College of Tropical Agriculture and Human Resources
University of Hawai'i at Manoa

Evaluation of Amulet™ C-L Fruit Fly Bait Stations and Roosting Host Plants for the Control of Melon Fruit Fly on Zucchini Crops

At A Glance: We conducted field trials to develop improved melon fly management techniques by using targeted bait applications and/or other control methods applied to border plants, such as Amulet™ C-L. The main objectives of these field trials were to 1) identify preferred melon fruit fly roosting host plants around zucchini crops and 2) determine the efficacy of Amulet™ bait stations for controlling melon flies in zucchini crops.

Introduction

The melon fruit fly, *Zeugodacus cucurbitae* (Coquillett) (Diptera: Tephritidae), is a major pest of cucurbit vegetables and tomatoes (Rabindranath, 1986). Losses from melon fly damage range from 30% to 100% crop loss (Dhillon, et. al., 2005). It is recommended to follow integrated pest management to control melon fly populations such as sanitation, male annihilation cue-lure traps, and protein baits to achieve better control of melon flies (Messing, 1999).

The recent management strategy includes Amulet™ C-L (0.34% fipronil) bait stations, which are effective through horizontal insecticide transfer (transfer from one individual to another) of the fipronil toxicant among the individuals of a population (Spafford et al. 2018). The male flies ingest fipronil from Amulet™ C-L stations and regurgitate, thus transferring to females through food sharing, causing their mortality. Toxic protein bait stations and sprays, such as Amulet™ C-L and GF-120, are commonly applied by Hawai'i farmers to vegetation bordering cucurbits and tomato fields. However, not all plant species surrounding vegetation are preferred as roosting sites where the adult melon flies seek shelter for feeding and mating (McQuate, et. al., 2007).

Field trials were conducted to develop improved melon fly management techniques by using targeted bait applications and/or other control methods applied to border plants, such as Amulet™ C-L. The main objectives of these field trials were to 1) identify preferred melon fruit fly roosting host plants around zucchini crops and 2) determine the efficacy of Amulet™ bait stations for controlling melon flies in zucchini crops.

Materials and Methods

Identifying Roosting Hosts

The abundance of melon flies was monitored on different plant species bordering cucurbit crops to identify the preferred roosting host plants. The field experiment was conducted on a commercial farm at the Kula Agricultural Park in Maui from July to November 2019. McPhail-type traps (Scentry Biologicals Inc., Billings, MT, USA) baited with torula yeast were used to monitor the abundance of melon flies in different plant species. One trap per plant species was installed at approximately 300 ft apart. Each trap was loaded with 3 torula yeast baits (Scentry Biologicals) tablets diluted in 300 ml of water (Figure 1).

Traps were hung on the most common and predominant plant species on the borders of zucchini crops at approximately 4 to 5 feet in height (Figure 2). These plants species were castor bean (*Ricinus communis*), koa haole (*Leucaena leucocephala*), bamboo (*Bambusa vulgaris*), Mexican sunflower (*Tithonia diversifolia*), banana (*Musa spp.*), avocado (*Persea americana*), mango (*Mangifera indica*), elephant grass (*Pennistum purpureum*), perennial soybean (*Neonotonia wightii*), cassava (*Manihot esculenta*), and African couch grass (*Digitaria abyssinica*). A stake was set to hang the trap for the African couch grass. The traps were serviced weekly when the numbers trapped were counted, and the new Torula yeast mixture was refilled.

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Figure 1. Preparation of McPhail-type traps to monitor melon fruit fly abundance in different roosting host plants.

Amulet™ C-L Efficacy

The Amulet™ C-L baits (BASF Corporation) were mounted in plastic cups and installed in the preferred roosting host plants. The cups were inverted to protect the bait from rain and sun, and painted yellow to increase attractiveness to melon flies (Figure 3).

Along with the Amulet™ C-L bait, a McPhail-type trap was installed on the same plant species to collect melon flies. The male and female melon flies in the McPhail traps were examined and counted weekly.

At harvest, the number of damaged and marketable zucchini fruits were counted weekly and expressed as a percent of damaged versus marketable zucchini yields from multiple fields planted on the farm on different dates during this study.

Figure 2. McPhail-type trap set up at potential roosting host plants.

Figure 3. Amulet™ C-L set up in a yellow inverted cup hanged in the Koa haole tree.

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Results

Identifying Roosting Hosts

The preferred hosts for roosting areas were castor bean, Koa haole, bamboo, avocado, mango, and cassava, with flies captured in a range of 800 to 1150 individuals per week. Blooming plants attracted greater numbers of melon flies, as pollen served as a food source for melon flies. The least preferred roosting hosts were elephant grass, perennial soybean, banana, Mexican sunflower, and African couch grass, with flies captured ranging from 2 to 102 individuals per week (Figure 4).

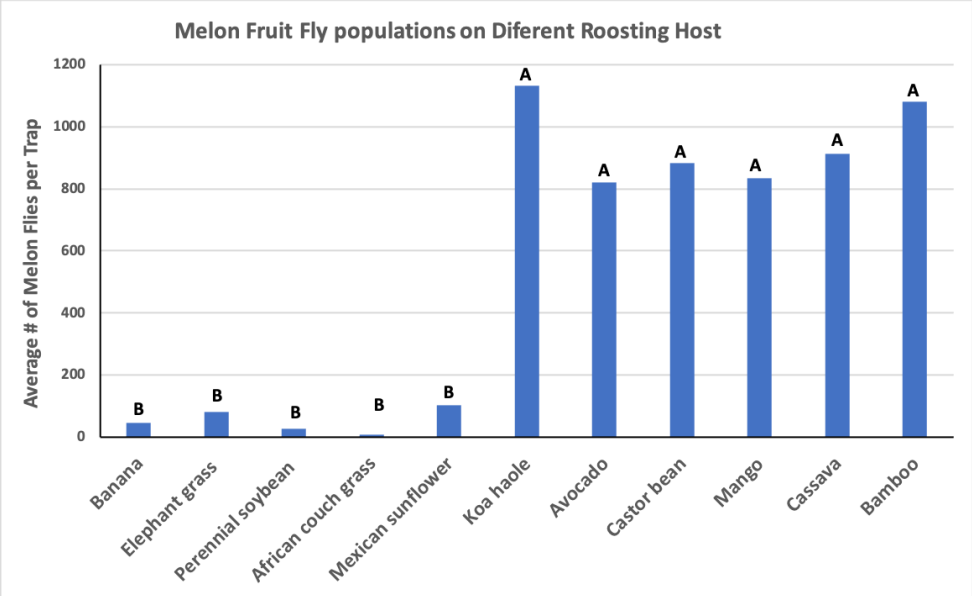

Figure 4. Mean number of melon fruit flies trapped in McPhail-type traps on different plant species at the Kula Agricultural Park.

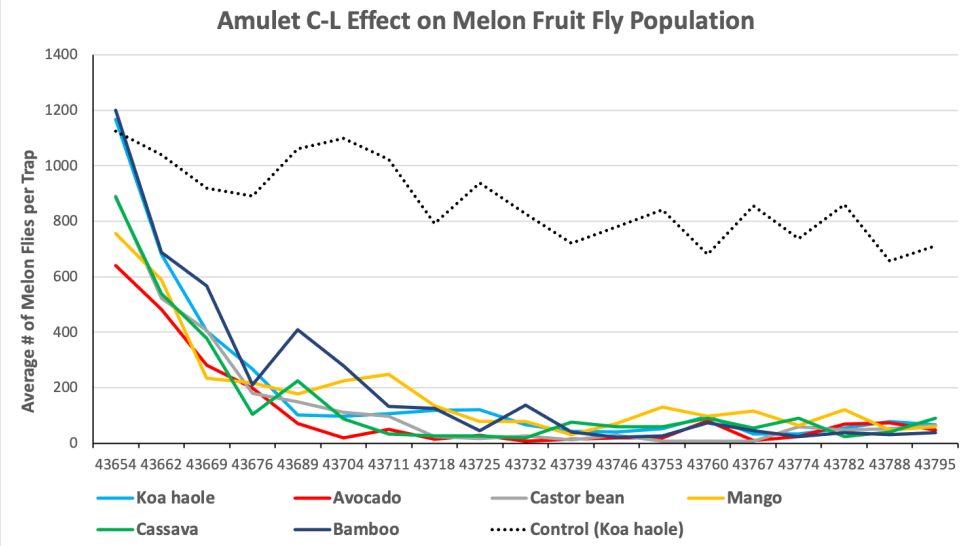

Figure 5. Mean numbers Melon fly trap catches in different preferred host plant species after Amulet™ C-L installation.

Amulet™ C-L Efficacy

The abundance of melon fruit flies as indicated by trap catches decreased by an average of 50% after two weeks of Amulet C-L exposure. After a long exposure period (approximately four months), melon fruit fly abundance significantly reduced from 1,200 flies to 90 flies per trap per week (Figure 5).

The average percentage of male and female melon flies captured at roosting hosts was 45% and 55% respectively, indicating that Amulet™ C-L decreased both male and female melon fly populations (Figure 6).

There were no significant (P>0.6) differences among the roosting hosts, where Amulet™ C-L was installed, which indicates that castor bean, Koa haole, bamboo, avocado, mango, and cassava can serve as good roosting hosts for melon flies.

Melon fly damage to zucchini crops decreased from 80% to 45% after two weeks of Amulet™ C-L exposure and continued decreasing every week, reaching less than 5% damage after two months of exposure (Figure 7). In contrast, Melon fly damage in control areas ranged from 60% to 85%. These results indicated that Amulet™ C-L bait stations can be used as an effective control strategy for the melon fruit fly.

Conclusion

Understanding the biology and behavior of target pests is essential for the effective use of control strategies in integrated pest management programs. In the case of melon flies, understanding the roosting host preference was important to decide the placement of Amulet™ C-L. As identified in this trial, the placement of Amulet™ C-L in preferred roosting host plants significantly reduced the melon fly population, reducing the damage to zucchini fruits. In addition, the use of preferred roosting host plants can also be incorporated into the targeted

application of protein bait sprays like GF-120 for increased control of melon flies.

Although the purpose of McPhail traps is only for use as a monitoring tool, it can also help to reduce this pest population as a mass trapping method, since these traps caught more than 1,000 flies per week in some traps during this study. In conclusion, the use of Amulet™ C-L bait in the preferred host plants can significantly reduce the population of melon fruit flies in zucchini fields resulting in profitable zucchini farming.

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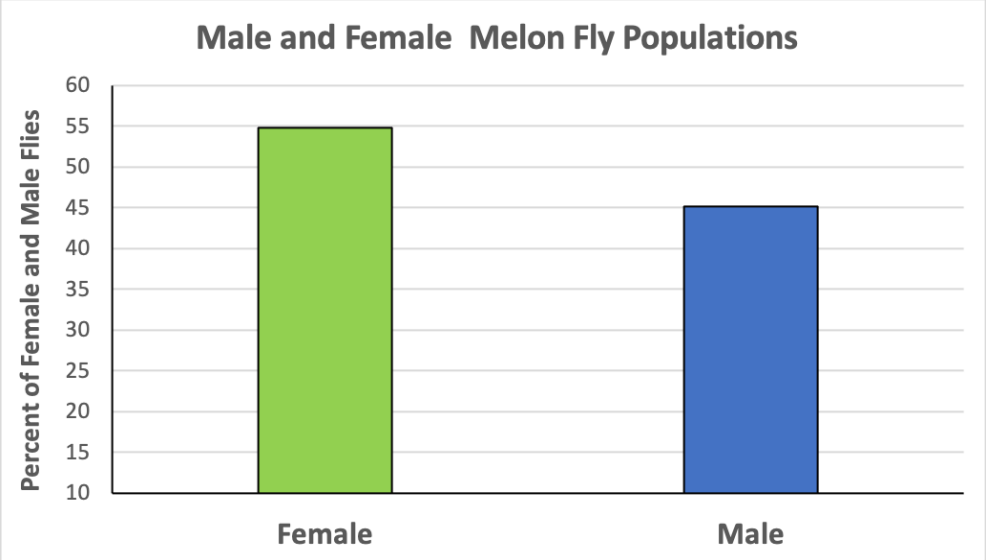

Figure 6. Percentage of female and male melon fly populations at the roosting host areas.

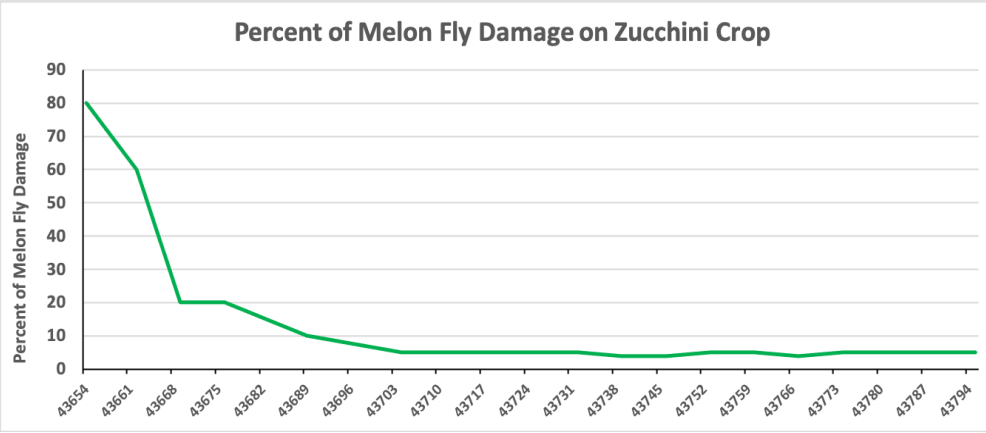

Figure 7. Percent of Melon fly damage in zucchini fruits after Amulet™ C-L installation.

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