Hybrid

'Burpee'. Plant vigorous, early, low resistance to mildews. Fruit medium size, well-netted, with prominent ribbing, round to slightly oval shape. Flesh deep orange, thick, firm, with good flavor.

'Classic'. Early, vigorous, tolerant to Fusarium wilt. Deep salmon flesh, with good aroma and texture.

'Early Market'. Early, resistant to Fusarium wilt and powdery mildew. Fruit medium small, round-oval with definite ribbing and good net. Flesh thick, firm and very sweet, with small cavity. Recommended.

'Harper'. Early, resistant to Fusarium wilt. Fruit nearly round small well-netted, mild ribbing. Flesh thick, salmon color, of excellent flavor.

'Mainrock'. Early, tolerant to Fusarium wilt. Fruit elongated medium size, with medium netting and definite ribbing. Flesh salmon-orange, thick of excellent flavor.

'Samson'. Midseason, resistant to Fusarium wilt and tolerant to mildews. Fruit medium to large size, nearly round, well-netted, faint ribbing, with small cavity. Flesh thick, firm, deep salmon color and of very good flavor. Suitable for shipping. Recommended.

'Saticoy'. Midseason, tolerant to Fusarium wilt, and mildews. Fruit medium to large size, oval, thin net, with no ribbing. Flesh firm, thick, deep orange in color with excellent flavor. Suitable for shipping. Recommended.

'Star Headliner'. Early, tolerant to Fusarium wilt and powdery mildew. Fruit medium size, oval shape, heavily netted, with definite ribbing. Flesh firm, strong orange color with good flavor. Suitable for shipping.

'Super Market'. Midseason, tolerant to Fusarium and downy mildew. Fruit medium size, round, heavy net, with slight ribbing. Flesh thick, salmon color, firm and of good quality. Suitable for shipping.

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TOMATO PINWORM CONTROL

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Abstract. **Recent increases in populations of the tomato pinworm, Keiferia lycopersicella (Walsingham), reached epidemic proportions in some localities in 1973. Injuries by the small larvae occur in tomato leaves, flowers, young fruit, old fruit and stems where the insect is abundant. In three chemical control experiments sprays of chlordimeform combined with Dipel (a Bacillus thuringiensis preparation) parathion, leptophos, carbophenothion and azinfosmethyl were effective. A general relationship was found in which the use of materials that were effective in reducing leaf injuries and worm holes in fruit also increased fruit yield of the plants.**

Infestations of the tomato pinworm *Keiferia lycopersicella* (Walsingham) in Florida have been observed for decades as small populations. Occasionally serious injuries were reported (6) and (7). Observations by Kelsheimer from 1942 to 1969 showed tomato pinworms were present but with the use of DDT and parathion tomato pinworms almost disappeared (verbal communication). In Dade County Florida they were observed occasionally over essentially the same period. In 1970 there was an apparent increase in tomato pinworm infestations; in 1971 there was a further increase and in 1972 the insect reached epidemic (serious) proportions in Florida. Neither DDT nor parathion had been used for several years previous to 1970. It was evident that the factors which had previously kept large populations in check were no longer effective. Initial control studies, therefore, were inaugurated and are summarized below.

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Types of injuries. Larvae hatch from eggs laid on the upper and the lower leaf surfaces and begin feeding. Some feed on the surfaces of leaves, some feed between the leaf surfaces and make blotch mines in the leaves. Leaves are often rolled or folded such that the larvae feed therein protected—from predaceous enemies and chemical sprays. Larvae in most severe infestations destroy much leaf surfaces, cause leaves to wither and die, enter and mine in the stems and feed on flowers and stems thus destroying fruit production. Larvae enter fruit and destroy it. Some burrow into tops, bottoms or sides of fruit making holes about 1-3 mm (1/25-1/8 inch) in diameter. A portion of the fruit is infested by larvae which burrow beneath the fruit stem and enter the core of the fruit. Since the larvae are small, about 6-8 mm (1/3-1/4 inch) long at maturity and about 0.85 mm long as newly hatched larvae. They are inconspicuous, therefore, and unless close examinations are made of plants for initial infestations severe losses may result.

Chemical control. Control under greenhouse conditions was reported on in 1931 as unsatisfactory (3). Control with calcium arsenate and cryolite was only partial (1) whereas the botanicals, pyrethrum and rotenone sprays, gave some excellent results. After extensive tests with pre-DDT materials it was found that (4) four applications of 70 percent sodium fluoaluminate (cryolite) in talc as a dust applied at 20 to 25 pounds per acre at 10-day intervals was the best field treatment. Post-DDT materials of parathion, Supracide® (0,0-dimethyl phosphorodithioate S-ester with 4-(mercaptomethyl)-2-methoxy-Δ^2-1,3,4-thiadiazolin-5-1) phosphamidon, Zectran® (4-dimethylamino 3,5-Xylyl methyl carbamate) and Monitor® (0,S-

Table 1. Effect on tomato plants of insecticides on tomato pinworms and plot yield of tomatoes. Experiment A (Bradenton AREC).

Treatment		Mean number	
Material	Amt. a.i./ 100 gals	Pinworms/ plant	Mkt. fruit/ plot
Phosvel(R) 50WP	16 oz	0.50a	139a
Azinphosmethyl, 2E +	12 oz		
trichlorofon, 4L	8 oz	1.75ab	119ab
Parathion, 8E	8 oz	2.50ab	134a
Orthene(R) 75WP	8 oz	2.50ab	147a
Chlordimeform 95SP	8 oz	2.50ab	137a
Trichlorofon 4LS	8 oz	2.75ab	76 c
Carbaryl, 4F	8 oz	3.25ab	97 bc
Dimethoate, 2.67E	8 oz	4.00abc	92 bc
Carbofuran, 4F	16 oz	4.25abc	112abc
Diazinon, 50WP	8 oz	5.50 bc	99 bc
Monocrotophos, 3.2E	8 oz	5.75 bc	137a
Check		7.25 c	76 c

Treatments were applied on Sept. 28, Oct. 3, 10, 24, Nov. 2, 9, 16, 30 and Dec. 12, 1972.

dimethyl phosphoramidothioate) were effective (5). A number of newer insecticides, diazinon among others, were effective under plant house conditions (5) in 1973.

Methods

Three experiments, A on the west coast of Florida and B and C in Dade County Florida were conducted with many of the newer insecticides. 'Walter' tomato plants were set September 14, 1972 in Experiment A. 'Homestead' tomato seed were planted for Experiment B, January 18, and Experiment C on February 20, 1973. Insecticides were applied with a compressed air sprayer in Experiment A, with a power sprayer in Experiment B and with hand pump sprayer in Experiment C. Treatments were randomized in each of four replications, in each experiment. In Experiment A plants were grown on raised, mulched beds, in plots with 10 plants in each. In Experiment B plots were 15 feet long, rows were 6 feet apart and replication blocks were 20 feet apart. In Experiment C plots were 12 feet long, rows were 6 feet apart and adjoined end-to-end. The insecticides used and application dates are given in Tables 1, 2 and 3.

Treatment evaluations were determined by counting live larvae and marketable fruit per plot in Experiment A; attacks of tomato pinworm larvae in leaves, injuries per fruit and number of fruit per plant in Experiments B and C.

All data were analyzed statistically to determine the significances of treatment means results to obtain 95% levels of probability. Those means which were significant have small letters to indicate the significances. Those data in which the arrays lacked significance are indicated with n.s., for not significant.

Results and Discussion

Experiment A. Tomato pinworm populations were comparatively low in the fall of 1972 (Table 1). Several materials gave significant tomato pinworm control over untreated plots. Leptophos was most effective in giving fewest numbers of live pinworms in leaves; it was second in yield of tomatoes. Azinfosmethyl + trichlorofon ranked second in live pinworm larvae and fifth in yield. Chlordimeform, Orthene® and parathion shared third place in number of tomato pinworms per plant; all had comparatively high yields of fruit.

Experiment B. Data on larval injuries to the

Table 2. Effect on tomato plants of insecticides on tomato pinworm in leaves, injuries per fruit and yield of tomatoes. Experiment B (Homestead AREC).

Treatment		Mean larval	Mean in-	Mean number
Material	Amt./100 gals.	damages	juries/fruit	fruit/plant
Chlordimeform, S.P.	2 oz +			
Dipel	2 oz	1.75a	0.21a	116 n.s.
Chlordimeform, S.P.	4 oz +			
Dipel	4 oz	2.50a	0.23a	91
Chlordimeform, S.P.	8 oz	2.75a	0.12a	89
Thuricide, H.P. + Plyac	1 lb + ½ pt.	3.50a	0.44abc	64
Monitor,(R) 4E	1½ pts	5.00ab	0.78 bcde	91
Monocrotophos, 3.2E	1 qt	5.50ab	0.45abc	81
Methomyl, L 1.8E	1 qt	6.50abc	0.27ab	109
Batospeine(R)	2 2/3 lbs	7.75abc	0.55abc	76
Dipel(R)	½ lb	8.00abc	0.58abc	79
Orthene(R) 75WS	¾ lb	8.50abc	0.63abcd	94
Gardona(R) 75WP	1¼ lb	8.75abc	0.66abcd	84
Toxaphene, 8E + M.O. Bait	1 pt.+ 1 qt	11.75 bc	1.15 ef	56
Biotrol, XK	2 lbs	11.75 bc	1.07 def	62
Sandoz, 52-135, 80WP	1 lb	12.50 cd	0.84 cdef	62
Pyrocide(R) F7083	1 qt	17.50 de	0.85 cdef	100
Check		18.25 e	1.25 f	80

Treated: 3/19, 27, 4/2, 9, 16, 23, 30, May 7, 14 and 21.

Table 3. Effect on tomato plants of insecticides on tomato pinworm in leaves, injuries per fruit and yield of tomatoes. Experiment C (Homestead AREC).

Treatment		Mean larval	Mean injuries/	Mean number
Material	Amt./100 gals.	injuries	fruit	fruit/plant
Parathion, 8E	1 pt.	8.38a	0.98 n.s.	2.08 cd
Carbophenothion, 4E	1 pt.	10.25ab	0.91	2.23 cd
Azinfosmethyl, 2E	2 qts	10.38ab	1.01	2.41 cd
Ethyl-, methyl parathion, 6-3E	1 qt	12.63ab	1.88	1.47abc
Supracide(R), 2E	1 qt	16.00ab	0.77	2.95 d
Orthene(R), 75W.S.P.	1 lb	16.88ab	1.86	0.86ab
Diazinon, 50 W.P.	2 lbs	18.63ab	1.74	2.21 cd
Formothion, 2E	½ pt.	19.00ab	1.71	2.03 c
Trichlorofon, 80WP	2 lbs	21.63ab	1.07	1.43abc
Naled, 8E	1 qt	22.38ab	2.71	0.73a
Demeton, 6E + Toxaphene, 8E	1/3 pt. 1 pt.	22.50ab	1.07	1.87 bc
Monocrotophos, 3.2E	1 qt	24.88ab	3.01	1.39abc
Dimethoate, 2.67	1 qt	25.13ab	2.15	1.40abc
Demeton, 6E	1/2 pt.	27.25 b	2.07	1.68abc
Check		57.75 c	0.79	0.62a

Treated: March 27, April 2, 9, 16, 23, 30, May 7, 14 and 21.

top leaves taken after the third weekly application and twice thereafter at approximately two week intervals are summarized in Table 2. Chlordimeform at 2, 4 and 8 ounces per 100 gallons of water, the 2 and 4 ounce rates each combined with the same weights of Dipel (a *Bacillus thuringiensis* preparation) gave good tomato pinworm control. Thuricide (a *B. thuringiensis* preparation) plus Plyac (a surfactant) was in fourth place in control of the pinworm injuries to leaves. Injuries to the fruit were somewhat related to the leaf injuries (Table 2). Most treatment materials gave significant reductions of larval damage to the leaves.

Experiment C. All insecticides in the test significantly reduced larval injuries to the leaves, with parathion providing most reduction (Table 3). Unsprayed, check, plants in Experiment C were killed by the tomato pinworm, although not shown by the data. Twelve of the 15 treatments are not significantly different from one another in mean injuries per fruit which may suggest that the tomato pinworm populations were overriding the treatments.

Based on manifold differences in the extremes of best treatment and the check that of Experiment A is 4.1 X, B is 10.4 X and C is 6.9 X fold more leaf injuries than the check. Based on percentage control the most effective materials in Experiments A, B and C gave 93, 96 and 86 percent control, respectively. The most severe attacks were considered to be in Experiment C where larval injuries to the check plants were almost 58, more than in Experiment A and B.

Relationships were observed through graphic studies of the data in which there was more fruit from plants from which fewer tomato pinworms had emerged or had fewer larval injuries.

In consideration of the data in Tables 1, 2 and 3 and approved materials it is suggested that two materials be combined for tomato pinworm control, as chlordimeform, 2 or 4 ounces; parathion, 8E, ½ pt.; azinfosmethyl, 2E, 1 pt. with leptophos, 50W, 1 lb.; Dipel, ¼ lb., or methomyl, 1.8E, 1 qt.

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A SEROLOGICAL TEST FOR DISTINGUISHING BIDENS MOTTLE AND LETTUCE MOSAIC VIRUSES

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Abstract. **Lettuce mosaic virus (LMV) and bidens mottle virus (BMV) both cause serious mosaic diseases of lettuce and endive in Florida. To expedite identification of the viruses in field samples, a rapid, specific assay technique was needed. For this purpose, antisera to each virus were produced in rabbits and serological tests were conducted in agar gels. The BMV antiserum reacted positively with extracts from BMV-infected plants, and the LMV antiserum reacted with extracts from LMV-infected plants, but neither antiserum cross-reacted. The serological tests have been used to detect three new weed hosts of BMV, and to further assess the importance of LMV and BMV in lettuce and endive production.**

Virus diseases of lettuce (*Lactuca sativa* L.) and endive (*Cichorium endivia* L.) are among the most important limiting factors in producing these crops in Florida (6). Two major viruses have been implicated thus far: lettuce mosaic virus (LMV), and bidens mottle virus (BMV).

LMV and BMV are distinct, although they have several properties in common. They both cause mosaics, mottling, and stunting of lettuce and endive; they are aphid borne (3, 5, 12), and both are filamentous, with particles about 720-750 nm long (3, 12). The two viruses have different host ranges and LMV is seed-borne in lettuce, whereas there is no evidence that BMV is seed-borne. A rapid means of distinguishing these two viruses in field samples was needed to evaluate and implement control measures. Serology was tested because of its general success for diagnosing other plant viruses (10, 11, 13), and because of preliminary tests which indicated that LMV and BMV are serologically distinct (5; Purcifull and K. A. Kimble, unpublished).

Materials and Methods

An isolate of LMV obtained from commercial seed was used for preparation of antisera. This isolate was compared serologically to the American Type Culture Collection (ATCC) isolate of LMV (PV-63) and to various field isolates from lettuce and endive. For routine culture LMV was propagated in garden pea (*Pisum sativum* L. cv. Little Marvel). For purification, the virus was cultured either in pea or in *Chenopodium quinoa* Willd. Most of the work with BMV was done with the ATCC isolate (PV-165) cultured in a *Nicotiana* hybrid (2).

LMV and BMV were purified by routine virus purification methods, involving clarification of leaf homogenates with chloroform or *n* - butanol; precipitation of virus with polyethylene glycol, followed by differential and density-gradient centrifugation (Purcifull, E. Hiebert, and S. Christie, unpublished).

An antiserum to LMV was prepared by injecting a rabbit intramuscularly with purified or pyrrolidine treated virus (11) emulsified 1:1 with Freund's incomplete adjuvant. One ml of virus was injected initially, followed six weeks later by an injection of pyrrolidine-treated virus (1 ml), with a final injection of purified virus (0.5 ml) being

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