulidaeTipulidaePH02HeteropteraMiridaePK, O, Mo, M, H12ReduviidaeZelus renardii KolenatiAZK, O, Mo, L, M, H30HomopteraAZK, O, Mo, L, M, H30HomopteraAPK, O, Mo, L, M, H01Sp.?APH01Sophonia rufofascia(Kuoh and Kuoh)APK, O, Mo, L, M, H0HeteropsyllidaeEpyris sp.??ZM2HymenopteraBethylidaeEpyris sp.??Z0ChalcididaeChalcididaeEpyris sp.??Z0Dirhinus anthracia WalkerPIZO, Mo, M, H10EupelmidaeEupelmidaeZM10 | | | | | | | |
| ScatopsidaePsectrosciara brevicornisJohannsenASO, Mo, M160sp.??SM10SciaridaeLycoriella hoyti (Hardy)ESO, Mo, M, H191sp.??SM01SyrphidaeCopestylum tamaulipanum(Townsend)ASK, O, Mo, L, M, H10TipulidaeLimonia sp.?E?H02HeteropteraMiridae?Kalania sp.?E?H02Pycnoderes quadrimaculatusGuerin-MenevilleAPK, O, Mo, L, M, H12ReduviidaeZelus renardii KolenatiAZK, O, Mo, L, M, H30HomopteraAphididae;?PM31cicadellidae;?PM11sp.?APH01Sophonia rufofascia(Kuoh and Kuoh)APK, O, Mo, L, M, H01PsyllidaeHeteropsylla cubana Crawford APK, O, Mo, L, M, H890HymenopteraBethylidaeZM200ChalcididaeZZM20ChalcididaeZZM100Eupelmus sp. A??ZM10 | | Α | S | K. O. Mo. L. M. H | 2 | 0 | 2 |
| Psectrosciara brevicornisJohannsenASO, Mo, M160sp.??SM10SciaridaeLycoriella hoyti (Hardy)ESO, Mo, M, H191sp.??SM01SyrphidaeCopestylum tamaulipanum(Townsend)ASK, O, Mo, L, M, H10TipulidaeLimonia sp.?E?H02HeteropteraMiridae?Kalania sp.?E?H02Guerin-MenevilleAPK, O, Mo, L, M, H12ReduviidaeZelus renardii KolenatiAZK, O, Mo, L, M, H30HomopteraAphididae;?PM31cicadellidae;?PM31sp.?APK, O, Mo, L, M, H01PsyllidaePK, O, Mo, L, M, H01Heteropsylla cubana Crawford APK, O, Mo, L, M, H890HymenopteraZM20ChalcididaeZM20ChalcididaeZQ00HomopteraZZ00HymenopteraZZ00Eupelmus sonthracia WalkerPIZ00Dirhinus anthracia WalkerPIZ0 <td></td> <td></td> <td>~</td> <td>, -, -,,,,</td> <td>_</td> <td>-</td> <td>_</td> | | | ~ | , -, -,,,, | _ | - | _ |
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| • | Feeding habit ² | Known Hawaiian distribution ³ | No. captured | | |
|--------|---|---|--|--|--|
| status | | | Kula | Kamuela | Total |
| | | | | | |
| | | | | | |
| ? | Р | Н | 3 | 2 | 5 |
| ? | Р | Н | 0 | 1 | 1 |
| | | | | | |
| | | | | | |
| ? | S | М | 7 | 0 | 7 |
| ? | S | М | 8 | 0 | 8 |
| ? | S | М | 1 | 0 | 1 |
| | | | | | |
| n) A | S | O, L, M | 3 | 0 | 3 |
| | | | | | |
| Е | S | Н | 0 | 6 | 6 |
| Е | S | Н | 0 | 1 | 1 |
| Е | S | Н | 0 | 4 | 4 |
| | | | | | |
| | | | | | |
| | | | | | |
| re) A | S | Н | 0 | 3 | 3 |
| Total | 2,371 | 70 | 2441 | | |
| | status ¹ ? ? ? ? n) A E E E e | status ¹ habit ² ? P ? P ? S ? S n) A S E S E S E S E S E S | status1habit 2 Hawaiian distribution3?PH?PH?SM?SM?SM?SMn)ASO, L, MESHESHe)ASH | status1habit 2 Hawaiian distribution3Kula?PH3?PH0?SM7?SM1n)ASO, L, M3ESH0ESH0e)ASH0 | status ¹ habit ² Hawaiian distribution ³ Image: Constraint of the status of |

¹Residency status: E = endemic; A = adventive; PI = purposely introduced; ? = unknown.
²Feeding habit: Z = zoophagous; P = phytophagous; S = saprophagous; ? = unknown.
³Known Hawaiian distribution: K = Kauai Island; O = Oahu Island; M= Maui Island, Mo = Molokai Island; L = Lanai Island; Kh = Kahoolawe Island; H = Hawaii Island.

Acknowledgments

We thank Gregory J. Boyer and Albert H. Kawabata (USDA-ARS-U. S. Pacific Basin Agricultural Research Center (PBARC), Kamuela Hawaii); Jari S. Sugano, Earl Y. Fujitani, Troy I. Kawahara, and Linda K. Fujitani (University of Hawaii, Kula Experiment Station, Kula, HI); and Lester M. Klungness, Charmaine D. Sylva, and Cheryl M. Y. N. Chan (USDA-ARS-U. S. Pacific Basin Agricultural Research Center (PBARC), Hilo, Hawaii) for their assistance with this survey. Also, we thank Renato C. Bautista, Tom W. Culliney and Grant T. McQuate for their critical review of a previous version of this manuscript. Special thanks to the State of Hawaii Department of Agriculture staff for their assistance and the use of the Hawaiian arthropod collection and scientific literature.

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