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Efficacy of Five Different Insecticides Against Citrus Leaf Miner *Phyllocnistis citrella* Stainton (Lepidoptera; Gracillariidae)

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Abstract: Studies on the efficacy of five different insecticide i.e. Thiodan 35 EC (Endosulfan), Actara 25 WG (Thiamethoxam), Match 050 EC (Lufenuron), Supracide 40 EC (Methiodethion) and Laser 25 EC (Dimethoate+Cypermethrin) were carried out against citrus leaf miner (*Phyllocnistis citrella* stnt) in April, 2002 at Agricultural Research Institute (ARI) Tarnab, Peshawar. The results revealed that after first application, Thiodan 35 EC proved to be the best insecticide followed by Actara 25 WG, Match 050 EC, Supracide 40 EC and Laser 25 EC with infestation of 2.70, 4.41, 5.67, 6.93 and 9.62% of leaf miner per 6" tender shoot, respectively. Wherein control, it was 19.84%. Similarly, after second spray the minimum percent infestation was recorded in Thiodan 35 EC followed by Actara 25 WG, Match 050 EC, Supracide 40 EC and Laser 25 EC as 2.41, 3.84, 5.15, 6.16 and 7.74%, respectively. Where in check it was recorded as 13.38%. Based on the present finding it could be suggested that Actara 25 WG and Thiodan 35 EC should be listed in the spray schedule for the control of citrus leaf miner.

Key words: Thiodan, Actara, Match, Supracide, Laser, citrus leaf miner

INTRODUCTION

Citrus (*Citrus* spp.) is one of the most important fruit crops of the world. In Pakistan it represents approximately 40% of all fruit crops and are mostly concentrated in Punjab and in the NWFP. The total cultivated area in Pakistan is 1,98,700 ha with a production of 18,97,700 tones. The total cultivated area in NWFP is 4,800 ha with a production of 40,200 tonnes[1]. Low yield and poor quality fruits are mainly due to the attack of many insect pests and several diseases but Citrus leaf miner is the most important one amongst these pests.

Citrus leaf miner (*Phyllocnistis citrella* Stainton) (Lepidoptera; Gracillariidae) is widely distributed throughout South East Asia, up to China, Korea and Japan and across the Philippines and Indonesia, to Papua New Guinea and the northern tip of Australia. In Africa it is only recorded from the Sudan.

The feeding larvae make broad serpentine galleries (mines) in the leaves, leaving a distinctive dark line of faecal pellets along the center of the tunnel. In young leaves the lamina folds over and twists, with a high degree of distortion; badly damaged leaves dry out and are clearly of little use photosynthetically[2]. Damage by the pest is serious on young leaves. The injured epidermis takes the shape of twisted silvery galleries. On the older leaves, brownish patches are formed which serve as foci of infection for citrus canker. The attacked leaves remain on the plants for a considerably long time and the pest gradually spreads to fresh leaves. Heavily attacked plants can be spotted from a distance and young nurseries are most severely affected and those of orange and grapefruit may not even survive. In the case of larger trees also their photosynthesis is adversely affected, vitality is reduced and there occurs an appreciable reduction in yield[3].

Chemical control of citrus leaf miner have been found affective by many researchers across the globe. Boulahia[4] found that Confidor (imidacloprid), Evisect (thiocyclam) and the mineral oil oleostec significantly reduced the pest population as compared to untreated plants.

Mixtures of various insecticides have also been evaluated and found effective against this pest. Rezk[5] concluded that a mixture of vertimec (abamectin) and mineral oil was the most effective combination for the control of Citrus leaf miner followed by a mixture of methomyl (lannate)+dimethoate, methomyl alone and dimethoate.

Keeping in view the great commercial importance of citrus fruit and importance of this pest in Pakistan, particularly in NWFP, the present study was conducted with the view to determine the efficacy of five different insecticides against citrus leaf miner.

MATERIALS AND METHODS

Selection of experimental plants: Twenty-eight citrus plants were selected at citrus orchard of Agricultural

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Table 1: The efficacy of five different insecticides

Trade name	Common name	Chemical group	Dose
Actara 25 WG	Thiamethoxam	Neonicotinoid	10 g/HLW
Match 050 EC	Lufenuron	I. G. R	60 mL/HLW
Supracide 40 EC	Methiodethion	Organophosphat	150 mL/HLW
Thiodan 35 EC	Endosulfan	Organochlorine	200 mL/HLW
Laser 25EC	Dimethoate+Cypermethrin	Pyrethroid+OP	200 mL/HLW

Research Institute (ARI) Tarnab. The experiment was laid out in Randomized Complete Block Design (RCBD) having six treatments including control. Each treatment consisted of three replicates. Between the treatments two plants were kept untreated to serve as buffer. Data were analyzed using F-test and DMR for means separation.

Population density/Infestation: For infestation of citrus leaf miner, number of leaves in the check and treated plots were counted. A leaf having even a single tunnel was considered as infested leaf. To determine infestation, the number of infested and non-infested leaves in treated and check plants were counted. Percent-infested leaves per plant were recorded on weekly basis and within 48 hours after insecticide application. Treatments were applied to the trees with fresh and uninfected leaves except for the laser and check plots where some leaf minor infestation was already existed.

Chemical control: Five different insecticides were applied along with one control to study their effectiveness in managing the pest's populations (Table 1).

RESULTS AND DISCUSSIONS

The efficacy of five insecticides namely Thiodan 35 EC, Actara 25 WG, Match 050 EC, Supracide 40 EC and Laser 25 EC was tested against citrus leaf miner (*Phyllocnistis citrella* stnt). The results of the experiment are presented in Table 1.

First spray: The post spray data recorded after first spray at 24 h and then with weekly intervals are presented in (Table 2). The data showed that after 24 h all the insecticides were significantly different from those of check plots.

The results of Thiodan, Actara and Match were non-significant to each other as in the three insecticides treated plots, percent infestation was zero. Similarly Supracide and Laser were statistically same, however, Supracide (0.60) had less percent infestation than Laser (2.76). The maximum percent infestation was recorded in control (7.23).

After first week all the treatments were found superior than control. Thiodan showed minimum (0.50% infestation/6" tender shoot) followed by Actara (2.30), Match (3.96), Supracide (5.06) and Laser (7.56). The highest percent infestation was recorded in control i.e. 12.27/6" tender shoot.

After second week, Thiodan proved to be the best treatment by having citrus leaf miner percent infestation of 2.06/6" fresh shoot followed by Actara (4.08), Match (5.76), Supracide (6.93) and Laser (9.96). The highest percent infestation occurred in check (18.97).

After third week the results of all the treatments were significant. The best one was Thiodan having minimum percent infestation of citrus leaf miner i.e. 3.66/6" shoot followed by Actara (5.80), Match (7.43), Supracide (8.50) and Laser (12.3). The maximum percent infestation was recorded in check (26.73). The results of Match (7.43) and Supracide (8.56) were somewhat similar and non-significant. However, Match treated plants were having fewer citrus leaf miner as compared to Supracide.

After fourth week, all the insecticides were significant to control. Thiodan showed less percent infestation of citrus leaf miner i.e. 7.30/6" tender shoot followed by Actara (9.90), Match (11.20), Supracide (12.73) and Laser (15.53) as compared to control (34.0). The percent infestation in Match and Supracide treated plots was non-significant, however, Match had lower percent infestation of citrus leaf miner than Supracide.

The first spray (overall means) revealed that Thiodan ranked first with 2.70% infestation per six inches tender shoot followed by Actara (4.41), Match (5.67), Supracide (6.93) and Laser (9.62) as compared to control (19.84). Means showed that all the insecticides were effective against citrus leaf miner as compared to control. Minimum percent infestation was recorded in Thiodan and maximum in control.

Second spray: The post spray data are presented in Table 3. After 24 h all the insecticides gave significant control of citrus leaf miner (*Phyllocnistis citrella*) than check. In Thiodan, Actara, Match and Supracide treated plots, no new infestation was recorded. Laser (1.91) was significantly different from the above four insecticides where as in check the percent infestation was found to be maximum than in treated plants i.e. 6.53/6" tender shoot.

Table 2: Percent infestation of citrus leaf miner per 6" tender shoot after first spray

Insecticides trade name	Common name	24 h	1st week	2nd week	3rd week	4th week	Overall mean 1st spray
Thiodan 35 EC	Endosulfan	0B	0.50E	2.06E	3.66D	7.30D	2.70D
Actara 25 WG	Thiamethoxam	0B	2.30DE	4.08D	5.80CD	9.90CD	4.41CD
Match 050 EC	Lufenuron	0B	3.96CD	5.76C	7.43C	11.20C	5.67BC
Supracide 40 EC	Methiodethion	0.60B	5.86BC	6.93C	8.56C	12.73C	6.93BC
Laser 25 EC	Dimethoate +Cypermethrin	2.76B	7.56B	9.96B	12.3B	15.53B	9.62B
Check		7.23A	12.27A	18.97A	26.73A	34.0A	19.84A

Means followed by the same letter(s) in a column are not significantly different from each other (p>0.05), using DMR test

Table 3: Percent infestation of citrus leaf miner per 6" tender shoot after second spray

Insecticides trade name	Common name	24 h	1st week	2nd week	3rd week	4th week	5th week	Overall mean 2nd spray
Thiodan 35 EC	Endosulfan	0C	0.33D	1.86E	3.26E	5.26E	7.60E	2.14F
Actara 25 WG	Thiamethoxam	0C	1.46CD	3.46D	5.86D	8.23D	9.86D	3.80DE
Match 050 EC	Lufenuron	0C	2.93C	5.93C	7.60C	9.33CD	11.27CD	5.15CD
Supracide 40 EC	Methiodethion	0C	4.74B	6.76BC	8.73BC	10.60C	12.30C	6.16BC
Laser 25 EC	Dimethoate+Cypermethrin	1.91B	5.20B	8.20B	10.13B	13.27B	15.80B	7.74B
Check		6.53 A	8.53A	13.27A	17.67A	20.73A	24.47A	13.38A

Means followed by the same letter(s) in a column are not significantly different from each other (p>0.05), using DMR test

After first week of the second spray, the percent infestation of citrus leaf miner was significantly lower as compared to the untreated plots. However, within insecticides, Thiodan and Actara ranked first and second in reducing citrus leaf miner infestation to 0.33 and 1.46, respectively. Match stood second while Supracide and Laser were collaborated as 3rd in ranking as compared to the control (8.53). It is cleared that the lowest percent infestation of *Phyllocnistis citrella* was noted in Thiodan and the highest in control (8.53).

After second week, data showed that the insecticides were significant with check. However, Thiodan ranked first in reducing the percent infestation of citrus leaf miner (1.86/6 inches tender shoot). 3.46, 5.93, 6.76 and 8.20% infestation was recorded in Actara, Match, Supracide and Laser treated plots, respectively. Maximum percent infestation were recorded from check i.e. 12.27/6" tender shoot.

After third week of spray all the insecticides proved better than check. Thiodan proved to be the best of all insecticides in reducing the percent infestation of citrus leaf miner to 3.26/6" tender shoot. Actara ranked second in reducing percent infestation to 5.86 followed by Match and Supracide having percent infestation of 7.60 and 8.73, respectively. Laser was significantly better than check having 10.13/6" shoot but not proving to be as good as the other four insecticides. Maximum percent infestation was recorded in check i.e. 17.67/6" shoot.

The data recorded after 4th week showed that 5.26% infestation/6" tender shoot was found in Thiodan treatment which is minimum of all insecticides followed by Actara (8.23), Match (9.33) and Supracide (10.60/6" shoot). Laser showed 13.27% infestation, which proved inferior to other insecticides. However, it gave good control than check, where 20.73% infestation was recorded.

For the residual effect data was also recorded on 5th week which revealed that all the insecticide were effective as compared to control. Thiodan was the best with 7.60% infestation, which is minimum followed by Actara (9.86), Match (11.27), Supracide (12.30) and Laser (15.80). The maximum percent infestation was recorded in check which was 24.47/ 6 inches shoot.

All the treatments were found superior than control in reducing the percent infestation of citrus leaf miner. Thiodan 35 EC was the best resulting in minimum percent infestation followed by Actara 25 WG, Match 050 EC, Supracide 40 EC and Laser 25 EC.

Su[6] applied four insecticides for the control of citrus leaf miner in Fujian, China. The results showed that 10% Admire (imidacloprid), 1.8% abamectin emulsion, 2.5% Grenade (cyhalothrin) and 20% carbosulfan were all effective (more than 90%) against the pest.

Overall the performance of Thiodan 35 EC ranked first followed by Actara 25 WG, Match 050 EC, Supracide 40 EC and Laser 25 EC. Chemical control have always been found effective against the citrus leaf miner. Verma and Phogat[7] carried out experiments on citrus in Uttar Pradesh, India. They concluded that soil drenching with lindane and foliar spray of monocrotophos and phosphamidon reduced the infestation of *P. citrella* by 87.52% and 85.86% and larval mortality by 98.14 and 95.93%, respectively.

The present study confirmed the efficacy of these insecticides against this major pest of citrus in Peshawar valley. As the time passes more and more new products are being introduced to the market which need close monitoring and evaluation. The present study was such an effort in which various insecticides were tested for their efficacy. The present studies also revealed that all the insecticides were effective in controlling the pest and were significantly better than the control. Based on the

present finding it could be suggested that Actara 25 WG and Thiodan 35 EC should be listed in the spray schedule for the control of citrus leaf miner.

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