

**Survey of *Dacus cucurbitae*
Coquillett (Diptera: Tephritidae)
Infestations in the Cultivated and
Weedy Forms of *Momordica charantia* L.
(Cucurbitaceae)**

NICANOR J. LIQUIDO¹, ROY T. CUNNINGHAM¹,
SUSUMU NAKAGAWA² and GRANT UCHIDA³

ABSTRACT

Melon fly, *Dacus cucurbitae* Coquillett, infestation surveys in bitter melons in Hawaii have been reported from *Momordica* sp., *Momordica charantia* L., and *Momordica balsamina* L. in the Hawaiian entomological literature. However, recent taxonomic studies show that *M. balsamina* does not occur in Hawaii; the Hawaiian species is *M. charantia*. Because of apparent confusion and error in the identity of bitter melons in the Hawaiian literature, we searched for a data base which included collections of both the cultivated and weedy forms of *M. charantia*. The USDA-ARS Tropical Fruit and Vegetable Research Laboratory's data base, archived in Hilo, Hawaii, met this requirement and therefore was used to compare the relative infestation rates of the cultivated and weedy forms of *M. charantia* by melon fly. Based on mean larvae per fruit, the cultivated form produced more melon flies than the weedy form; while based on mean larvae per weight of fruit, the weedy form produced more melon flies. Melon flies in both forms were more abundant at wet, lower elevations than at drier, higher elevations. The data presented here demonstrate that *M. charantia* serves as a melon fly host in residential, agricultural and forest ecosystems of Hawaii.

Momordica sp., commonly referred to as bitter melon, chinese cucumber, etc., was first reported as a host of the melon fly, *Dacus cucurbitae* Coquillett, in Hawaii by Back and Pemberton (1917, 1918). McBride and Tanada's (1949) list of melon fly hosts entered *Momordica* sp. of Back and Pemberton (1917, 1918) as made up of two taxonomically distinct species: *M. charantia* L. as a "preferred, cultivated host"; and *M. balsamina* L. as a "wild host." We believe that the host list of McBride and Tanada (1949) prompted the usage of *M. balsamina* to refer to the wild, weedy forms of bitter melon in Hawaii.

The confusion over the nomenclature of bitter melon in Hawaii probably started with Pope (1929), who identified the wild Hawaiian *Momordica* as *M. balsamina*. Degener (1947) argued that *M. balsamina* is not known in Hawaii, and that the Hawaiian specimens should be correctly identified as *M. charantia* var. *charantia* for the cultivated form and *M. charantia* var.

¹Tropical Fruit and Vegetable Research Laboratory, Agricultural Research Service, United States Department of Agriculture, P. O. Box 4459, Hilo, Hawaii 96720.

²1180 Mililani St., Hilo, Hawaii 96720.

³Department of Entomology, University of Hawaii, Honolulu, Hawaii 96822.

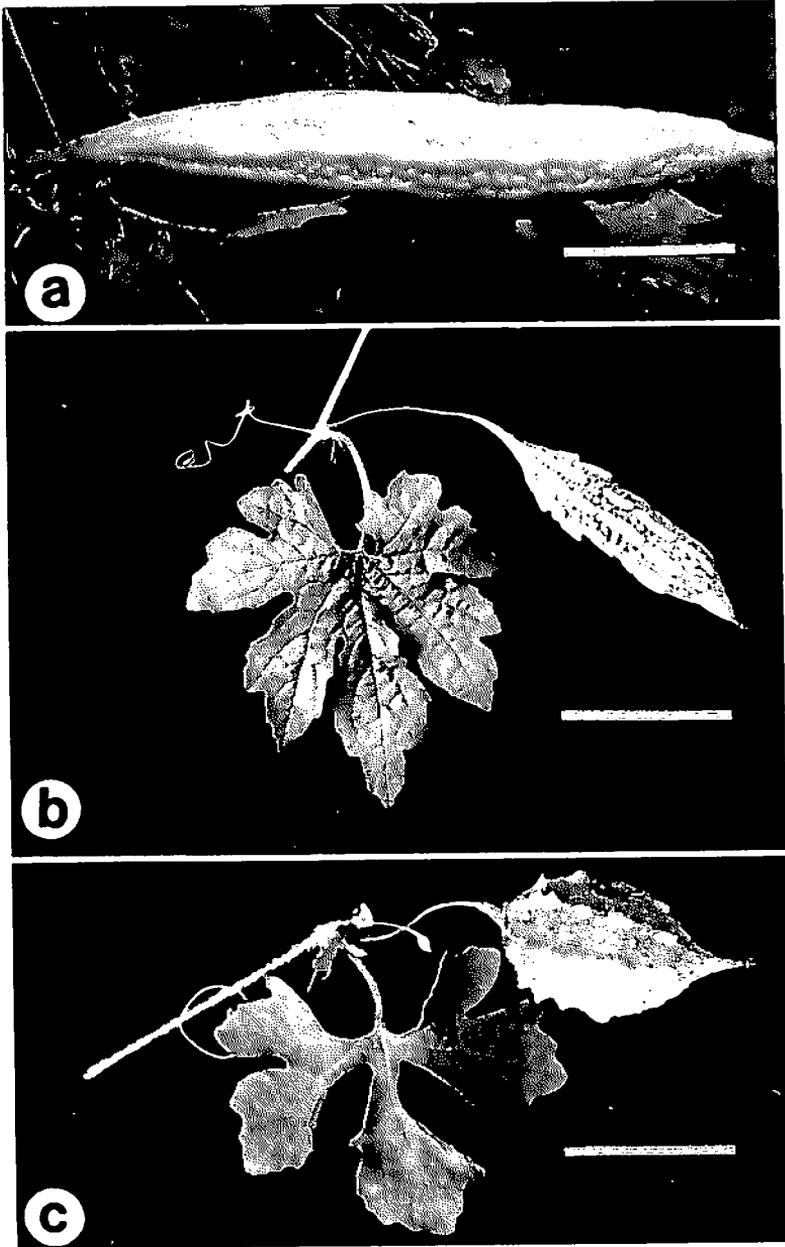


FIGURE 1. Fruits of *Momordica charantia* L.: (a) cultivated form, grown commercially, with irrigation and fertilization, bar line = 5 cm; (b) cultivated form, grown under dooryard cultivation, no irrigation, no fertilization, bar line = 5 cm; (c) weedy form, bar line = 3.5 cm.

abbreviata for the weedy form. Neal (1965) listed *M. charantia* only; although she recognized two forms of *M. charantia* based on the leaf and fruit morphology, no subspecific distinction was made. Telford (1990) referred the two forms of *M. charantia* in Hawaii and made no taxonomic separation. Uchida et al. (1990) reviewed the taxonomic status of *Momordica* in Hawaii with special emphasis on resolving the nomenclatural error in the botanical and entomological literature dealing with host plants of melon fly.

There are at least two field surveys on the infestation rate of melon fly in "weedy or wild" bitter melon identified as *M. balsamina* (Newell et al. 1952; Harris et al. 1986). We reviewed the Hawaiian entomological literature and found no information on infestation of melon fly in the cultivated form of *M. charantia*.

This paper reports on infestation rates of melon fly in the cultivated and weedy forms of *M. charantia*, based on data retrieved from the Tropical Fruit and Vegetable Research Laboratory's historical data base on host plants of fruit flies in Hawaii. The data base contains information from fruit collections conducted on the islands of Hawaii and Maui from 1949 to 1985, and includes well-documented records from *M. charantia*. Retrieving information from the data base was simplified because fruit collectors described bitter melon samples either as "common, cultivated" or "wild"; the data entries were, therefore, coded and separated accordingly. We used these

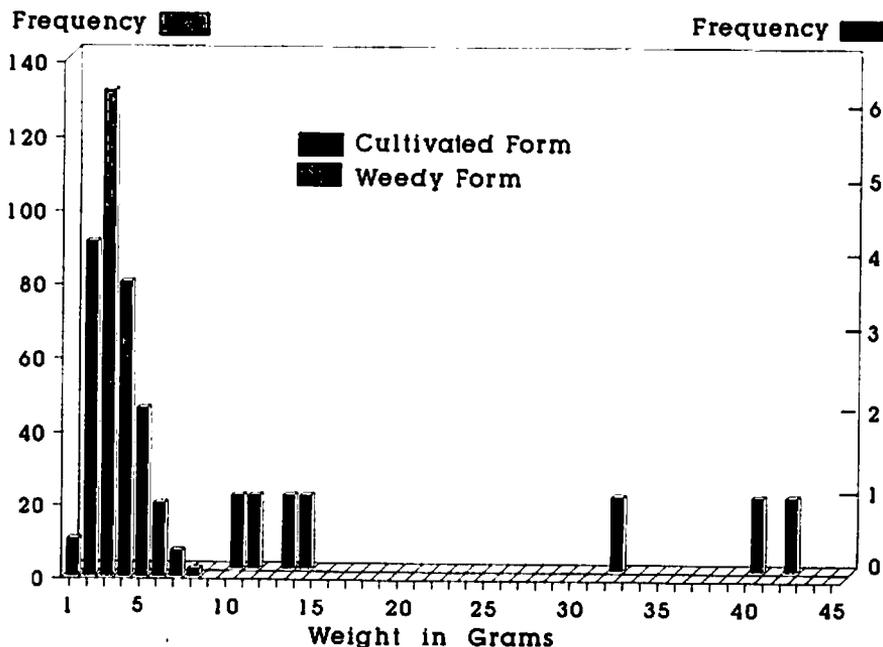


FIGURE 2. Frequency distribution of fruit weight of cultivated and weedy forms of *Momordica charantia* L. Fruits were originally weighed in groups of 10-50 (the range of sample size per collection); thus, the weight per fruit in the graph represents mean weight per fruit per collection.

TABLE 1. Infestation Rates of *Dacus cucurbitae* Coquillett in weedy and cultivated forms of *Momordica charantia* L. at different localities in Hawaii.

Site	Number of Collections	Total Number of Fruits	Mean Melon Flies per Fruit
Cultivated Form (Hawaii Collections, 1949-1985)			
Hilo	1	14	2.07
Honomalino	1	20	1.10
Kawaihae	1	50	4.12
Kapoho	1	49	1.41
Kulani	1	11	7.36
Kurtistown	1	8	9.00
South Point	1	38	3.49
Total	7	190	
Grand Mean			4.22
Weedy Form (Hawaii Collections, 1949-1985)			
Captain Cook	10	281	2.49
Honomalino	251	27,662	2.35
Honaunau	22	1,234	0.35
Kalapana	17	488	2.77
Kawaihae	23	853	2.67
Keauu	2	75	3.11
Kohala	2	156	0.02
Kcalakekua	1	45	2.44
Kailua	1	50	1.56
Kapoho	28	1,479	2.14
Mahukona	13	835	0.13
Napoopoo	16	662	0.75
South Point	5	182	3.01
Total	391	34,002	
Grand Mean			1.83
Weedy Form (Maui Collections, 1951-1963)			
Kahikinui	6	168	0.97
Kahului	2	90	0.00
Kaupo	4	38	3.08
Nuu	2	36	1.55
Olowalu	3	37	2.26
Pukalani	1	19	0.11
Puunene	1	28	4.86
Total	19	416	
Grand Mean			1.83

data to examine infestation rates of melon fly in the two forms of *M. charantia* because the data spanned several decades. Furthermore, we believe this data base is the only one that includes the cultivated form.

Fig. 1 shows the two forms of *M. charantia*. Note the distinct differences in shape of leaves and size and wartiness of fruits. Fig. 2 gives frequency distribution of weight of fruit samples per batch of collections; all fruit samples retrieved for this report were fully ripe when collected. Fruits of the weedy form were small, ranging from 1-8 g, with most fruits weighing between 2-5 g. In comparison, fruits of the cultivated form weighed from

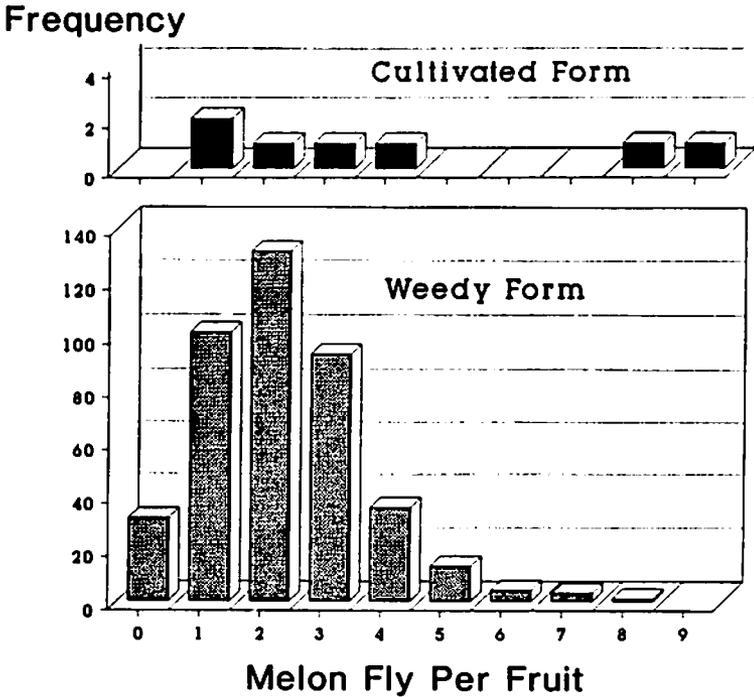


FIGURE 3. Frequency distribution of number of *Dacus cucurbitae* Coquillett per fruit in the cultivated and weedy forms of *Momonitica charantia* L. Fruit samples were held in groups of 10-50 (the sample size of each collection); thus, the number of melon flies in the graph represents mean melon flies per fruit per collection.

10 to 42 g. Under normal commercial cultivation, fruits of the cultivated form are > 20 cm and > 100 g. The weedy form generally has fruits ≤ 10 cm in length.

Table 1 summarizes the infestation rates of melon fly in the two forms of *M. charantia*. For the Hawaii survey, 34,002 fruits of the weedy form were collected from 13 collection sites, while 190 fruits of the cultivated form were collected from 7 sites. Because all collections were made in dooryard patches, abandoned agricultural land, and forest situations, there were relatively few fruit samples of the cultivated form. Only the weedy form was found on Maui, where 416 fruits were collected from 7 sites. The mean number of melon flies per fruit per site for the weedy form ranged from 0.02 (highland of Kohala, 610 m) to 3.11 (Keaau, 30-60 m) on Hawaii, and from 0.11 (Pukalani, 488 m) to 4.86 (Puunene, 60 m) on Maui. Fruits of the cultivated form were collected only on Hawaii and yielded 1.10 to 9.0 melon flies per fruit. For the Hawaii samples, the weighted melon fly per gram of fruit was 0.83 for the cultivated form and 0.18 for the weedy form. For the Maui samples, the mean melon fly per gram of fruit of the weedy form was 0.27.

Fig. 3 shows the frequency distribution of mean melon fly per fruit per collection, without regard to sampling sites. Mean melon fly in fruits of the weedy form ranged from ≤ 1 to 8, with most fruit samples having means of ≤ 1 to 3; while melon fly in the cultivated form ranged from ≤ 1 to 9.

This paper is the first published record of the melon fly survey from *M. charantia* on Hawaii and Maui. The data presented here confirm that *M. charantia* serves as a breeding host of melon fly in residential, agricultural and forest ecosystems in Hawaii.

REFERENCES CITED

- Back, E. A. and C. E. Pemberton. 1917. The melon fly in Hawaii. USDA Bull. 491.
- _____. 1918. The melon fly. USDA Bull. 643.
- Degener, O. and A. Greenwell. 1947. Flora Hawaiiensis, Fam. 337. Cucurbitaceae, *Momordica*, *Momordica charantia*, 2 pp. (Privately published).
- Harris, E., J. M. Takara, and T. Nishida. 1986. Distribution of the melon fly, *Dacus cucurbitae* (Diptera: Tephritidae), and host plants on Kauai, Hawaiian Islands. Environ. Entomol. 15:488-493.
- McBride, O. C. and Y. Tanada. 1949. A revised list of host plants of the melon fly in Hawaii. Proc. Hawaii. Entomol. Soc. 13:411-421.
- Neal, M. C. 1965. In Gardens of Hawaii. Bernice P. Bishop Mus. Spec. Publ. 50.
- Newell, T. M., W. C. Mitchell and F. L. Rathburn. 1952. Infestation norms of *Dacus cucurbitae* in *Momordica balsamina*, and seasonal differences in activity of the parasite *Opius fletcheri*. Proc. Hawaii. Entomol. Soc. 14:497-508.
- Pope, W. T. 1929. Manual of Wayside Plants of Hawaii. Charles E. Tuttle Co., Tokyo.
- Telford, I. R. H. 1990. Cucurbitaceae. In: Wagner, W. L., D. R. Herbst and S. H. Sohmer. Manual of the Flowering Plants of Hawaii. Bernice P. Bishop Mus. Spec. Publ. 83. 1:568-583.
- Uchida, G. K., R. I. Vargas, J. W. Beardsley and N. J. Liquido. 1990. Host suitability of wild cucurbits for melon fly, *Dacus cucurbitae* Coquillett, in Hawaii, with notes on distribution and taxonomic status. Proc. Hawaii. Entomol. Soc. 30:37-52.