

**FEEDING CYCLE OF THE
FRUIT PIERCING MOTH
IN AMERICAN SAMOA**

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ABSTRACT

The fruit piercing moth (FPM), *Othreis fullonia*, a serious pest in American Samoa, is generally nocturnal. This study was conducted to determine the number and sex of adult FPM feeding on tomato during four 1-hr periods on four nights about 1 week apart. For each hour beginning at 7 pm, 10 pm, 1 am, and 4 am, two collectors walked among 5 rows of 50 tomato plants and captured moths in nets feeding on the fruit. Moths were placed in cages for later identification in the laboratory. The moths began feeding immediately following sunset (7 pm). Most were captured between 10 to 11 pm, and few were seen between 1 to 2 am. Feeding increased slightly before dawn (4 to 5 am). Secondary moths, also captured while feeding, were present in more constant numbers throughout the night, but peaked in population between 1 to 2 am when FPM numbers were lowest. Any effort to disrupt FPM feeding, it seems, may be more effective if applied between sunset and midnight.

The fruit piercing moth (FPM), *Othreis fullonia* Clerck, occurs in the tropical and subtropical regions of Australia, Africa, South and Southeast Asia, and many islands in the Pacific and Indian Oceans. Common fruit hosts of the adult moths include citrus, banana, guava, starfruit, mango, cashew nut, litchi, passionfruit, pineapple, kiwifruit, apple, apricot, peach, plum, persimmon, nectarine, fig, custard apple, tomato, green pepper, and eggplant (Cochereau, 1977; Maddison, 1982; Waterhouse and Norris, 1987; Vargo, personal observation). The moth pierces the skin of fruit to feed on juice and pulp with its barbed, heavily sclerotized proboscis. The puncture serves as an entry point for the rot fungus, *Oospora* (Maddison, 1982). Larvae feed on *Erythrina* spp. throughout Oceania, and vines of the family Menispermaceae in the Indo-Malayan region and elsewhere.

The destructive effects of the FPM were first recorded in 1869 by the French botanist, Thozet, as injuring orange fruits at Rockhampton in Australia (Baptist, 1944). In 1961, it was identified

and documented in American Samoa as a serious pest of tomatoes (Comstock, 1981). It was observed to cause severe damage on green peppers in 1987 on the Manua Islands of American Samoa (Maddison and Vargo, personal observations). While fruit hosts of the moth have been identified, and a review of the distribution, biology, and natural enemies has been made by Waterhouse and Norris (Waterhouse and Norris, 1987), little is known about the temporal feeding habits of the moth. The purpose of this paper is to determine the nightly feeding cycle of the FPM on tomato in American Samoa.

METHODS AND MATERIALS

Seeds of tomato, *Lycopersicon esculentum*, cv. King Kong, were sown in peat pots filled with Jiffy Mix (a 1:1 mix of peat and vermiculite) in early July, 1989. The 3-week-old seedlings were transplanted to 5 rows, each with 9 to 12 plants with 0.6 m between plants and 1 m between rows. Planting occurred at the Land Grant Experimental Station, Malaeaimi, Tutuila, American Samoa. When fruits were nearing maturity in mid-September, moths were captured one night each week over a 4-week period, during four 1-hr capture periods each night beginning at 7 pm, 10 pm, 1 am, and 4 am. Preliminary observations indicated that moths did not visit the tomato plot until after sunset (6:30 pm). Two observers, equipped with head-mounted flashlights, walked between rows of tomato plants capturing feeding moths with nets. The moths were placed in cages and later identified by species and sex in the laboratory.

RESULTS AND DISCUSSION

The FPMs fed throughout the night with most feeding occurring between the 7 to 8 pm and 10 to 11 pm periods (Fig 1). The peak feeding interval for both sexes was 10 to 11 pm, but more males than females fed between 7 to 8 pm (Figs. 2 & 3). More females than males fed during the 1 to 2 am and the 4 to 5 am periods, but the differences were not significant (Figs. 2 and 3). Although feeding occurred throughout the night, most FPMs visited the plot

during the 2 pre-midnight intervals. No moths were collected during the 1 am and 4 am periods on September 18 because of heavy rain.

Eight species of secondary moths were also collected feeding on punctured tomato fruits. (These moths were eaten by rats before they could be identified.) Secondary moths fed throughout the night with peak numbers captured between 10 to 11 pm and 1 to 2 am (Fig. 4) except on September 13, when most secondary moths were taken between 7 to 8 pm. Secondary moths outnumbered FPMs after midnight.

Secondary moths are believed to feed at the punctures initially made by the FPM (Denton and Muniappan, personal communication). This feeding by secondary moths may promote the introduction and spread of rot-inducing organisms. Fig. 4 shows that secondary moth feeding continued beyond the peak feeding times of the FPM. This behavioral adaptation is both timely and advantageous to the secondary moths; not only have the punctures already been made by the FPM, but there is less competition with the FPM after midnight. Recent observations (Denton and Muniappan, personal communication) indicate that some of the secondary moths may actually be primary fruit piercing moths, i.e., they visit and pierce fruit before the FPM. This is suggested by their heavily sclerotized, barbed or serrated mouthparts. If true of some of our so-labeled "secondary moths," the later timing of their visits would result in decreased competition between these primary moths and the FPM. More work is needed to establish the identification and status--primary or secondary--of currently labeled secondary moths.

Control methods for the FPM currently focus on the use of biological controls (Sands and Broe, 1990). Mechanical methods, such as net barriers, are also being tested (Ali and Vargo, 1991). In outbreak situations, it may be useful to know when peak feeding times occur so that alternative methods of control, such

as net captures or other means to disrupt feeding, may be successfully implemented. In American Samoa, these peak periods appear to occur before midnight. However, consideration must also be given that some of the so called "secondary moths" may in fact be primary feeders whose feeding periods are constant throughout the night.

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