Effects of Insecticide Application on
Population Density of the Chillie Thrips,
Scirtothrips dorsalis HOOD (Thysanoptera:
Thripidae), on Grape¹

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The chillie thrips, *Scirtothrips dorsalis* HOOD, has been found on 50 host plants (MURAOKA, 1988) and is an important insect pest of plants such as grape, citrus and persimmon (TAKAGI et al., 1972). In grape fields, insecticides are sprayed three or four times a year to control this species and the effects of insecticide application have been assessed by the level of damage to fruit clusters (HENMI, 1972; MIYAHARA and YAMADA, 1978; TSUCHIYA, 1978; UENO, 1984). However, the effects of the insecticides on the population density of *S. dorsalis* on grape have not been examined. Identification of the relationship of damage to fruit clusters with the thrips density could help in the control of this species. In this study, the effects of insecticide application on the population density of *S. dorsalis* and on damage to grape clusters were evaluated.

MATERIALS AND METHODS

The investigation was carried out in 1991 at the Osaka Prefectural Agricultural and Forestry Research Center in an open field planted with *Delaware* grapes 19 years age. Two adjacent 90 m² experimental plots, one sprayed and the other used as the control, were used. Two replications were done. In the sprayed plot, 220 l per 10 a of permethrin (20%, WP) was sprayed on 22 May and again on 14 June, and the same dose of fenitrothion (50%, EC) was sprayed on 13 August. In the control plot, no insecticides were applied.

Seasonal fluctuation in the number of adults and larvae on

shoots and fruit clusters collected by the washing method. The densities of adults and larvae on shoots were investigated by the shoot washing method (SHIBAO et al., 1993) every 7 days from 20 May to 24 September. Ten 30 cm long shoot tips were collected at random from both plots and washed with diluted cleanser; the washings were then filtered through filter paper (5.5 cm in diameter, Toyo No. 2). The adults and larvae caught on the filter paper were counted under a binocular microscope. The densities of adults and larvae on fruit clusters were also investigated every 7 days from 19 June to 29 July. Six fruit clusters were collected at random from each plot and treated as in the shoot washing method.

Damage assessment. The damage to fruit clusters was measured by examination of 30 fruit clusters per plot at harvest on 24 July. The number of damaged fruit clusters was counted and the level of damage to each cluster was classified on a four-point scale: A, no damage; B, light damage (< 20% of berries damaged); C, medium damage (21–50%); D, severe damage (> 51%). The damage index was calculated as $100 \times (B + 3C + 6D) / [6 \times (A + B + C + D)]$, where *A–D* represented the number of fruit clusters.

RESULTS

Seasonal fluctuations in the number of adults and larvae collected from shoots by the washing method

There were two adult peaks, one in early July and one in early August, in the sprayed plot and four smaller adult peaks (middle of July, early and late August, and middle of September) in the control plot (Fig. 1). The number of adults was almost constant from the start in late May to late June in both plots, but from early July to early August, there were many more adults in the sprayed plot than in the control plot. Larvae could be found from June to September in both plots. In the sprayed plot, the number of larvae started increasing in the middle of June and peaked at 26.9 per shoot in late July. In the control plot, the number of larvae started increasing in early June and peaked at 28.3 per shoot in early July. The number of larvae in the sprayed plot was smaller from early June to early July than that in the control plot, but larger from the middle of July to the middle of August.

Seasonal fluctuations in the number of adults and larvae collected from fruit clusters by the washing method

The number of adults peaked at 4.8 per fruit cluster

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Fig. 1. Seasonal fluctuations in the number of *S. dorsalis* adults and larvae per grape shoot collected by the washing method from sprayed (●) and control (○) plots. Vertical bars: standard error. Arrows: insecticide application in the sprayed plot.

Fig. 2. Seasonal fluctuations in the number of *S. dorsalis* adults and larvae per grape fruit cluster collected by the washing method from sprayed (●) and control (○) plots. Vertical bars: standard error. Arrows: insecticide application in the sprayed plot.

ter in the middle of July in the sprayed plot and at 3.4 in early July in the control plot (Fig. 2). The number of adults in the sprayed plot was smaller from the middle of June to early July than that in the control plot, but larger in the middle of July. The number of

larvae in the sprayed plot increased in the middle of July, and the largest number per fruit cluster was 17.1 in late July. The number of larvae in the control plot increased in late June and the largest number per fruit cluster was 12.8 in early July. The number of larvae in the sprayed plot was much smaller from late June to the middle of July than in the control plot, but larger in late July.

Damage assessment

The proportion of damaged fruit clusters and the damage index in the sprayed plot were 60.0% and 22.2, respectively, and those in the control plot were 90.0% and 38.3, respectively. The two values in the sprayed plot were less than those in the control plot. There was a significant difference ($p < 0.01$, χ^2 -test) in the proportion of damaged fruit clusters between both plots.

DISCUSSION

The larval density of *S. dorsalis* on shoots in the sprayed plot started increasing in the middle of June and the peak was in late July. The initiation of the increase and the time of the first peak were 10 and 20 days later, respectively, than those of the control plot. On the other hand, for fruit clusters in the sprayed plot, the larval increase started in the middle of July with a peak in density in late July. These times were 30 and 20 days later, respectively, than those in the control plot. The effects of insecticide application, therefore, lasted longer on fruit clusters than on shoots. Observations in the field suggested a possible explanation; new leaves and stems that grew after the insecticide applications may have provided insecticide-free space for immigrating adults to colonize, when fruit clusters were still uniformly covered with the insecticide.

Spraying of permethrin in late May and the middle of June in an open field of *Delaware* grapes retarded the increase of the larval density by 10 days on shoots and 30 days on fruit clusters, and reduced the damage to fruit clusters. In experiments with other grapes, such as *Neo Muscat*, *Kyoho* and *Campbell Early*, damage to fruit clusters was affected by the density of *S. dorsalis* on fruit clusters during the first month after floral abscission (HENMI, 1972; MIYAHARA and YAMADA, 1978). In this study, larval density on fruit clusters in the sprayed plot was low from the middle of June to early July, within a month of floral abscission (in early June for *Delaware*). Perhaps damage to *Delaware* fruit clusters may also be reduced by suppression of larvae in the first month after floral abscission.

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Comparison of the Sex Pheromone System between Japanese and Thai Populations of the Potato Tuberworm Moth, *Phthorimaea operculella* (Lepidoptera: Gelechiidae)¹

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The potato tuberworm moth, *Phthorimaea operculella*, is a world wide pest of various plants including potato and tobacco. The sex pheromone of this species is composed of two components, (*E,Z,Z*)-4,7,10-tridecatrienyl acetate (triene) and (*E,Z*)-4,7-tridecadienyl acetate (diene) (PERSOONS et al., 1976). The glandular component ratio in each female adult is, however, widely variable in Japanese and American populations (ONO et al., 1990) and there is also

no optimal blend ratio of triene and diene for male response (ONO and ORITA, 1986). The component ratio in females of the Japanese population is known to be affected by temperature conditions (ONO, 1993, 1994). The authors obtained *P. operculella* from Thailand and compared the sex pheromone system between Japanese and Thai populations.

MATERIALS AND METHODS

P. operculella larvae of the Thai population were collected at a potato field in Chiangmai, Thailand, and reared with potato tuber under 25°C and a 14:10 LD photoregime.

The pre-conditioning of females at different temperatures was similar to that of ONO (1994). Female adults reared at 25°C were moved to each temperature condition (15, 25 and 35°C) before 12-h. Samplings were conducted at about 1 h before lights off of the second day. Glandular pheromone content of individual females was analyzed by GLC. The procedure of sample preparation, GLC equipment, and condition of analyses were basically same as those of ONO (1993).

Male response was examined by a simple method. Three or 4 males were introduced into a plastic container (9 cm dia. and 200 ml capacity). A piece of filter paper treated with the synthetic sex pheromone (purity: more than 90%) was inserted from a top opening (1 cm dia.) of the container after the moths became quiet.

Male behavior was recorded for 60 s from 30 s after filter paper insertion. Male responses were cat-

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