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Research Article

Effect of different insecticides against citrus psylla, *Diaphorina citri* (Liviidae: Hemiptera) at Ari-Tarnab, Peshawar

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ABSTRACT

The Asian citrus psylla is one of the most serious pests of citrus, severely infest the leaves and young shoot. To evaluate the effectiveness of chemicals addressed against citrus psylla nymph and adult, the chemicals via Malathion, Lambda Cyhalothrin, Pyriproxifen and Polytrin-c were tested. Experiment was carried out in randomized complete block design with 5 treatment including control replicated three times. Results showed that after first spray, the lowest mean population was recorded in Polytrin-c (5.97) which was statistically non-significant with Lambda cyhalothrin (6.65) and maximum population was observed in control (18.41). After second spray lowest mean population was recorded in Lambda cyhalothrin (5.773) statistically non-significant with followed by Polytrin-c (6.86) and highest mean population was recorded in control (18.16). All the applied chemicals were dominant in suppressing the pest population. Application of Lambda cyhalothrin and Polytrin-c twice at 15 days' interval was noted fruitful in minimizing pest.

Keywords: Citrus plant; citrus psylla; polytrin-c; Peshawar.

INTRODUCTION

Asian citrus psylla (ACP), *Diaphorina citri* Kuwayama (Hemiptera: Psyllidae) is one the most annoying and destructive pest of citrus. It is responsible for the spread of huanglongbing (HLB) disease by acting as vector of bacterium, Candidatus Liberibacter asiaticus, (Halbert and Manjunath, 2004). HLB is a world known citrus disease which cause death and decline of infested trees (Bové, 2006). Citrus psylla in both its adult and nymphal stage targeted the buds cause softening of young shoot, leaves curling, defoliation and honey dew production which led to sooty mould fungus infection, results in dropping of premature fruits (Shah and Saleem, 2000). Heavy infestation results in leaves distortion which may cause plants death (Bove, 2006). Pakistan is among the top citrus growing countries worldwide. According to the Food and Agriculture Organization (FAO, 2020), citrus production in Pakistan has been increasing steadily over the years. In 2020, Pakistan produced about 2.5 M tons citrus fruits, proving it 11th largest producer of citrus globally. Citrus fruits are grown in different regions of Pakistan, with Punjab being the largest producer, followed by Sindh, Khyber Pakhtunkhwa, and Baluchistan. The citrus trees are highly infested by citrus psylla, accounts for lowering production.

The soil and foliar application of chemicals play an important role in managing the disease and insect pest infestation (McCoy et al., 2009). The adult stage of psyllids is mostly visible to application of foliar spray than immature stage. They are also accountable for the spread of bacterium to the health trees (Stansly and Qureshi, 2008).

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Pesticides are rapid in action and have knockdown effect, therefore are extensively used against majority of the insect pests. Several research studies described the efficiency of pesticides in controlling citrus psyllid (Monzo et al., 2014; Khan et al., 2013; McKenzie et al., 2004). The extensive use of pesticides employs a pressure in selecting appropriate chemical poison against the pest (Singh and Yadav, 2018). Therefore, the current investigation was done to appraise the effective and economical chemical poison for the management citrus psylla in the field condition.

MATERIALS AND METHODS

Selection of Plants and Population Density

This experiment was conducted at Agriculture Research Institute Tarnab, Peshawar, during 2022-23. The experiment was designed as RCBD having 05 treatments including control (untreated plants), replicated 03 times. Four reference points (north, south, east and west) having pest infestation were selected randomly. The pest was recorded on 3 leaves of selected branch (total 12 leaves/ tree). Invasion was detected equally on lower and upper leaf surfaces. High infestation was observed in the month of October.

Chemical control

Four insecticides (Malathion, Lambda Cyhalothrin, Pyriproxifen and Polytrin-c) were sprayed at their recommended dose at morning time. Two sprays were given during peak infestation at 21 days interval. Four liters of spray were used per tree as shown in Table (1).

Parameters

1. Mean number of citrus psylla adults per leaf.
2. Percent decrease in mean population over control.

Data analysis

Statistix 8.1 was used to analyze the data and the ANOVA was calculated. Treatment means were separated by using LSD test at 5% level of probability.

RESULTS AND DISCUSSION

Table (1) indicated that before spray application the data recorded was non-significant. After 1st day of spray application, the lowest number of pests was noted in Polytrin-c (8.183) which was statistically non-significant to Lambda cyhalothrin (8.383), Malathion (10.41) and Pyriproxifen (11.33). The highest number of pests was noted control (18.00). After 2nd day of spray the pest population was lowest in Lambda cyhalothrin (5.60), statistically similar with Polytrin-c (6.16) and Malathion (7.50). The highest pest population was recorded in control (19.08). Similar trend was observed after 3rd day of spray application with Lambda cyhalothrin showing lowest pest population (4.58), statistically similar with Polytrin-c (5.55) and Malathion (6.08) while the highest population was noted in control (19.0). After 7 days of treatments, Polytrin-c showed lowest pest population (1.75) which was non-significant with Lambda cyhalothrin (2.75) and Malathion (3. 41). The highest population was observed in control (18.58). Data recorded after 14 days of treatments application showed that Polytrin-c and Lambda cyhalothrin recorded lowest pest population (0.58) followed by Malathion (3.66). The highest pest population was recorded in control (17.41). Data recorded after 21 days showed that Polytrin-c recorded lowest number of pest (0.66) which was non-significant with Lambda cyhalothrin (1.15) while the highest pest population was noted in control (18.10), Overall mean data showed that Polytrin-c recorded lowest pest population (5.79), non-significant with Lambda cyhalothrin (6.65) and Malathion (7.24) while the untreated plot recorded highest pest population (18.41).

Table 1. Mean number of Citrus psylla population per plant after 1st spray application.

Treatment	DBS	1 DAS	2 DAS	3 DAS	7 DAS	14 DAS	21 DAS	Mean
Malathion	16.807	10.41 B	7.50C	6.08C	3.41C	3.66C	2.83C	7.24 C
Lambda Cyhalothrin	23.537	8.383 B	5.60C	4.58C	2.75CD	0.58D	1.16D	6.65 C
Pyriproxifen	18.55	11.33 B	11.91B	9.33B	6.25B	7.08B	6.08B	10.07B
Polytrin-C	18.183	8.183 B	6.16C	5.55C	1.25D	0.58D	0.66D	5.79C
Control	18.75	18.00 A	19.08A	19.0A	18.58A	17.41A	18.10A	18.41A
LSD	2.144	3.313	2.124	2.566	1.774	1.4	1.621	1.591
CV	5.94	15.62	11.22	15.3	14.61	12.68	14.93	8.77

Table (2) showed that after 1 days of spray, highest percent mortality was recorded in Polytrin-c (53.05), statistically similar with Lambda cyhalothrin (52.45) while the lowest % mortality was recorded in Pyriproxifen (34.43). After 2nd day of treatment application, % mortality was observed maximum in Lambda cyhalothrin (72.82) which was non-significant with Polytrin-c (70.13) while the lowest mortality was observed in Pyriproxifen (43.59). Data after 3 days indicated that highest % mortality was recorded in Lambda cyhalothrin (80.31), statistically in line with Polytrin-c (74.89) and Malathion (73.29). The lowest % mortality was noted in Pyriproxifen (58.24). Data observed after 7 days indicated that Polytrin-c recorded maximum % mortality (93.95) while minimum % mortality was observed in Pyriproxifen (72.02). After 14 days of spray, % mortality was recorded highest in Polytrin-c (96.80) which was non-significant with Lambda cyhalothrin (96.75) while Pyriproxifen recorded lowest % mortality (61.21). Data recorded after 21 days showed that Polytrin-c was found best having maximum % mortality (96.48) which was statistically similar with Lambda cyhalothrin (93.92). The minimum % mortality was recorded in Pyriproxifen (68.75). Overall mean data showed that Polytrin-c was found fruitful with % mortality (71.09), statistically similar with Lambda cyhalothrin (66.84). Pyriproxifen was found least effective having % mortality (49.62).

Table 2. Percent mortality after first spray application in different days interval.

Treatments	1 DAS	2 DAS	3 DAS	7 DAS	14 DAS	21 DAS	Mean
Malathion	42.06ab	65.05b	73.29a	84.88b	79.72b	85.74b	64.30b
Lambda Cyhalothrin	52.45a	72.82a	80.31a	86.85b	96.75a	93.92a	66.84ab
Pyriproxifen	34.43b	43.59c	58.24b	72.02c	61.21c	68.75c	49.62c
Polytrin-C	53.05a	70.13ab	74.89a	93.95a	96.80a	96.48a	71.09a
CV	16.60	5.25	8.46	9.06	11.01	9.98	5.34

Table (3) indicated that maximum number of pests was recorded in untreated plot (18.58) and pyriproxyfen (18.33) was found non-significant, while the lowest was recorded in Lambda cyhalothrin (10.75). Due to this high infestation 2nd spray application was initiated. After 1-day treatment application, Lambda cyhalothrin recorded minimum pest population (9.91), statistically similar to Malathion (11.33) and Polytrin-c (11.41) respectively. The highest population was recorded in control (18.25). After 2 and 3 days of spray, same trend was noted as Lambda showed minimum pest population (7.50, 5.70) which was non-significant with Malathion (8.41, 6.58) and Polytrin-c (9.66, 7.00) respectively. Maximum pest population was noted in control (18.33, 18.41). Data recorded after 7 days indicated that Lambda cyhalothrin and malathion recorded minimum pest population (4.75) each respectively, which was statistically similar with Polytrin-c (5.58) and Pyriproxifen (6.16). The highest pest population was observed in control (18.08). After 14 days of spray, Lamda cyhalothrin showed minimum number of pest (0.58), statistically similar with Polytrin-c (0.75) followed by Malathion (3.66). The maximum pest population was recorded in control (17.41). After 21 days of treatment application, pest population was observed less in Polytrin-c (0.66) which was statistically similar with Lambda cyhalothrin (1.16) followed by Malathion (2.75) respectively. The highest pest population was observed in control (18.10). Overall mean data showed that, Lambda cyhalothrin was found fruitful with lowest pest population (5.77) which was non-significant with Polytrin-c (6.86) and Malathion (7.44) while the highest pest population was observed in control (18.16).

Table 3. Mean number of *Citrus psylla* population per plant after 2nd spray application.

Treatment	DBS	1 DAS	2 DAS	3 DAS	7 DAS	14 DAS	21 DAS	Mean
Malathion	14.58B	11.33C	8.41BC	6.587BC	4.75B	3.66C	2.75C	7.440C
Lambda cyhalothrin	10.75C	9.91C	7.50C	5.750C	4.75B	0.58D	1.16D	5.773C
Pyriproxifen	18.33A	14.58B	10.83B	8.333B	6.16B	6.83B	6.00B	10.15B
Polytrin-c	12.93BC	11.41C	9.66BC	7.00BC	5.58B	0.75D	0.66D	6.86C
Control	18.58A	18.25A	18.33A	18.41A	18.08A	17.41A	18.10A	18.16A
LSD	2.542	3.095	2.6053	2.3237	1.8671	1.3216	1.5502	1.9148
CV	8.98	12.55	12.64	13.39	12.61	12	14.35	10.51

Table (4) revealed that after 2nd spray application on day 1, the highest % mortality was observed in Lambda cyhalothrin (45.47), found non-significant with Malathion (38.14) and Polytrin-c (36.61). The lowest % mortality was observed in Pyriproxifen (31.07). After 2 days of spray, mortality was highest in Lamba cyhalothrin (58.91), statistically similar with

Malathion (53.99) and Polytrin-c (46.63) respectively. The lowest % mortality was noted in Pyriproxifen (40.02). Data recorded after 3 days indicated that Lambda cyhalothrin (68.43), Malathion (64.29) and Polytrin-c (61.47) displayed highest % mortalities, which was found non-significant. The Minimum % mortality was noted in Pyriproxifen (54.12). Data observed after 7 days revealed that Malathion and Lambda cyhalothrin displayed highest % mortality (73.68 and 73.50) while the lowest mortality was observed in Pyriproxifen (65.70). After 14 days of spray, Lambda cyhalothrin found highest % mortality (96.61), statistically similar with Malathion (78.82). Lowest % mortality was noted in Pyriproxifen (60.54). After 21 days of spray application, highest % mortality was observed in Polytrin-c (96.26), found non-significant with (93.48) while the lowest % mortality was noted in Pyriproxifen (66.67). Overall mean data showed that Lambda cyhalothrin found fruitful with maximum % mortality (68.10), statistically similar with Polytrin-c (61.87). The lowest % mortality was noted in Pyriproxifen (43.60).

Table 4. Percent mortality after Second spray application in different days interval.

Treatments	1 DAS	2 DAS	3 DAS	7 DAS	14 DAS	21 DAS	Mean
Malathion	38.14ab	53.99a	64.29a	73.68a	78.82b	84.78b	59.04b
Lambda Cyhalothrin	45.47a	58.91a	68.43a	73.50a	96.61a	93.48a	68.10a
Pyriproxifen	31.07b	40.02b	54.12b	65.70c	60.54c	66.67c	43.60c
Polytrin-C	36.61ab	46.63ab	61.47ab	68.92b	95.73a	96.26a	61.87ab
CV	18.42	13.40	6.82	8.95	9.54	11.23	7.09

In Pakistan, citrus psylla proved to be the most damaging pest (Abbas, 2001). Its infestation can cause defoliation and dropping of fruit at prematurity (Shah and Saleem, 2000). Psyllids infestation mainly observed in September, June and April (Sharma, 2008). For the control of insect pest, 4 chemical poisons were investigated in the field among which pyriproxyfen was noted least efficient. All the treatments during 1st week of application lowered the pest by 90% (Rao and Shivankar, 2011). After 30 days of spray, the efficiency of the treatments was reduced to 70%. The application of lambda cyhalothrin and polytrin-c twice at 15 days interval were noted fruitful in minimizing pest (Shivankar *et al.,* 2000) The current figures indicated the dominance of polytrin-c against psyllids population after both sprays at 3 to 7 days. These figures are in line with Farmanullah and Gul (2005) and Sharma (2008). These findings are also in evidence with Setamou *et al.* (2010) and Shuvankar *et al.* (2000), which showed the complete destruction of the pest at 7 days after spraying. Polytrin-c was followed by lambda cyhalothrin in managing pest population after both sprays at 7 days. lambda in assessment with methomyl and lambda + neem solution after 4 days, displayed complete pest mortality (Khan *et al.,* 2012). The poison after 14 days tremendously lowered the pest attack on grapefruit leaf tissues (Setamou *et al.,* 2010). Lambda was trailed by malathion in reducing the pest at two weeks interval after the application of both sprays. The current study concluded that all the treated poisons significantly lowered the pest population.

CONCLUSION AND RECOMMENDATIONS

From the above study, it was concluded that all the selected treatments were effective in reducing pest population. Lambda cyhalothrin and Polytrin-c was found in minimizing pest population after 1st and 2nd spray application. It is therefore recommended that these treatments should be thoroughly used in various other climatic conditions for effective control of the pest.

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