

## INFLUENCE OF STAKE AND MULCH CULTURE ON LEPIDOPTEROUS PESTS OF TOMATO<sup>1</sup>

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### ABSTRACT

Response of various lepidopterous species to staked and artificially mulched culture of tomatoes was evaluated by counting numbers of pests and by examining damage to tomato foliage and fruit. Granulate cutworm, *Feltia subterranea* (Fab.), numbers and injury to fruit were less in early spring on plants grown on black polyethylene-coated paper mulch. Numbers of granulate cutworms, southern armyworms, *Spodoptera eridania* (Cramer), and a complex of less abundant noctuid larvae were inhibited by staking. Damage by all species was also reduced in staked plants. Insecticidal sprays applied to staked plants resulted in increased leafmining by tomato pinworms, *Keiferia lycopersicella* (Walsingham).

South Florida tomatoes reach markets during winter and spring when produce brings its greatest prices. The high value of these tomatoes has made the use of certain costly cultural practices feasible. Two such practices now widely accepted are mulching soil with artificial material and staking plants.

Polyethylene film or paper laminated to such film has been used in recent years most advantageously because it shields fruit from soil-borne pathogens, helps to retain fumigants within the plant bed for maximum efficiency, retards weed growth, and helps to maintain optimal nutrient and moisture levels in the root zone (Kelbert et al. 1966). Staked culture permits effective spray coverage by pesticides and closer plant spacing; it also enables mechanical and chemical weed control in row middles, and prevents fruit contact with soil and hazards of soil-borne pathogens (Kelbert et al. 1966).

These cultural systems alter the environment of tomato fields, and associated insect populations may respond to this habitat change. Changes in insect fauna associated with various mulches have been reported by Wolfenbarger and Moore (1968), Ota and Smith (1968), Webb and Smith (1973) and others. Price and Poe (1976) reported that greater numbers of *Liriomyza sativae* Blanchard leafminers were associated with either mulched or staked tomato culture and that parasitism by hymenopterans was reduced in staked plants.

This paper reports results of experiments performed in Bradenton, Florida, to evaluate response of Lepidoptera to cultural practices. The first test was conducted in the spring of 1973 without pesticidal applications. The following fall, similar tests were evaluated with and without the influence of pesticides.

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## MATERIALS AND METHODS

Mulched and staked treatments and unmulched/unstaked controls were randomly applied to plots of 'Walter' tomatoes 1 row by 75 ft. Treatments were replicated 7 times in the spring and 4 times in each of the fall tests. Plant beds in mulched plots were covered with polyethylene coated paper (black paper in the spring and tan in the fall). Staked plants were pruned to 2 main stems then tied to 4-ft wooden stakes. A mixture of dimethoate (0.25 lb AI/acre) and methomyl (0.50 lb AI/acre) and Manzate 200 (2.00 lb AI/acre) was applied each week to plots of 1 fall test, and Manzate 200 (2.00 lb AI/acre) alone was applied to plots of a second fall test.

In the spring test, weekly counts of pest species were made after 10 April from plants and bed surfaces in 35 ft of row per plot. Similar inspections were made in the fall tests on 22 December. In addition, 25 leaves were taken at random from each plot of the 2 fall tests on 8 successive weeks beginning October 8. Numbers of mines in the terminal 3 leaflets were recorded to evaluate the population density of the tomato pinworm, *Keiferia lycopersicella* (Walsingham). Damage to fruit was determined by inspecting fruit from 2 spring harvests (2 weeks apart) and from a single fall harvest.

## RESULTS AND DISCUSSION

Granulate cutworms, *Feltia subterranea* (Fab.), were pests of fruit grown in the spring. Damage by this species was primarily to fruit resting on the plant bed. During the early spring, fewer larvae inhabited mulched plots than control plots (Table 1), but this was not true later when foliage shaded the mulch and temperatures were as low as those of unmulched surfaces. Fruit taken at the first harvest from mulched plots was less

TABLE 1. INFLUENCE OF CULTURAL SYSTEMS ON GRANULATE CUTWORM NUMBERS AND THE PERCENT OF FRUIT DAMAGED DURING THE EARLY SPRING (PRIOR TO 9 MAY) AND LATE SPRING (AFTER 9 May) 1973.

Cultural system	Early spring**		Late spring	
	Mean number cutworms*	% fruit damaged	Mean number cutworms	% fruit damaged
Control (unstaked/unmulched)	21.5 a†	28.0 a	11.5 a	11.2 a
Mulched	7.1 b	19.0 b	19.1 a	11.4 a
Staked	6.7 b	4.0 c	1.1 b	0.3 b

\* Values are the average numbers of larvae per 35 ft of row recorded on 3 sample dates in the early spring and 2 sample dates in the late spring in 7 replications.

\*\* Fruit from an early harvest is considered early spring fruit and that harvested 2 weeks later is considered late spring fruit.

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

damaged than that from control plots, apparently as a consequence of the lower cutworm population early in the season (Table 1). Granulate cutworm numbers were consistently less in staked plants than in unstaked plants.

Cabbage loopers, *Trichoplusia ni* (Hubner); tomato fruitworms, *Heliothis zea* (Boddie); and beet armyworms, *Spodoptera exigua* (Hubner), fed on spring fruit regardless of whether or not the fruit rested on the plant beds. Fruit injury from this complex increased from 1% at the first spring harvest to 12% at the second. Mulching practices did not influence fruit damage by insect feeding, but injury to late harvest fruit was significantly lower in staked plots (4%) than in control plots (12%).

Up to 40% of the fall tomato crop was damaged by southern armyworm, *Spodoptera eridania* (Cramer), larvae which fed largely on fruit contacting the plant bed. Mulching practices had no effect on numbers of southern armyworms or injury to fruit, but both were reduced in staked plots (Table 2).

Insecticides in the fall substantially reduced southern armyworm numbers and their damage, but did not significantly alter southern armyworm response to cultural systems (Table 2).

Moderate infestations of tomato pinworms were observed in the spring and fall. Cultural practice did not affect pinworm damage to fruit, but records of pinworm leafmining injury to pesticide-treated plants in the fall indicated greater mining activity in staked tomatoes than in unstaked tomatoes. When pesticides were applied, 4.8% of the leaves from staked plants were mined, but a significantly lower ( $P \leq .05$ ) 1.8% of the leaves from unstaked plants were mined. Tomato pinworms were heavily parasitized by *Apanteles* sp. during 1973 at Bradenton (Poe 1974). Apparently, thorough pesticide coverage of the staked plants reduced parasitism of pinworms by *Apanteles* sp.

This study has established the importance of staked culture in minimizing loss from southern armyworms and granulate cutworms. This benefit, in conjunction with previously cited horticultural values, may make the costly staked culture a more economically acceptable alternative.

TABLE 2. INFLUENCE OF CULTURAL SYSTEMS ON NUMBERS OF SOUTHERN ARMYWORMS AND THE PERCENT OF FRUIT DAMAGED IN AN INSECTICIDE-TREATED AND UNTREATED EXPERIMENT, FALL 1973.

Cultural system	With insecticides		Without insecticides	
	Mean number armyworms*	% fruit damaged	Mean number armyworms	% fruit damaged
Control (Unstaked/unmulched)	6.8 a **	3.5 a	32.8 a	39.6 a
Mulched	7.5 a	1.8 a	26.8 a	33.3 a
Staked	0.5 b	0.2 b	11.0 b	13.7 b

\* Values are the average numbers of larvae per 35 ft of row recorded on 22 December from 4 replications.

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

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## BOOK REVIEW

THE CORIXIDAE OF THE WESTERN HEMISPHERE. H. B. Hungerford. Univ. Kansas Sci. Bull. 32: 1-827. 112 plates, 19 text fig. 1948. Reprinted 1977 by Entomological Reprint Specialists, Los Angeles, \$25.00. The reprinting of the late Dr. Hungerford's monograph on the western hemisphere Corixidae provides a most valuable service for aquatic entomologists. Although the basic text was published nearly 30 years ago, the value of the work is clearly reflected in the decision of Entomological Reprint Specialists to make it available once more.

Dr. Reece Sailer, a student of Dr. Hungerford's and an original contributor to the monograph, reviewed the book before reprinting. In his preface to the republished edition, Dr. Sailer stated "A quarter of a century after its publication *The Corixidae of the Western Hemisphere* remains unchallenged as the definitive work on classification and identification of water boatmen", a statement that is not likely to be debated.

Dr. Sailer has taken the opportunity in this reprint edition to include a revised key to the genus *Trichocorixa* so that original defects are deleted, making the key usable. He has also added a supplementary bibliography updating the literature to 1975.

A review of the book, written by Maurice T. James and published in the Annals of the Entomological Society of America (1949, 42(1): 47) summarizes the value of the book to entomologists. He stated "The identification of the American Corixidae which in the author's words 'has been a difficult and discouraging task for many years', should be greatly facilitated by this monograph." No subsequent work has replaced the usefulness of this book. Entomological Reprint Specialists are to be congratulated in making the volume available once more.

Lewis Berner