

**Picture-wing fly**  
*(Drosophila montgomeryi)*

**5-Year Review**  
**Summary and Evaluation**

**U.S. Fish and Wildlife Service**  
**Pacific Islands Fish and Wildlife Office**  
**Honolulu, Hawaii**

## 5-YEAR REVIEW

Species reviewed: Picture-wing fly (*Drosophila montgomeryi*)

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**5-YEAR REVIEW**  
**Picture-wing fly/*Drosophila montgomeryi***

**1.0 GENERAL INFORMATION**

**1.1 Reviewers**

**Lead Regional Office:**

Region 1, Endangered Species Program, Division of Recovery Jesse D'Elia,  
(503) 231-2349

**Lead Field Office:**

Pacific Islands Fish and Wildlife Office, Loyal Mehrhoff, Field Supervisor,  
(808) 792-9400

**Cooperating Field Office(s):**

N/A

**Cooperating Regional Office(s):**

N/A

**1.2 Methodology used to complete the review:**

This review was conducted by staff of the Pacific Islands Fish and Wildlife Office of the U.S. Fish and Wildlife Service (USFWS), beginning on April 8, 2010. The review was based on the final rule to list 12 Hawaiian picture-wing flies, designation of Critical Habitat for 12 species of picture-wing flies from the Hawaiian Islands Final Rule, the Recovery Outline for 12 Hawaiian picture-wing flies, current published and unpublished materials and expert opinions and knowledge on the *Drosophila montgomeryi* species. The draft five-year review was then reviewed by the Endangered Species Recovery Program Leader and the Assistant Field Supervisor for Endangered Species before signature by the Pacific Islands Fish and Wildlife Office Field Supervisor and transmittal to the Regional Office.

**1.3 Background:**

**1.3.1 FR Notice citation announcing initiation of this review:**

[USFWS] U.S. Fish and Wildlife Service. 2010. Endangered and threatened wildlife and plants; initiation of 5-year status reviews of 69 species in Idaho, Washington, Hawaii, Guam, and the Commonwealth of the Northern Mariana Islands. Federal Register 75(67):17947-17950.

### 1.3.2 Listing history

#### Original Listing

**FR notice:** [USFWS] U.S. Fish and Wildlife Service. 2006. Endangered and threatened wildlife and plants; Determination of status for 12 species of picture-wing flies from the Hawaiian Islands. Federal Register 71(89):26835-26852.

**Date listed:** May 9, 2006

**Entity listed:** Species

**Classification:** Endangered

#### Revised Listing, if applicable

**FR notice:** N/A

**Date listed:** N/A

**Entity listed:** N/A

**Classification:** N/A

### 1.3.3 Associated rulemakings:

[USFWS] U.S. Fish and Wildlife Service. 2008. Endangered and threatened wildlife and plants; Designation of critical habitat for 12 species of picture-wing flies from the Hawaiian Islands. Final Rule. 73(234):73794-73888.

Three Critical Habitat units totaling 332 hectares (822 acres) have been designated for *Drosophila montgomeryi* on the island of Oahu.

**1.3.4 Review History:** N/A

**1.3.5 Species' Recovery Priority Number at start of this 5-year review:** 5

### 1.3.6 Current Recovery Plan or Outline

**Name of plan or outline:** Recovery Outline for 12 Hawaiian Picture-wing Flies

**Date issued:** August 2006

**Dates of previous revisions, if applicable:** N/A

## 2.0 REVIEW ANALYSIS

### 2.1 Application of the 1996 Distinct Population Segment (DPS) policy

**2.1.1 Is the species under review a vertebrate?**

       *Yes*

  X   *No*

**2.1.2 Is the species under review listed as a DPS?**

       *Yes*

  X   *No*

**2.1.3 Was the DPS listed prior to 1996?**

*Yes*  
 *No*

**2.1.3.1 Prior to this 5-year review, was the DPS classification reviewed to ensure it meets the 1996 policy standards?**

*Yes*  
 *No*

**2.1.3.2 Does the DPS listing meet the discreteness and significance elements of the 1996 DPS policy?**

*Yes*  
 *No*

**2.1.4 Is there relevant new information for this species regarding the application of the DPS policy?**

*Yes*  
 *No*

**2.2 Recovery Criteria**

**2.2.1 Does the species have a final, approved recovery plan containing objective, measurable criteria?**

*Yes*  
 *No*

**2.2.2 Adequacy of recovery criteria.**

**2.2.2.1 Do the recovery criteria reflect the best available and most up-to date information on the biology of the species and its habitat?**

*Yes*  
 *No*

**2.2.2.2 Are all of the 5 listing factors that are relevant to the species addressed in the recovery?**

*Yes*  
 *No*

**2.2.3 List the recovery criteria as they appear in the recovery plan, and discuss how each criterion has or has not been met, citing information:**

A draft recovery plan for *Drosophila montgomeryi* is being developed but was published at the time of completing this 5-year review.

## 2.3 Updated Information and Current Species Status

### 2.3.1 Biology and Habitat

#### 2.3.1.1 New information on the species' biology and life history:

The general life cycle of Hawaiian *Drosophila* is typical of that of most flies: after mating, females lay eggs from which larvae (immature stage) hatch; as larvae grow they molt (shed their skin) through three successive stages (instars); when fully grown, the larvae change into pupae (a transitional form) in which they metamorphose and emerge as adults.

Montgomery (1975) reported that the larvae of *Drosophila montgomeryi* feed only within the decaying bark of *Urera kaalae* (family Urticaceae), a federally listed endangered plant (USFWS 1991, 1995) that grows on slopes and in gulches of diverse mesic forest (Wagner *et al.* 1999). In 2004, only 41 individuals of *U. kaalae* were known to remain in the wild (USFWS 2004). In 2005, The Nature Conservancy of Hawaii (TNCH) outplanted many seedlings of this species on the Honouliuli Preserve at several locations within *D. montgomeryi*'s historical range (TNCH 2005). The Oahu Plant Extinction Prevention Program has been monitoring the outplantings and developing plans for further restoration after TNCH halted management in the Preserve.

Field observations of *Drosophila montgomeryi* in stands of *Urera glabra*, where no *U. kaalae* are found, suggest that this taxon also serves as a host (Oahu Army Natural Resources Program [OANRP] 2010). Management of *D. montgomeryi* will require maintaining the host trees in sufficient numbers and density to allow for a perpetual presence of decaying host tree parts.

#### 2.3.1.2 Abundance, population trends (e.g. increasing, decreasing, stable), demographic features (e.g., age structure, sex ratio, family size, birth rate, age at mortality, mortality rate, etc.), or demographic trends:

Bait can be used to survey for Hawaiian *Drosophila* but only to indicate the presence or absence of taxa. There is no technique currently available to uniquely mark individual flies and thereby quantify the number of *Drosophila montgomeryi* visiting the bait (K. Magnacca, *in litt.* 2010). In addition, Hawaiian *Drosophila* life cycles, are influenced by rainfall patterns and other environmental variables, making survey results difficult to compare over time and across sites. Even the very common species of picture-wing flies fluctuate widely seasonally as well as daily, confounding negative survey records for a taxa (K. Magnacca, *in litt.* 2012b). The rarity of *Urera kaalae*, the larval host of *D. montgomeryi* further complicates estimating population and demographic trends.

Biologists have observed a general decline of the Hawaiian *Drosophila* along with other components of the native ecosystem (OANRP 2010).

Historically, *Drosophila montgomeryi* is known from three mesic native forest sites in the southern Waianae Mountains on western Oahu between 580 and 885 meters (1,900 and 2,900 feet) above sea level. Between 1970 and 1972, two surveys were conducted at Alaheihe Gulch and six surveys were conducted at Kaluaa Gulch. One *D. montgomeryi* was recorded from Alaheihe Gulch and 10 were recorded from Kaluaa Gulch (K. Kaneshiro *in litt.* 2005) during the eight surveys. In January 2010, one male fly was observed at Kaluaa Gulch (K. Magnacca *in litt.* 2012a). At Palikea, 11 surveys were conducted between years 1966 to 1997 and only one *D. montgomeryi* was reported from these surveys in 1997 (K. Kaneshiro *in litt.* 2005). Puu Kaua, is historically the site with the highest number of individuals observed. Three surveys were conducted between years 1970 to 1971; 0, 177 and 21 *D. montgomeryi* were recorded during these surveys, respectively. *Drosophila montgomeryi* were not recorded during five subsequent surveys conducted in 1997 to 1999 at Puu Kaua (K. Kaneshiro, *in litt.* 2005).

In 2007, at Puu Kalena, located on Schofield Barracks, West Range, one possible *Drosophila montgomeryi* was observed by Dr. Steven Montgomery on baits placed near a group of 30 *Urera glabra* trees. The only other endemic *Drosophila* that resembles *D. montgomeryi* is associated with *Pisonia* sp. and no *Pisonia* sp. trees were in the area (OANRP 2007). In May 2008, 45 flies were recorded and in June 2009, 12 flies were recorded over a three day period at the same location at Puu Kalena (OANRP 2008, OANRP 2009). In February 2010, three male *D. montgomeryi* were recorded at Puu Hapapa (Magnacca, *in litt.* 2012a).

In 2004, only 41 individuals of *Urera kaalae* were known to remain in the wild (USFWS 2004). In 2005, TNCH outplanted many seedlings of this species at several locations within *Drosophila montgomeryi*'s historical range (TNCH 2005).

**2.3.1.3 Genetics, genetic variation, or trends in genetic variation (e.g., loss of genetic variation, genetic drift, inbreeding, etc.):**

No new information is available.

**2.3.1.4 Taxonomic classification or changes in nomenclature:**

No changes in taxonomic classification have occurred. *Drosophila montgomeryi* was described by Hardy and Kaneshiro (1971) from specimens collected in the Waianae Mountains of Oahu in 1970. Morphologically, this species appears to be most closely related to *Drosophila pisonia* from the island of Hawaii. It can be distinguished by the narrow, pale brown stripe on each side of the top of the thorax, the

long hairs on the front legs, and the second antennal segment, which is yellow, tinged with brown on the top. The picture wing group is divided into four major subgroups based on maps of chromosomal inversions. *Drosophila montgomeryi* is in the glabriapex subgroup (Edwards et al., 2007).

**2.3.1.5 Spatial distribution, trends in spatial distribution (e.g. increasingly fragmented, increased numbers of corridors, etc.), or historic range (e.g. corrections to the historical range, change in distribution of the species' within its historic range, etc.):**

Seasonal and day-to-day variability of *Drosophila* presence and lack of surveys for historical sites complicates assessing the current range of a species. *Drosophila montgomeryi* was first described from specimens collected in the Waianae Mountains of Oahu in 1970 (Hardy and Kaneshiro 1971). The larvae of the species feed within the decaying bark of *Urera kaalae*, and possibly *Urera glabra*. *Urera kaalae* grows on slopes and in gulches of diverse mesic forest. This species is historically known from three mesic native forest sites in the southern Waianae Mountains on western Oahu between 580 and 885 meters (1,900 and 2,900 feet) above sea level. In 1971, Puu Kaua was the site with the highest number of individuals (198 observed) but the species has not been recorded in five subsequent surveys conducted from 1997-1999 (K. Kaneshiro, *in litt.* 2005). In Kaluaa Gulch, 10 flies were recorded in the 1970-1972 and one fly was recorded in February 2010 (K. Kaneshiro *in litt.* 2005; K. Magnacca *in litt.* 2012a). The last *D. montgomeryi* recorded at the historical Palikea site was in 1997. In January 2010, three flies were recorded on Puu Hapapa at an elevation of 2640 feet (K. Magnacca *in litt.* 2012a). The greatest abundance of flies recorded between years 2007-2009 was 56 from Puu Kalena (2800 ft. elevation), located within Schofield Barracks. The most recent surveys show the species is present in at least three locations in the Waianae Mountains. Reductions of host plant numbers can lead to fragmentation of the population.

**2.3.1.6 Habitat or ecosystem conditions (e.g., amount, distribution, and suitability of the habitat or ecosystem):**

In accordance with section 3(5)(A)(i) of the Endangered Species Act and the regulations at 50 CFR 424.12, in determining which areas occupied at the time of listing to propose as Critical Habitat, we consider the Primary Constituent Elements (PCE) to be those physical and biological features that are essential to the conservation of the species and that may require special management consideration or protection. The PCEs for *Drosophila montgomeryi* are: (1) Mesic, lowland, diverse ohia and koa forest between the elevations of 524–910 meters (1,720–2,985 feet); and (2) the larval stage host plant *Urera kaalae*, a federally endangered

species, which exhibits one or more life stages (from seedlings to senescent individuals).

A Final Rule establishing three Critical Habitat units for *Drosophila montgomeryi* went into effect January 5, 2009 (USFWS, 2008).

*Drosophila montgomeryi*-Unit 1-Kaluaa Gulch consists of 213 hectares (527 acres) of diverse, mesic forest within the southern Waianae Mountains of Oahu. Ranging in elevation from 525–850 meters (1,720–2,785 feet), this unit is privately owned and is part of a larger area called the Honouliuli Preserve, administered and managed by The Nature Conservancy of Hawaii (TNCH).

*Drosophila montgomeryi*-Unit 2-Palikea consists of 84 hectares (208 acres) of lowland, mesic, koa and ohia forest within the southern Waianae Mountains of Oahu. Ranging in elevation from 585–910 meters (1,920–2,985 feet), this unit is privately and State-owned, and is part of a larger area called the Honouliuli Preserve, administered and managed by TNCH.

*Drosophila Montgomery*-Unit 3-Puu Kaua consists of 35 hectares (87 acres) of lowland, diverse mesic, koa and ohia forest within the southern Waianae Mountains of Oahu. Ranging in elevation from 570–870 meters (1,865–2,855 feet), this unit is privately owned and is part of a larger area called the Honouliuli Preserve, administered and managed by TNCH.

According to the most recent survey data (K. Kaneshiro, *in litt.* 2005), these three units were occupied by *Drosophila montgomeryi* at the time of listing. These units include the known elevation range, moisture regime, and native forest components used by foraging adults that have been identified as the PCEs for this species. This unit also includes populations of *Urera kaalae*, the larval stage host plant associated with this species.

#### **2.3.1.7 Other:**

### **2.3.2 Five-Factor Analysis (threats, conservation measures, and regulatory mechanisms)**

#### **2.3.2.1 Present or threatened destruction, modification or curtailment of its habitat or range:**

Lands with suitable habitats and that are designated as Critical Habitat units need management and control for feral ungulates, such as pigs and goats; nonnative insects, such as ants, yellowjackets, and tipulids; rats; nonnative plants; and wildfire (Cuddihy and Stone 1990; Science Panel 2005). The invasion of several nonnative plants, including species such as *Psidium cattleianum* (strawberry guava), *Lantana camara* (lantana), *Melinis minutiflora* (molasses grass), *Schinus terebinthifolius* (Christmas berry), and *Clidemia hirta* (Koster's curse), further contributes to the

degradation of native forests and the host plants of picture-wing flies (Wagner *et al.* 1999; Science Panel 2005). *Psidium cattleianum*, *L. camara*, *M. minutiflora*, and *S. terebinthifolius* form dense stands, thickets, or mats that shade or outcompete native plants. *Melinis minutiflora* is a grass that increases fire risk and tends to replace native plants following fires (Smith 1985; Cuddihy and Stone 1990; Wagner *et al.* 1999), and *L. camara* produces chemicals that inhibit the growth of other plant species (Smith 1985; Wagner *et al.* 1999). *Passiflora mollissima* (banana poka) is a vine that causes damage or death to native trees by overloading the branches and also shades out native plants beneath its dense canopy cover (Wagner *et al.* 1999). Furthermore, *Urera* spp., the host plant species for *D. montgomeryi*, are rare or sparsely distributed and threatened by ongoing habitat degradation.

Fire threatens the picture-wing flies living in dry to mesic lowland forests on Oahu. A large factor in the alteration of Hawaiian dry and mesic regions in the past 200 years has been the increase in fire frequency, a condition to which the native flora is not adapted. The invasion of fire-adapted alien plants, especially *Melinis minutiflora*, facilitated by ungulate disturbance, has increased the susceptibility of native areas to wildland fire and increased fire frequency. The impact of an altered fire regime is a serious and immediate threat to the dry and mesic habitats that support over one-third of Hawaii's threatened and endangered species, including the picture-wing flies and their host plants (Hughes *et al.* 1991; Blackmore and Vitousek 2000). The Waianae Mountains are very susceptible to wildfire from a variety of sources including Army training, agriculture, and arson.

The three Critical Habitat units are within the Honouliuli Preserve that is administered and managed by The Nature Conservancy of Hawaii (TNCH). TNCH and Oahu Plant Extinction Prevention Program manage the Honouliuli Preserve to reduce the threats posed by nonnative plants, wildfire, and ungulate damage.

The Oahu Army Natural Resources Program, U.S. Army Garrison, Hawaii has developed an Oahu Implementation Plan. This resources management plan includes a stabilization plan for *Drosophila montgomeryi* on lands within Schofield Barracks. This plan includes a wildfire management plan to minimize risk of fire during Army training, managing ungulates through fencing, conducting weed control, monitoring for alien predatory insects, and expanding habitat restoration.

### **2.3.2.2 Overutilization for commercial, recreational, scientific, or educational purposes:**

Overutilization is not known to be a threat to this species.

#### **2.3.2.3 Disease or predation:**

Disease is not known to be a threat to any of the Hawaiian picture-wing flies. However, predation by nonnative insects and other arthropods poses a grave threat to Hawaii's native *Drosophila*, through direct predation or possibly parasitism as well as competition for food or space (Howarth and Medeiros 1989; Howarth and Ramsay 1991; Howarth et al. 2001).

*Drosophila montgomeryi* flies at all life stages, face substantial predation pressure from nonnative insects such as western yellowjacket wasps ants.

The *D. montgomeryi* larval stage, faces resource competition from nonnative tipulid flies (crane flies, family Tipulidae) which also feed within the decomposing bark of *Urera* spp. (Science Panel 2005).

Currently, existing regulations offer inadequate protection to these species from the introduction of nonnative insects and the loss of their host plants.

#### **2.3.2.4 Inadequacy of existing regulatory mechanisms:**

Regulatory mechanisms remain inadequate for thorough protection of the species, particularly quarantine regulations pertaining to the prevention of accidentally introduced arthropods, and augmentation and introduction of biological control agents in Hawaii.

#### **2.3.2.5 Other natural or manmade factors affecting its continued existence:**

Several species of nonnative rats, including the Polynesian rat (*Rattus exulans*), the roof rat (*Rattus rattus*), and the Norway rat (*Rattus norvegicus*), are present on the Hawaiian Islands and cause considerable environmental degradation (Kishinami 2001). The seeds, bark, and flowers of *Urera* spp. may be susceptible to herbivory by rats (Science Panel 2005; K. Magnacca, *in litt.* 2005). The herbivory by rats causes host plant mortality, diminished vigor, and seed predation, resulting in reduced host plant fecundity and viability (Science Panel 2005; K. Magnacca, *in litt.* 2005).

The effects of climate change on picture-wing flies and host-plant range will likely be significant. Life cycle characteristics such as length of larval period and adult longevity are highly dependent on temperature and other environmental factors affected by climate change. In general, stage length and longevity decrease with temperature increase. Fecundity and sex ratio can also be influenced by temperature. However, current climate change analyses in the Pacific Islands lack sufficient spatial resolution to make predictions on impacts to this species. The Pacific Islands Climate Change Cooperative has currently funded climate modeling that will help resolve these spatial limitations. We anticipate high spatial resolution climate outputs by 2013.

## 2.4 Synthesis

Hawaii picture-wing fly, *Drosophila montgomeryi*, is an endangered endemic species found only on the island of Oahu. *Drosophila montgomeryi* is restricted to the natural distribution of its host plant, *Urera kaalae* (family Urticaceae). *Drosophila montgomeryi* larvae feed within the decaying bark of *U. kaalae*, and possibly *U. glabra* hosts that are found in dry to mesic, lowland forests. *Urera kaalae* is a federally endangered plant.

The Primary Constitutive Elements (PCE) for *Drosophila montgomeryi* are: (1) Mesic, lowland, diverse ohia and koa forest between the elevations of 524–910 meters (1,720–2,985 feet); and (2) the larval stage host plant *Urera kaalae*, which exhibits one or more life stages (from seedlings to senescent individuals). On January 5, 2009, the Final Rule establishing Critical Habitat (CH) for *D. montgomeryi* went into effect. Three CH units totaling 332 hectares (822 acres) have been designated for *D. montgomeryi* on the island of Oahu. According to the most recent survey data these CH units were occupied by *D. montgomeryi* at the time of listing. The CH Units are on the Honouliuli Preserve. The Honouliuli Preserve is managed by The Nature Conservancy of Hawaii (TNCH) and the Oahu Plant Extinction Prevention Program. The management measures include reducing the risk of wildfire and ungulate damage. The Oahu Army Natural Resources Program, U.S. Army Garrison, Hawaii has developed a stabilization plan for *D. montgomeryi* on lands within Schofield Barracks. This plan includes a wildfire management plan to minimize risk of fire during Army training, managing ungulates through fencing, conducting weed control, monitoring for alien predatory insects, and expanding habitat restoration.

Current threats to *Drosophila montgomeryi* include feral ungulates, such as goats and pigs; nonnative insects such as yellowjacket wasps, ants, and tipulids; rats; invasive plants, and wildfire. Lands with suitable habitats and those designated as Critical Habitat need management and control for these threats. Currently, existing regulations offer inadequate protection to these species from the introduction of nonnative insects and the loss of their host plants. Climate change may significantly impact the life cycle characteristics of *D. montgomeryi* and the range of its host plants. A draft recovery plan for this species is being developed.

Since *Drosophila montgomeryi* was listed as endangered under the Endangered Species Act, observations of 61 individuals at two locations were reported. Many significant threats to *D. montgomeryi* are not being managed and its larval stage host plant is an endangered species. In 2004, only 41 individuals of the host plant *Urera kaalae* were known to remain in the wild. Therefore, *D. montgomeryi* meets the definition of endangered, as it remains in danger of extinction throughout its range.

### 3.0 RESULTS

#### 3.1 Recommended Classification:

Downlist to Threatened

Uplist to Endangered

Delist

*Extinction*

*Recovery*

*Original data for classification in error*

No change is needed

#### 3.2 New Recovery Priority Number:

**Brief Rationale:**

#### 3.3 Listing and Reclassification Priority Number: N/A

**Reclassification (from Threatened to Endangered) Priority Number:** \_\_\_\_\_

**Reclassification (from Endangered to Threatened) Priority Number:** \_\_\_\_\_

**Delisting (regardless of current classification) Priority Number:** \_\_\_\_\_

**Brief Rationale:**

### 4.0 RECOMMENDATIONS FOR FUTURE ACTIONS

1. Develop and implement a Recovery Plan.
2. Protect the habitat of *Drosophila montgomeryi* and its larval plant host, *Urera kaalae*, and possibly, *Urera glabra*, and control fire, rat, nonnative insect, and ungulate threats.
3. Eliminate or manage nonnative plants that compete with *Urera kaalae* and increase wildfire risk.
4. Survey and document predatory threats.
5. Develop and implement a systematic *Drosophila montgomeryi* survey and monitoring plan that includes historic habitats and other suitable habitats.
6. Evaluate the need to re-establish or supplement *Urera kaalae*, *Urera glabra*, and *Drosophila montgomeryi* populations within their historical and current range.
7. Conduct research to identify larvae and adult host range.

## 5.0 REFERENCES

- Blackmore, M., and P.M. Vitousek. 2000. Cattle grazing, forest loss, and fuel loading in a dry forest ecosystem at Puu Waawaa Ranch. *Biotropica* 32:625-632.
- Cuddihy, L.W., and C.P. Stone. 1990. Alteration of the Native Hawaiian Vegetation; Effects of Humans, Their Activities and Introductions. Cooperative National Park Resources Studies Unit. University of Hawaii. Honolulu, Hawaii.
- Edwards K.A., L.T. Doescher, K.Y. Kaneshiro, D. Yamamoto. 2007. A Database of Wing Diversity in the Hawaiian *Drosophila*. *PLoS ONE* 2(5): e487.
- Hardy, D.E., and K.Y. Kaneshiro. 1971. New picture-winged *Drosophila* from Hawaii. Part II (Drosophilidae, Diptera). Pages 151-170 in M.R. Wheeler (Editor), *Studies in Genetics VI*. University of Texas Publication No. 7103. Austin, Texas.
- Howarth, F.G., and A. Medeiros. 1989. Non-native invertebrates. Pages 82-87 in C.P. Stone and D.B. Stone (Editors), *Conservation Biology in Hawaii*. Cooperative National Park Resources Studies Unit. University of Hawaii. Honolulu, Hawaii.
- Howarth, F.G., and G.W. Ramsay. 1991. The conservation of island insects and their habitats. Pages 71-107 in N.M. Collins and J.A. Thomas (Editors), *The Conservation of Insects and Their Habitats*. Academic Press. London. UK.
- Howarth, F.G., G.M. Nishida, and N.L. Evenhuis. 2001. Insects and other terrestrial arthropods. Pages 41-62 in *Hawaii's invasive species. A Hawaii Biological Survey Handbook*. Mutual Publishing and Bishop Museum Press. Honolulu, Hawaii.
- Hughes, R. F., P. M. Vitousek, and T. Tunison. 1991. Alien grass invasion and fire in the seasonal submontane zone of Hawaii. *Ecology* 72:743-46.
- Kishinami, C. H. 2001. Mammals. Pages 17-20 in G.W. Staples and R.H. Cowie (Editors), *Hawaii's Invasive Species*. Mutual Publishing and Bishop Museum Press. Honolulu, Hawaii.
- Montgomery, S. L. 1975. Comparative breeding site ecology and the adaptive radiation of picture-winged *Drosophila* (Diptera: Drosophilidae) in Hawaii. *Proceedings of the Hawaiian Entomological Society* 12:65-103.
- [OANRP] Oahu Army Natural Resources Program. 2007. *Drosophila* survey notes, August 21-23, 2007, from Dr. Steven Montgomery provided to the Environmental Division, Director of Pulic Works, U.S. Army Garrison, Hawaii. 2 pp.

- [OANRP] Oahu Army Natural Resources Program. 2008. *Drosophila* survey notes, May 28-29, 2008, from Dr. Steven Montgomery provided to the Environmental Division, Director of Public Works, U.S. Army Garrison, Hawaii. 2 pp.
- [OANRP] Oahu Army Natural Resources Program. 2009. *Drosophila* survey notes, June 9-11, 2009, from Dr. Steven Montgomery provided to the Environmental Division, Director of Public Works, U.S. Army Garrison, Hawaii. 2 pp.
- [OANRP] Oahu Army Natural Resources Program. 2010. Taxon Summary: *Drosophila montgomeryi*. Pages 16-1–16-4, *In* Final implementation plan for Makua Military Reservation, Island of Oahu. U.S. Army Garrison, Hawaii.
- Science Panel for 12 Species of Hawaiian Picture-wing Flies. 2005. Notes for science panel hosted by the Pacific Islands Fish and Wildlife Office, November 15 to 16, 2005. 23 pp.
- Smith, C.W. 1985. Impact of alien plants on Hawaii's native biota. Pages 180-250 in C.P. Stone and J.M. Scott (Editors), *Hawaii's Terrestrial Ecosystems: Preservation and Management*. Cooperative National Park Resources Studies Unit. University of Hawaii. Honolulu, Hawaii.
- [TNCH] The Nature Conservancy of Hawaii. 2005. South Ekahanui Fence and Restoration Project at Honouliuli Preserve, Phases 2 and 3: Final Report.
- [USFWS] U.S. Fish and Wildlife Service. 1991. Endangered and threatened wildlife and plants: Determination of endangered status for 26 plants from the Waianae Mountains, Island of Oahu, Hawaii. *Federal Register* 56:55770-55786.
- [USFWS] U.S. Fish and Wildlife Service. 1995. Recovery Plan for the Waianae Plant Cluster. U.S. Fish and Wildlife Service. Portland, Oregon. 207 pp
- [USFWS] U.S. Fish and Wildlife Service. 2004. Hawaiian Islands Plants: Updated June 15, 2004. Listed and Candidate Species, As Designated Under the U.S. Endangered Species Act list. Pacific Islands Fish and Wildlife Office, Honolulu, Hawaii. 17pp.
- [USFWS] U.S. Fish and Wildlife Service. 2006. Endangered and threatened wildlife and plants; Determination of status for 12 species of picture-wing flies from the Hawaiian Islands. *Federal Register* 71:26835-26852.
- [USFWS] U.S. Fish and Wildlife Service. 2008. Endangered and threatened wildlife and plants; Designation of critical habitat for 12 species of picture-wing flies from the Hawaiian Islands. Final Rule. 73:73794-73888.
- [USFWS] U.S. Fish and Wildlife Service. 2010. Endangered and threatened wildlife and plants; initiation of 5-year status reviews of 69 species in Idaho, Washington,

Hawaii, Guam, and the Commonwealth of the Northern Mariana Islands. Federal Register 75:17947-17950.

Wagner, W. L., D.R. Herbst, and S.H. Sohmer. 1999. Manual of the Flowering Plants of Hawaii. University of Hawaii Press and Bishop Museum Press. Honolulu, Hawaii. 919 pp.

#### ***IN LITT. REFERENCES***

Kaneshiro, K. *in litt.* 2005. Complete collection data for the 12 species of Hawaiian picture-wing flies. Compiled from the Hawaiian *Drosophila* Database Project. Excel program file format. 16 pp.

Magnacca, K. *in litt.* 2010. Army environmental sites collecting report. Puu Hapapa, February 23-25, 2010. Submitted by Karl Magnacca, Department of Biology, University of Hawaii, Hilo. 1 pp.

Magnacca, K. *in litt.* 2012a. Collection and survey data set for listed Hawaiian *Drosophila* from 2009 to 2011 compiled by Karl Magnacca, Research Entomologist, Division of Forestry and Wildlife and sent to Diane Sether, U.S. Fish and Wildlife Service, Honolulu, HI.

Magnacca, K. *in litt.* 2012b. Email communication between Karl Magnacca, Research Entomologist, Division of Forestry and Wildlife and Diane Sether, U.S. Fish and Wildlife Service, Honolulu, HI on May 1, 2012.

**Signature Page**  
**U.S. FISH AND WILDLIFE SERVICE**  
**5-YEAR REVIEW of Picture-wing fly**  
**(*Drosophila montgomeryi*)**

**Current Classification:** Endangered

**Recommendation resulting from the 5-Year Review:**

- Downlist to Threatened
- Uplist to Endangered
- Delist
- No change needed

**Appropriate Listing/Reclassification Priority Number, if applicable:** \_\_\_\_\_

**Review Conducted By:**

Diane Sether, Invertebrate Biologist  
Jess Newton, Endangered Species Recovery Program Leader  
Assistant Field Supervisor for Endangered Species

Approved Jess Newton Date 8/28/2012  
for Field Supervisor, Pacific Islands Fish and Wildlife Office