

## NEW RECORDS AND ACCOUNTS

***Protaetia orientalis* (Coleoptera: Scarabaeidae) Attracted to Methyl Eugenol Fruit Fly Lure**Luc Leblanc<sup>1</sup>, Steven Graham<sup>2</sup>, Kurt Pohlman<sup>2</sup>, and Brian Fujita<sup>2</sup><sup>1</sup>Department of Plant and Environmental Protection Sciences, University of Hawaii, 3050 Maile Way, Room 310, Honolulu, HI 96822-2271<sup>2</sup>USDA-APHIS, 41-650 Ahiki Street, Waimanalo, HI 96795

**Abstract.** The attraction of *Protaetia orientalis* (Gory and Percheron), and probably also *P. fusca* (Herbst), to the methyl eugenol fruit fly male lure is reported, based on two years of trapping data on Oahu (Hawaiian Islands).

**Key words:** nontarget, male lures, trapping, *Protaetia orientalis*, methyl eugenol

The male lure methyl eugenol, commonly used to monitor and control pest fruit flies, is also known to attract nontarget insects closely associated with flowers, feeding on pollen or nectar: honeybee, one syrphid fly, two crambid moths, one nitidulid beetle, and several species of lacewings (Leblanc et al. 2009). The attraction of flower insects is not so unexpected, since methyl eugenol and its related compounds are present in the flowers of a broad diversity of plant families (Tan and Nishida 2012). However, attraction is weak and occurs mostly when trap support trees are at the flowering stage (Leblanc et al. 2009).

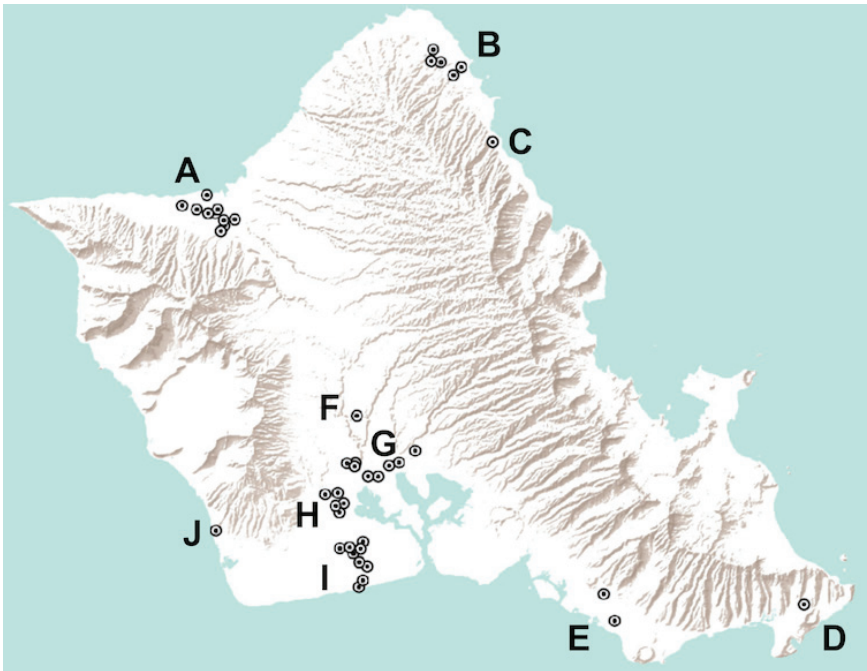
The Oriental flower beetle, *Protaetia orientalis* (Gory and Percheron) (Fig. 1a) is a pest whose adults feed on flower pollen and nectar, fermenting sap, and damaged fruit of a diversity of food plants (Ijima and Takeuchi, 2007). Native to Eastern Asia, it invaded Guam in the 1970's, and has been established on Oahu since at least 2002 (Anonymous 2013), where it has rapidly spread (Fig. 2). More recently, it was collected on Maui (September 2010) and on Hawaii (January 2013) (Bernarr Kumashiro, Hawaii State Department of

Agriculture, pers. comm.).

*Protaetia orientalis* was recently found to be attracted to methyl eugenol in detection traps maintained and emptied weekly on Oahu by USDA-APHIS technicians (Leblanc et al. 2012). Thousands of samples of each lure (methyl eugenol, cue-lure, and trimmedlure), collected in 134 sites between June 2011 and July 2013, were examined for the presence of *P. orientalis*. Beetles were collected at 45 sites (Fig. 2), among 10392 samples (3464 of each of the three lures) with 8 specimens among 5 cue-lure samples, one in a single trimmedlure sample, and 1242 beetles among 287 methyl eugenol samples. Mean captures were 0.35 beetles per trap per week for all methyl eugenol samples and 4.31 per trap per week for positive samples, and 161 samples had a single beetle, 50 with two beetles, 17 with three beetles, 12 with four beetles, 8 with five beetles, and a maximum of 81 beetles in one sample. The difference in beetle captures in methyl eugenol-baited traps, compared to the two other lures, was highly significant (ANOVA:  $F = 48.93$ ;  $df = 2, 10389$ ;  $P < 0.001$ ). By far the largest number of captures was in a trap on an



**Figure 1a, b.** Adults of *Protaetia orientalis* (1a, left) and *P. fusca* (1b, right).



**Figure 2.** Map of trapping sites on Oahu with captures of *Protaetia orientalis*. Letters refer to broad regions cited on Table 1.

**Table 1.** Trapping sites on Oahu with captures of *Protaetia orientalis* in traps baited with methyl eugenol, unless otherwise indicated in the footnote, classified by coded regions displayed on Figure 2.

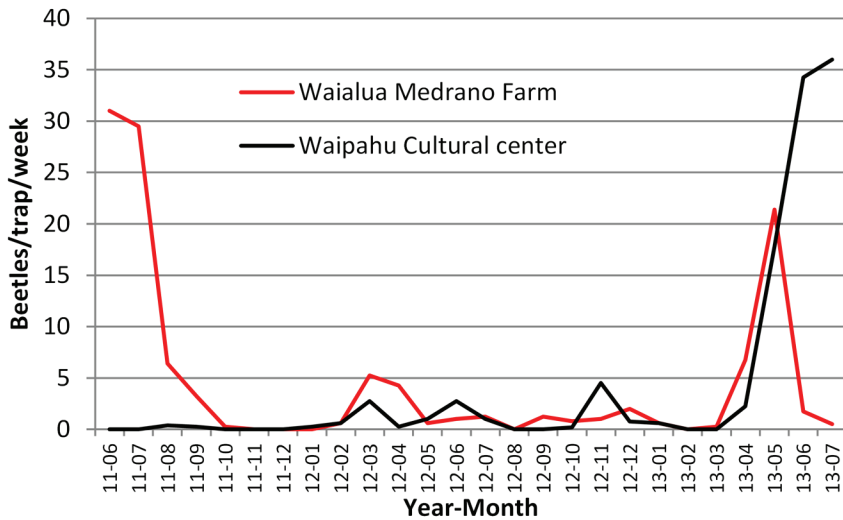
Region	Localities (number of samples with beetles, number of beetles)
A. Waialua	Bounpheng farm (3,5). Bi-farm (11,15). KV farm (2,2). Louan-gratth farm (5,5). Medrano farm (52,416). Phoutha farm (2,2). Venevongsoth farm (Kaupe Rd) (29,54). Twin Bridge (Medrano farm) (20,80) <sup>1</sup> . Waialua Co-Op (20,35) <sup>2</sup> . Waialua Farmers (J&B Kirk) (9,16).
B. Kahuku	Fukuyama-Matsuda farm (14,21). Hawaii Ag. Park site 1 (3,4), and site 2 (1,1). Malaekahana Hui West LLC (1,1). Tropic Farm (8,13).
C. Hauula	Green Growers Inc. (1,1).
D. Hawaii Kai	Hawaii Kai community garden (6,19).
E. Honolulu	Ala Wai community garden (2,8). Makiki community garden (1,1).
F. Mililani	Mililani Ag. Park (3,3) <sup>3</sup> .
G. Pearl City / Waipahu	Kahuawai Street (1,1). Haawi Way (1,1). Kunia Road (16,52). Lahaole Place (2,2). Leeward Nursery (3,4). Nolupe Street (1,1). Opeha Street (1,1). Waipahu Cultural Center (39,443). Waipahu United Church of Christ (2,2).
H. Honouliuli	Aloun Farms site 1 (3,3), and site 2 (1,1). C&S Services (1,1). Fat Law's Farm, Inc. (2,2). Kahe Moala (9,10) <sup>2</sup> .
I. Ewa	Fort Weaver Road (2,2) <sup>2</sup> . Iroquois Road (2,6). Kaiielele Street (1,1). Kamoawa Street (1,1). Koihala Place (2,4). Makalauna Place (1,1). Pailani Street (1,1). Papipi Road (4,5). Piliokahe Place (1,1). Pohakupana Street (1,1).
J.	Waimanalo Gulch landfill (2,2).

<sup>1</sup> includes one sample with one beetle in a cue-lure trap. <sup>2</sup> includes two samples with a total of five beetle in cue-lure traps. <sup>3</sup> includes one sample with one beetle in a trimedlure trap.

African tulip tree (*Spathodea campanulata* P. Beauv.), in Waialua (Medrano farm) (416 beetles in 52 samples), and on a citrus tree at the Waipahu Cultural Center (443 beetles in 39 samples). All the localities with beetle captures are included on Figure 2 and listed on Table 1. The attraction is probably weak and short-ranged, as reported for other flower insects (Leblanc et al. 2009), since only 8% of the methyl eugenol samples contained beetles and 56% of these samples had a single beetle. Based on the dissection of 66 trapped

specimens, the sex ratio of the beetles was 31 females and 35 males, supporting food-related attraction rather than methyl eugenol possibly acting as a pheromone analog. Captures were highest during the summer months of 2011 and 2013 (Fig. 3), but it is not known whether beetles were actually more abundant or support trees were bearing flowers, attracting more beetles, at that time of the year.

Another species, *Protaetia fusca* (Herbst) (Fig. 1b), was also collected in methyl eugenol traps, but in much smaller



**Figure 3.** Monthly captures of *Protactia orientalis* in methyl eugenol traps at the two sites with the most captures.

numbers. Although not counted, the greatest majority was also collected in the methyl eugenol traps rather than those baited with the two other lures, suggesting attraction to methyl eugenol.

### Acknowledgments

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### Literature Cited

- Anonymous.** 2013. *Protactia orientalis* in Hawaii. Entophile blogspot. (<http://entophile.com/2009/09/02/protactia-orientalis-in-hawaii/>). (Accessed 2 August 2013).
- Leblanc, L., B. Fujita, S.H. Stein, and W.K. Sakamura.** 2012. Trapping records of fruit fly pest species (Diptera: Tephritidae) on Oahu (Hawaiian Islands): analysis of spatial population trends. *Proc. Hawaiian Entomol. Soc.* 44: 89–97.
- Leblanc, L., D. Rubinoff, and R.I. Vargas.** 2009. Attraction of nontarget species to fruit fly (Diptera: Tephritidae) male lures and decaying fruit flies in Hawaii. *Environ. Entomol.* 38: 1446–1461.
- Iijima, K., and M. Takeuchi.** 2007. Life history of *Protactia orientalis* (Coleoptera: Scarabaeidae) in the Kanto District; and food resource plants of *P. orientalis* in Japan. *J. Agric. Sci. Tokyo Univ. Agric.* 52: 89–96. (in Japanese).
- Tan, H.K., and R. Nishida.** 2012. Methyl eugenol: Its occurrence, distribution, and role in nature, especially in relation to insect behavior and pollination. *Journal of Insect Science.* 12: 56. Available online: [insectscience.org/12.56](http://insectscience.org/12.56).