MANGO BLOSSOM MIDGE

Larry M. Nakahara
Plant Quarantine Branch
Hawaii Department of Agriculture

Damage by the mango blossom midge was first noticed in late 1980 by a Hilo resident who anticipated a good mango crop because of drought conditions on the Big Island. In previous years, wet winter conditions had resulted in poor mango yields in rainy Hilo. When poor fruit set continued, the blossoms were examined by the resident and tiny "worms" were found in the buds.

The resident reported the find to Department of Agriculture Entomologist Ernest Yoshioka, who collected the first sample on January 4, 1981. Adult midges were reared from the sample and subsequently identified as the mango blossom midge, *Dasineura mangiferae* Felt, by Dr. Raymond Gagne of the Systematic Entomology Laboratory, USDA, Beltsville, Maryland. This was the first record of this midge in Hawaii.

Dasyneura mangiferae Felt was originally described from southern India in 1927, later renamed to *Procystiphora mangiferae* (Felt) and then to *Dasineura mangiferae* Felt. *D. mangiferae* belongs to the family Cecidomyiidae in the order Diptera.

Distribution

The mango blossom midge is only recorded from India but is believed to occur elsewhere in Asia. Because there are four species of midges that attack mango inflorescences in India, there is some confusion in earlier accounts as to the economic significance of this pest. Three species attack the blossoms while one attacks the axis of inflorescences. Of the three that attack the blossoms, two pupate in the soil and only *D. mangiferae* pupates in the bud. Mango is the only known host.

Life Cycle

Eggs. Eggs are deposited in the fold of the sepal and petal of small unopened mango flower buds. The tiny translucent eggs are elongated and cylindrical and are deposited during the daytime.

Larvae. Like other midges, *D. mangiferae* has four larval instars. The first is transparent, the second is whitish, while the third and fourth larval instars are yellowish-orange. The larva migrates from its place of hatching to the interior of the bud and begins to feed on the plant juices and internal organs of the bud. The larva feeds on the reproductive parts of both perfect and staminate flower buds, arresting the normal growth of the bud. This causes the buds of perfect flowers to abort, preventing normal fruit set. The fourth instar larva attains a length of 2.6 mm and a diameter of 0.7 mm.

Surveys showed that infested mango buds developed a reddish color before turning black while uninfested buds were light green to yellow in color.

Pupae. Before it pupates, the fourth instar larva orients its head towards the surface of the bud and cuts an exit hole. The larva then spins a cocoon of silken fibers and pupates within the bud. The pupal stage lasts 4–6 days.

Adults. Normally, the life cycle is completed within two weeks. Adults are minute and orange colored, the male slightly smaller than the female. Soon after emergence, the adults mate and the females look for oviposition sites. A female may deposit 2–3 eggs in one sitting.

1981 Surveys

Statewide distribution. Surveys showed that the mango blossom midge was well established on Oahu, Maui, and Kauai by February 1981. Infestations were reported from Molokai in May. Because of its widespread distribution, it was believed that the midge may have remained undetected in the state for several years. Damage by the midge may have been overlooked because of mango's variable fruit set.

Infestation rate. To determine the rate of infestation, mango panicles were collected in February from Manoa, Punahou, Pawaa, Waialae, and Waianae. Buds from each panicle were examined for midge larvae or pupae. Each sample consisted of 25 buds from one or more panicles per location.

Of three varieties, including 'Haden' and 'Pirie', 72–100 percent of the buds were infested with larvae or pupae. On the average, 91 percent of the buds were infested. The number of larvae or pupae ranged from one to 12 per bud, averaging 3.6 individuals per bud.

Fruit set. To determine possible effects on fruit set, 25 panicles with small fruits (1–3 cm diameter) were randomly selected from trees in Manoa, Punahou, Pawaa, and Waialae. The numbers of fruits per panicle were recorded from each tree. Fruit set for the 'Haden' variety ranged from zero to 13 fruits per panicle. The average was 1.9 fruits per panicle for the 'Haden' and 2.3 fruits per panicle for all varieties sampled.

1982 Surveys

Surveys conducted from February 1981 to February 1982 showed that flowering mango trees could be seen throughout the year on Oahu eliminating the need for diapause or alternative hosts for the midge's survival between seasons.

Infestation rate. In February, eight 'Haden' and 'Pirie' mango trees were sampled at Punahou and Kaimuki. Twenty-five buds from each of five panicles per tree were examined for the midge.

No differences were observed between varieties, and 68–100 percent of the buds were infested with larvae or pupae. On the average, 90 percent of the buds were infested. A range of one to 16 larvae or pupae were found in each bud, averaging 3.5 individuals per bud.

Although infestation rates were very high, 4.4 percent of 800 infested buds examined showed signs of normal fruit set, which may account for the presence of some fruits later in the season.

Fruit Set. In late April, the numbers of large fruits (7–10 cm lengths) were counted on 50 panicles at Punahou and Kaimuki. Fruits were found on 60 percent of the panicles. The number of fruits ranged from zero to five fruits per panicle, averaging 0.8 fruits per panicle. Surveys in June showed mango yields on backyard Oahu trees to be erratic and generally poor.

Economic Significance

Before the arrival of the midge, Yee (1976) noted that several individuals with mango orchards reported having as many as 10 fruits to a flower cluster from 'Haden' trees that were girdled to encourage annual bearing. In 1981, it was estimated that three to five fruits per panicle was considered acceptable for growers of the 'Haden' variety. The 1981 and 1982 surveys showed average yields of 2.3 and 0.8 fruits per panicle, respectively, indicating that the midge had a significant affect on mango yields. During the surveys, it was noted that several days of heavy rains during the flowering period helped increase fruit set, perhaps by killing the adult midges or affecting its egg-laying behavior. Wind, diseases, cultural practices, and varietal differences also affect fruit set. Because of these factors, it was not known to what degree the mango blossom midge affected fruit set and yield. To some degree, the midge helps stabilize the erratic bearing habits of most varieties. In 1983, a new powdery mildew fungus was discovered on mango blossoms in Hawaii. This new disease also affected fruit set.

Recommendations

Recommendations made after the 1981 surveys were not encouraging. Eradication or containment were not feasible because of the midge's widespread distribution. Flowering occurred during periods of high rainfall and gusty, variable winds, when conditions for chemical applications to tall trees were not ideal. The prospects for biological control were also dim, since the midge was a pest in its native country. Also, the public did not complain about the lower mango yields, perhaps remembering the "bumper-crop" years when it was difficult to even give mangos away.

However, recent amendments to 7 CFR part 318 by the United States Department of Agriculture, Animal and Plant Health Inspection Service may change that situation. The final rule, which took affect on February 5, 1993, allows previously prohibited fruits and vegetables from Hawaii to transit certain states in the northern corridor of the continental U.S. for shipping to foreign destinations if certain safeguards are met. This rule change will allow the transiting of untreated mango and other fruits to Canadian and European markets on sea vessels and flights from Hawaii through certain U.S. ports and airports. The new rule also allows for the off- and onloading of shipping boxes from one carrier to another.

More information on the economic significance and control of the mango blossom midge will be needed if Hawaii is to take full advantage of exporting mangos to those markets that have now become available because of the new shipping routes through the continental U.S.

References

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Q: Has this pest never been considered a serious enough problem to do something about it?

A: In 1981 there were a few of us that thought it was a significant problem. It turned out not to be significant simply because nobody complained. Nothing has been done on this midge since 1982. The pest is there every year. We noticed that clear weather at flowering favors the midge, whereas if there is rain at that time we see it less. We found the most severe incidence of this pest in dry areas.

Q: How did this pest get here?

A: We do not know. It is unlikely that anyone brought in a mango blossom carrying it. More likely it hitch-hiked on a plane somehow.

Q: Is there any biological control for it in India?

A: Some predators are mentioned, and we have seen some locally, like spiders and ladybug beetles, feeding on the midge. These are general predators, and from the standpoint of providing control of this particular pest, they are not effective.

Q: Have you evaluated any insecticides for controling this midge?

A: No.

Table 1. Mango blossom midge 1981 surveys: Infestation rate of mango flower buds on Oahu in February.

Location	Variety	Infested buds (%)	Number of larvae or pupae per infested bud	
			Average	Range
Manoa	Haden	100	4.3	1-9
Mango	Pirie	96	5.2	2-12
Punahou	Haden	100	3.8	2-10
Pawaa	Haden	72	3.3	1-5
Waialae	Haden	96	2.8	1-6
Waianae	unknown	84	2.5	1-4
	Average	91	3.6	

Table 2. Mango blossom midge 1981 surveys: Fruit set of mango panicles on Oahu in February.

Location	Variety	Number of fruits per panicle	
		Average	Range
Manoa	Haden	4.5	0-13
Manoa	Pirie	2.9	0-12
Punahou	Haden	0.4	0-2
Pawaa	Haden	0.8	0-2
Pawaa	Haden	2.7	0-5
Waialae	Haden	0.9	0-0
Waialae	Haden	2.8	1-6
Waialae	common	4.4	1-12
	Average (Haden)	1.9	

Table 3. Mango blossom midge 1982 surveys: Infestation rate of mango flower buds on Oahu.

Sampling date	Location	Infested buds (%)	Number of larvae or pupae per infested bud	
			Average	Range
February 3	Punahou	92	2.8	1-9
	Kaimuki	68	2.1	1-5
February 9	Punahou	100	5.0	1-16
	Kaimuki	100	4.1	1-13
	Average	90	3.5	

Table 4. Mango blossom midge 1982 surveys: Fruit set of mango panicles on Oahu.

Sampling date	Location	Panicles with fruits (%)	Number of fruits per panicle	
			Average	Range
April 27	Punahou	60	0.9	0-5
	Kaimuki	59	0.8	0-4
	Average	60	0.8	