RESPONSE OF *LIRIOMYZA* (DIPTERA: AGROMYZIDAE) AND ITS PARASITES TO STAKE AND MULCH CULTURE OF TOMATOES[1]

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ABSTRACT

The influence of tomato cultural systems, mulching and staking, on the leafminer, *Liriomyza sativae* Blanchard (=*L. munda* Frick) and its parasites was evaluated in 1973 in 1 spring and 2 fall field experiments at Bradenton, Florida. Leaf samples were examined for leafmines, and field collected pupae were held for parasite emergence. Both cultural techniques had a positive influence on *Liriomyza* and parasites. The number of leaf mines in tomato foliage from mulch culture and from stake culture was increased in the spring experiment but the same was true for only stake culture in the fall. Parasitism of leafminers by *Opius* spp. (Braconidae) was reduced by stake culture.

The impact of mulch and stake cultural systems on insect populations on tomatoes is not well documented. Poe observed that fewer granulate cutworms, *Feltia subterranea* (F.), were associated with staked tomatoes than were associated with nonstaked tomatoes. Light reflective properties of various artificial mulches have been reported to influence numbers of *Diaphania nitidalis* (Stoll), *Apis mellifera* L., and aphids on squash (Wolfenbarger and Moore 1968), and numbers of thrips, *Frankliniella tritici* (Fitch), on roses (Ota and Smith 1968). Webb and Smith (1973) compared artificial mulches with differing light reflective properties for effects on numbers of mines made by *L. munda* Frick (=*L. sitivae* Blanchard) and found that leaves from snap beans grown on beds covered with the artificial mulches had more leafmines than leaves from nonmulched snap beans. Wolfenbarger and Moore (1968) reported that *Liriomyza* spp. were repelled by aluminum foil mulch.

This paper reports results from experiments conducted in the spring and fall of 1973 at Bradenton, Florida, on the influence of staking and mulching on insect populations in tomatoes.

MATERIALS AND METHODS

Single rows of 'Walter' tomatoes were grown in 50 plant plots on raised beds. Plots were separated by a 5-ft alleyway within rows. Four cultural systems (i.e. mulch, stake, mulch/stake, and conventional nonmulch/nonstake) were randomly applied to plots. Mulched beds were completely covered with polyethylene plastic coated paper (black paper in the spring and tan paper in the fall). Staked plants were pruned to 2 stems and tied to 4 ft vertical cypress supports. Manzate 200 (2.0 lb AI/acre), methomyl

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(0.5 lb AI/acre) and dimethoate (0.25 lb AI/acre) were applied weekly in combination in 1 fall experiment only; plants were not treated in the other 2 experiments. Each cultural system was replicated 7 times in the spring test and 4 times in the fall tests.

Leaf samples were randomly selected from plants on 3 successive weeks beginning on 15 May and on 8 successive weeks beginning on 8 October to estimate the density of *Liriomyza* leafminer populations. In the fall, 10 leaves with 3 leaflets each were taken from each plot on the first 4 dates when the plants were small, but later in the fall, as in all samples in the spring, 25 leaves with 3 leaflets each were taken. Records were made of the number of *Liriomyza* mines per leaf sample.

In May and June, leafminer pupae were collected on 5 dates from beneath staked and nonstaked plants. Pupae were placed in 2-oz, covered plastic containers and held until all insects emerged to determine percent parasitism by hymenopterans.

Results and Discussion

In the spring, when the black mulch was used, fewer leafmines were found in samples taken from nonmulched/nonstaked tomatoes than in samples from either mulched or staked and nonmulched tomatoes (Table 1). Staking and mulching appeared to affect numbers of mines similarly and, when used together their effect was additive; a significantly greater number of mines was in the mulch/stake culture than in either cultural system used alone. In the fall test the presence of mulch did not affect the number of mines present, but staking again resulted in an increase (Table 1). During the fall, the application of insecticides did not influence the pattern of effects of the cultural systems but merely reduced the total numbers of mines observed in each system (Table 1).

The number of parasites (*Opius* sp., Braconidae) that emerged from leafminer pupae was significantly lower from staked plants than from nonstaked plants (Table 2). As a result, parasitism by *Opius* sp. might have been one cause for the lower numbers of leafmines observed in the nonstake systems.

TABLE 1.—Number of leafmines in tomato plants grown by 4 cultural systems in Bradenton, Florida, 1973.

Cultural system	Spring (no insecticides)	Fall (no insecticides)	Fall (with insecticides)
Nonmulch/Nonstake	99 a*	170a	60 a
Mulch**	150b	143a	54 a
Stake	145b	281b	167b
Mulch/Stake**	208c	376b	102b

*Values in the same column not followed by the same letter are significantly different at the 5% level by Duncan's multiple range test.

**Black mulch was used in the spring and tan mulch was used in the fall.

TABLE 2.—PARASITISM OF LEAFMINER PUPAE COLLECTED FROM STAKED AND NONSTAKED TOMATOES IN BRADENTON, FLORIDA, SPRING 1973.

Cultural system	Sample date				
	April 23	May 2	May 15	May 20	June 6
Stake culture					
No. Pupae	19	259	240	52	108
% parasitism*	32	28	20	81	74
Nonstake culture					
No. Pupae	84	221	81	43	46
% parasitism	49	45	43	95	91

*Analysis of variance of data indicates parasitism was greater (P = .01) under nonstake culture than stake culture.

That tomato cultural systems influence populations of pests (*Liriomyza* spp.) and beneficial organisms (*Opius* sp.) on tomato has been clearly demonstrated by these experiments. Because use of both stake and mulch cultural systems resulted in increased numbers of miners, tomatoes grown with these methods must receive greater emphasis and care in management of insect populations.

The differences in mines noted between staked and nonstaked plants might be due to the altered microenvironment, wind movements, other insects, light, or temperature resulting from the reflective properties of the plant bed or mulch surface. The differences in microenvironments should be investigated for these cultural systems.

The increased parasitism observed in nonstaked tomatoes and the progressively higher levels of parasitism with successive samples through time suggest that these naturally occurring beneficial insects could be managed to control leafminer populations. The increased economic benefits for fresh market tomatoes from stake, and stake/mulch culture may negate the practicality of management of parasites by altered cultural technique. However, with the introduction of machine harvest of tomatoes and increased cost of staking, nonstaked plants are more common, and further study of the management potential by cultural systems would be justified.

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