**Seasonal incidence and management of Pear Psylla (*Cacopsylla pyricola* Foerster, Hemiptera, Psyllidae) in Kashmir**

|  |  |
| --- | --- |
|  | ABSTRACT |
|  | Pear *(Pyrus communis*) is an important fruit crop cultivated worldwide, including the temperate regions of India, particularly Jammu and Kashmir. Pear Psylla (*Cacopsylla pyricola* (Foerster) has emerged as a significant pest, causing substantial losses by stunting tree growth, reducing fruit size leading to premature leaf drop. The present study investigated the influence of various abiotic factors such as temperature, humidity and rainfall on the seasonal incidence and population dynamics of Pear Psylla in four locations from two districts *viz*., Baramulla and Srinagar, Kashmir. Regular pest monitoring and meteorological data revealed that maximum and minimum temperatures had a positive correlation with Pear Psylla populations while rainfall and maximum relative humidity were negatively correlated. Regression analysis showed that these climatic factors accounted for up to 95% of the variation in pest populations. The results of the evaluation of different insecticides revealed that cyantraniliprole 10.26% OD with an efficacy of 92.74%, proved to be the most effective followed by Acetamiprid 20% SP (90.87%). These findings highlighted that the optimal temperature range for psylla development was between 27°C and 29°C suggesting that the weather conditions played a crucial role in fluctuating pest population and can govern the integrated pest management strategies. |

KEYWORDS: *Cacopsylla pyricola ,*Pear psylla ,Seasonal activity, Abiotic factor, Weather, Bioefficacy, Insecticide

1. INTRODUCTION

Pear (*Pyrus communis* L*.*) is a widely cultivated fruit tree species from the Rosaceae family. It is highly valued for its delicious and nutritious fruits making it a prevailing preference for fresh consumption and processing of various products. Pear cultivation has a long history with evidence dating back thousands of years in regions such as China and Europe (Wu *et al*., 2019). Over time, the cultivation of pear has spread to different parts of the world due to their adaptability to a wide range of climatic conditions.

Since prehistoric times, pear has been utilized as food, making them the second most significant fruit in the temperate region (Civolani, 2012). There are around 3,000 cultivars and over 20 main species; however, the majority of commercial variations are European or common pears (*Pyrus communis*).

Pears are the second most renowned temperate fruit in India in terms of both production and area. India ranks 6th in the world for pear production, with a total annual production of approximately 3,12,5000 metric tons in 2023.Pears are the second most popular fruit in Jammu and Kashmir, after apples and they are produced on 14,161 hectares of land with an 81,628 MT yield District Budgam is the largest producer of pear 15,909MT (Anonymous, 2021).

Many pests *viz.,* San Jose scale (*Quadraspidiotus perniciosus* (Comstock), the pear leaf blister mite (*Eriophyes pyri* (Pagenstecher)*,* the codling moth (*Cydia pomonella* (Linnaeus), the cotton aphid (*Aphis gossypii* (Glover) and the Pear Psylla (*Cacopsylla pyricola*), prey on pears in Jammu and Kashmir. In India's pear-growing regions, including Jammu and Kashmir, Pear Psylla is an emerging pest (Ahmad *et al.,* 2020). Pear Psylla produces the honeydew that promotes fruit russet and severe infestations can cause trees to droop and lose their leaves.

Psyllids, sometimes known as jumping plant lice (Chinery, 1993), are tiny, phloem-feeding insects that are members of the Psyllidae family and order Hemiptera. There have been reports of over 150 psyllid species as possible pests of temperate and subtropical plants grown in cultivation (Buckhardt, 1994). The pear psylla, or *Cacopsylla pyricola*, is a significant economic pest of pears. It was initially discovered in Connecticut in 1832 and brought to the United States (Pettit and Hutchison 1931). It is believed that Asia Minor or southern Europe is where the pest first appeared (Burts, 1970).

Pear psylla produces severe production losses at high densities by stunting trees, reducing fruit size, causing early fruit drop, and causing premature leaf drop (Burts, 1970; Westigard and Zwick, 1972). A toxin in the saliva of feeding nymphs is the cause of these symptoms, which have come to be known as "psylla shock" (Beers *et al*., 1993). Foliage experiences blackening and scorching, skin to the harm inflicted by webspinning mites. The adult pear psylla is ultimately responsible for transmitting the mycoplasma like bacterium that causes pear decline disease (Lindner *et al.,* 1961; Jensen *et al*., 1964) to trees through feeding (Hibino and Schneider, 1970). Pear psylla is a very challenging pest to eradicate and prompt and effective sampling of adults and immatures is necessary for effective treatment (Brunner, 1982). However, repeated applications of broad-spectrum insecticides with similar modes of action may result in the development of resistance (Saha and Mukhopadhyay 2013) and less effective control. To overcome the problems of resistance, the identification of new chemical molecules with better insecticidal properties and lower dosage with selective action is a continuous and effective process against insect pests in different crop ecosystems (Chandi *et al*., 2016).

Pear is an important commercial fruit crop of Jammu and Kashmir after apple and because of the serious dimensions of pear psylla not only as a pest but also as a vector it is necessary to work out the seasonal incidence of this pest and also to find out the field efficacy of the newer insecticides for the management of the said pest In view of the economic importance of Pear in Jammu and Kashmir and the damage caused by this pest, the studies were conducted to determine the seasonal incidence and management of Pear psylla.

1. **MATERIALS AND METHODS**

**2.1 Seasonal Incidence**

Seasonal incidence of Pear Psylla was carried out in two districts of Kashmir (Baramulla and Srinagar) with two locations from each district. From district Srinagar (1589 m a.s1), Harwan and Shalimar and from district Baramulla (1593 m a.s1), Nihalpora and Palhallan were selected. To study the seasonal incidence, data was recorded at fortnightly intervals starting from 20th SMW (Standard Meteorological Week) to 34th SMW on 10 randomly selected trees from each location. The Pear Psylla adults were collected and counted by a beating tray method and the different immature stages of Pear Psylla were monitored/counted by selecting a 1foot branch length and were tagged from individual trees from all four quadrants. The tagged pear trees were maintained free of chemical pesticides. Data on major abiotic factors such as maximum/minimum temperature, maximum/minimum relative humidity and rainfall were collected and the influence of weather parameters on incidence of pest were worked. To work out the impact of such abiotic factors and the buildup of the pest, meteorological data were procured from Meteorological departments of respective locations.

**2.2 Correlation analysis**

Correlation analysis was performed between weather parameters (maximum/minimum tempeature, maximum/minimum relative humidity and rainfall) and the incidence of Pear Psylla at each location. This approach aimed to determine the role of climatic factors in the buildup and fluctuation of pest populations. The correlation coefficient and regression coefficient analysis were carried out by using SAS Software (SAS Instue.1998).

**2.3 Bioefficacy of Newer Insecticides**

For management studies, experiment was carried out in a pear orchard at FOH, SKUAST-Kashmir in a randomized block design. There were six treatments and each treatment was replicated four times. Four newer insecticide molecules *viz*., Cyantraniliprole 10.26% OD, Flubendiamide 20% WG, Acetamiprid 20% SP and Spinosad 45% SC were evaluated in terms of their efficacy against *Cacopsylla* *pyricola* and were compared with Standard Check (Dimethoate 30% EC). Pre and post-count treatments were taken per 5cm twig length randomly from four directions of the tree a day before spraying and after the 3rd, 7th, and 14 days after spraying. The efficacy of treatments was calculated according to the equation of [Henderson and Tilton (1955)](https://www.sciencedirect.com/science/article/pii/S2090989614000083#b0045). The data was converted into percent pest reduction over control using the conversion formula and then analyzed using the ANOVA procedure.

[**Henderson and Tilton**](https://www.sciencedirect.com/science/article/pii/S2090989614000083#b0045) **formula**:

|  |  |  |  |
| --- | --- | --- | --- |
| Corrected % reduction in insect pest population | 1- | (n in Co. before treatment × n in T after treatment) | × 100 |
| (n in Co. after treatment × n in T before treatment) |

n = Insect pest population, Co. = control, T=treated

3 RESULTS

* 1. Seasonal Incidence

3.1.1 Seasonal Incidence of Pear Psylla on Pear . . in District Baramulla

The data presented in Table-1 revealed that the lowest incidence of nymph and adult (10.85) was observed in the 20th SMW and the highest as 44.30 in the 24th SMW. The mean pest incidence showed an increasing trend from 20th (10.85) to 24th (44.30) SMW. The mean pest incidence declined to 36.30 in the 26th SMW and then increased to 42.25 in the 28th SMW. The mean incidence decreased thereafter from 35.30 in the 30th SMW to 26.00 in the 34th SMW.

**3.1.2 Seasonal Incidence of Pear Psylla on Pear in District Srinagar**

Perusal of data, Table-2 revealed that the lowest incidence of nymph and adult (6.55) was observed in the 20th SMW and the highest as 34.30 in the 24th SMW. The mean pest incidence showed an increasing trend from 20th (6.55) to 24th (34.30) SMW. The mean pest incidence declined to 29.05 in the 26th SMW and then increased to 33.50 in the 28th SMW. The mean incidence decreased thereafter from 29.85 in the 30th SMW to 14.45 in the 34th SMW.

**Table 1: Seasonal incidence of Pear Psylla (*Cacopsylla pyricola*) on pear at different locations in district Baramulla during the year 2023**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Baramulla** | **Standard Meteorological Weeks (SMW)** | | | | | | | | | | | | | | | | **Mean** | | **Overall**  **Mean** | |
| **20 SMW** | | **22 SMW** | | **24 SMW** | | **26 SMW** | | **28 SMW** | | **30 SMW** | | **32 SMW** | | **34 SMW** | |  |  | |
| **Nymph** | **Adult** | **Nymph** | **Adult** | **Nymph** | **Adult** | **Nymph** | **Adult** | **Nymph** | **Adult** | **Nymph** | **Adult** | **Nymph** | **Adult** | **Nymph** | **Adult** |
| **Palhallan** | 10.2 ± 2.85 | 1.9 ± 0.99 | 18.6 ± 4.97 | 4.1 ± 0.87 | 39.2 ± 1.75 | 7.3 ± 1.76 | 32.8 ± 2.57 | 6.6 ± 1.34 | 36.9 ± 2.46 | 8.9 ± 1.19 | 30.6 ± 1.89 | 7.0 ± 0.66 | 27.8 ± 6.01 | 5.1 ± 0.99 | 24.1 ± 2.23 | 3.9 ± 0.99 | **33.12** | **30.76** | |
| **Nihalpora** | 8.1 ± 33 | 1.5 ± 1.08 | 14.6 ± 2.11 | 2.9 ± 0.73 | 35.9 ± 3.81 | 6.2 ± 0.78 | 28.0 ± 6.64 | 5.2 ± 0.42 | 32.1 ± 2.47 | 6.6 ± 0.51 | 28.3 ± 3.19 | 4.7 ± 0.48 | 25.9 ± 3.81 | 3.2 ± 1.47 | 21.8 ± 2.65 | 2.2 ± 0.42 | **28.40** |
| **Mean** | **10.85** | | **20.10** | | **44.30** | | **36.30** | | **42.25** | | **35.30** | | **31.00** | | **26.00** | | **30.76** |

**\*Each figure is a mean of 10 replication**

**Population count was taken on a 1ft branch**

## **Table 2: Seasonal incidence of Pear Psylla (*Cacopsylla pyricola*) on pear at different locations in district Srinagar during the year 2023**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Srinagar** | **Standard Meteorological Weeks (SMW)** | | | | | | | | | | | | | | | | **Mean** | **Overall**  **Mean** | |
| **20 SMW** | | **22 SMW** | | **24 SMW** | | **26 SMW** | | **28 SMW** | | **30 SMW** | | **32 SMW** | | **34 SMW** | |  |  |
| **Nymph** | **Adult** | **Nymph** | **Adult** | **Nymph** | **Adult** | **Nymph** | **Adult** | **Nymph** | **Adult** | **Nymph** | **Adult** | **Nymph** | **Adult** | **Nymph** | **Adult** |
| **Harwan** | 6.3 ± 1.56\* | 1.5 ± 1.08 | 12.8 ± 2.29 | 2.2 ± 0.63 | 30.6 ± 3.16 | 5.0 ± 1.05 | 26.3 ± 3.33 | 4.0 ± 0.66 | 29.5 ± 3.13 | 6.4 ± 1.17 | 27.7 ± 1.82 | 5.5 ± 1.08 | 22.1 ± 3.03 | 3.3 ± 1.15 | 15.3 ± 5.57 | 2.1 ± 0.73 | **25.07** | **22.87** |
| **Shalimar** | 4.2 ± 0.63 | 1.1 ± 0.99 | 8.1 ± 1.96 | 1.8 ± 0.63 | 28.8 ± 4.10 | 4.2 ± 1.03 | 24.3 ± 2.90 | 3.5 ± 0.84 | 25.5 ± 4.19 | 5.6 ± 1.42 | 23.3 ± 3.36 | 3.2 ± 0.63 | 18.1 ± 4.53 | 2.2 ± 0.42 | 10.3 ± 2.86 | 1.2 ± 0.42 | **20.67** |
| **Mean** | **6.55** | | **12.45** | | **34.30** | | **29.05** | | **33.50** | | **29.85** | | **22.88** | | **14.45** | | **22.87** |

**\*Each figure is a mean of 10 replication**

**Population count was taken on a 1ft branch**

* 1. **Effect of various abiotic factors on the fluctuation of Pear Psylla**

**3.2.1 Effect of various abiotic factors on the fluctuation of Pear Psylla population in district Baramulla**

Perusal of data, Table 3 and Figure 1 revealed that the population of Pear Psylla at Palhallan and Nihalpora exhibited a positive correlation with maximum and minimum temperatures, with correlation coefficients of 0.73 & 0.65 and 0.77 & 0.68 for nymphs respectively. The correlation coefficient for adults was 0.72 & 0.56 and 0.58 & 0.41, respectively, indicating the significant influence of these factors on population fluctuations. Conversely, rainfall weas negatively correlated, with coefficients of -0.37 &-0.42 for nymphs and -0.26 & -0.24 for adults respectively. Maximum relative humidity for nymphs was -0.37 & -0.36 and -0.10 &-0.14 for adults respectively. However, minimum relative humidity showed a positive correlation with coefficients of 0.59 & 0.60 for nymphs and 0.60 & 0.42 for adults respectively.

Perusal of data, Table 4 and Figure 1 revealed the relationships between meteorological and Pear Psylla populations (nymphs and adults) at Palhallan and Nihalpora, using the coefficient of determination (R²) and prediction equations to quantify these interactions. At Palhallan and Nihalpora, the R² value for the nymphs population was 0.80 and 0.82 indicating that 80% and 82% of its variation could be explained by meteorological variables, while for adults, the R² value was 0.77 and 0.62, explaining 77% and 62% of the variation.

**3.2.2 Effect of various abiotic factors on the fluctuation of Pear Psylla population in districts Srinagar**

Perusal of data, Table 5 and Figure 2 revealed that the population of Pear Psylla at Harwan and Shalimar exhibited a positive correlation with maximum and minimum temperatures, with correlation coefficients of 0.58 & 0.58 and 0.51 & 0.51 for nymphs respectively. The correlation coefficient for adults was 0.51 & 0.42 and 0.33 & 0.26, respectively, indicating the significant influence of these factors on population fluctuations. Conversely, rainfall was weekly correlated, with coefficients of 0.26 &0.31 for nymphs and 0.10 & 0.17 for adults respectively. Maximum relative humidity for nymphs was -0.64 & -0.72and -0.55 &-0.62 for adults respectively. However, minimum relative humidity showed a negative correlation with coefficients of -0.04 & -0.09 for nymphs and -0.04 & 0.03 for adults respectively.

Perusal of data, Table 6 and Figure 2 revealed the relationships between meteorological and Pear Psylla populations (nymphs and adults) at Harwan and Shalimar, using the coefficient of determination (R²) and prediction equations to quantify these interactions. At Harwan and Shalimar, the R² value for the nymphs population was 0.94 and 0.95 indicating that 94% and 95% of its variation could be explained by meteorological variables, while for adults, the R² value was 0.78 and 0.75, explaining 78% and 75% of the variation.

### Table 3: Correlation Coefficient between Pear Psylla (*Cacopsylla pyricola*) and abiotic factors in district Baramulla

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Correlation Coefficient (r)** | | | | |
| **Parameters** | **Palhallan** | | **Nihalpora** | |
| **Nymph** | **Adult** | **Nymph** | **Adult** |
| **Max. Temp. (oC)** | 0.73\* | 0.72\* | 0.77\* | 0.58\* |
| **Min. Temp. (oC)** | 0.65\* | 0.56\* | 0.68\* | 0.41 |
| **Rainfall (mm)** | -0.37 | -0.26 | -0.42 | -0.24 |
| **Max. RH** | -0.37 | -0.10 | -0.36 | -0.14 |
| **Min. RH** | 0.59\* | 0.60\* | 0.60\* | 0.42 |

**\*Population count was taken on a 1ft branch**

**Table 4: Regression coefficients between the abiotic factors and Pear Psylla (*Cacopsylla pyricola*) in district Baramulla**

|  |  |  |  |
| --- | --- | --- | --- |
| **Coefficient of determination**  **(R2)** | | | **Prediction equation** |
| **Palhallan** | Nymph | 0.80 | Y=257.13-0.04X1-4.93X2-16.17X3-4.39X4+5.46X5 |
| Adult | 0.77 | Y=40.84-0.15X1-1.78X2-5.41X3 - 0.99X4+1.88X5 |
| **Nihalpora** | Nymph | 0.82 | Y=119.71+1.45X1-1.50X2-5.12X3 – 2.23X4+1.97X5 |
| Adult | 0.62 | Y=60.97-0.39X1-1.91X2-6.08X3 – 1.15X4+1.93X5 |

**Y= No. of psyllids/shoot**

**X1=Maximum Temperature (oC)**

**X2=Minimum Temperature (oC)**

**X3= Rainfall (mm)**

**X4= Maximum Relative Humidity**

**X5=Minimum Relative Humidity**

**Fig. 1: Population build-up of Pear Psylla (*Cacopsylla pyricola* Foerster) in relation to some abiotic factors in Baramulla**

### Table 5: Correlation Coefficient of Pear Psylla (*Cacopsylla pyricola*) and abiotic factors in district Srinagar

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Correlation Coefficient (r)** | | | | |
| **Parameters** | **Harwan** |  | **Shalimar** | |
| **Nymph** | **Adult** | **Nymph** | **Adult** |
| **Max. Temp. (oC)** | 0.58\* | 0.51\* | 0.51\* | 0.33 |
| **Min. Temp. (oC)** | 0.58\* | 0.42 | 0.51\* | 0.26 |
| **Rainfall (mm)** | 0.26 | 0.10 | 0.31 | 0.17 |
| **Max. RH** | -0.64\* | -0.55\* | -0.72\* | -0.62\* |
| **Min. RH** | -0.04 | -0.04 | -0.09 | 0.03 |

**\*Population count was taken on a 1ft branch**

### Table 6: Regression coefficients between the abiotic factors and Pear Psylla (*Cacopsylla pyricola*) in district Srinagar

|  |  |  |  |
| --- | --- | --- | --- |
| **Coefficient of determination**  **(R2)** | | | **Prediction equation** |
| **Harwan** | Nymph | 0.94 | Y=110.08-0.10X1+1.67X2-0.12X3 -1.34X4+0.13X5 |
| Adult | 0.78 | Y=9.42+0.25X1+0.10X2-0.00X3 -0.19X4+0.04X5 |
| **Shalimar** | Nymph | 0.95 | Y=162.57-1.21X1+2.15X2-0.21X3 -1.62X4+0.01X5 |
| Adult | 0.75 | Y=3.29+0.38X1-0.06X2+0.03X3 -1.15X4+0.05X5 |

**Y= No. of psyllids/shoot**

**X1=Maximum Temperature (oC)**

**X2=Minimum Temperature (oC)**

**X3= Rainfall (mm)**

**X4= Maximum Relative Humidity**

**X5=Minimum Relative Humidity**

**Fig. 2: Population build-up of Pear Psylla (*Cacopsylla pyricola* Foerster) in relation to some abiotic factors in Srinagar**

**3.3**  **Bioefficacy of various insecticides against Pear Psylla (*Cacopsylla pyricola*) on pear**

Perusal of data Table 7 and Figure 3 revealed the findings from a field experiment that assessed the effectiveness of several newer groups of insecticides on pear psylla documented that Cyantraniliprole proved to be the most effective with an efficacy of 92.74%. The next effective treatment was Acetamiprid, reducing the population by 90.87 percent compared to that of the control group. Dimethoate and Spinosad, with percent population reductions of 89.70 and 82.43 percent, respectively were next effective treatment. However, Flubendiamide proved to be the least successful treatment with an efficacy of 77.20 percent.

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### Table 7: Bioefficacy of various insecticides in population reduction of Pear Psylla (*Cacopsylla pyricola*) at FOH, SKUAST-K, Shalimar during the year 2023

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Treatments** | **Insecticide Used** | **Dosage (ml/g per litre)** | **Pre-treatment count** | **Percent pest reduction**  **Days after treatment** | | | **Overall Mean** |
| **3 DAT** | **7 DAT** | **15 DAT** |
| **T1** | **Cyantraniliprole**  **(10.26%OD**) | 1.2 | 18.25  (25.29) | **90.03**  **(71.59)e** | **92.37**  **(73.96)d** | **95.84**  **(78.23)d** | **92.74**  **(74.59)** |
| **T2** | Flubendiamide  (20%WG) | 0.12 | 1850  (25.47) | 73.36  (58.92)a | 77.41  (61.62)a | 80.84  (64.04)a | **77.20**  **(61.47)** |
| **T3** | Acetamiprid  (20%SP) | 0.15 | 19.25  (26.02) | 89.19  (70.80)d | 91.32  (72.86)c | 92.11  (73.68)c | **90.87**  **(72.41)** |
| **T4** | Spinosad  (45% SC) | 0.25 | 16.50  (23.96) | 79.52  (63.09)b | 83.12  (65.74)b | 84.65  (66.93)b | **82.43**  **(65.25)** |
| **T5** | Dimethoate  (30% EC) | 1.0 | 18.75  (25.65) | 86.13  (68.13)c | 91.09  (72.63)c | 91.90  (73.46)c | **89.70**  **(71.28)** |
| **T6** | Control (water) | **-** | 19.50  (26.20) | 18.75  (25.65) | 17.50  (24.72) | 19.25  (26.02) | 18.50  (25.47) |
| **CD(p<0.05)** | |  |  | **0.75** | **0.92** | **0.94** |  |

Each figure is a mean of four replications and each replicant is a mean of four observations.

\*Figures within parenthesis are ARC sine transformed values of percent mortality

Pre/post count was taken on a 5cm twig

1. **DISCUSSION**

In 2023, a survey was conducted in the two districts of UT of Jammu and Kashmir (Srinagar and Baramulla) regarding the infestation of pear psylla. From each district two locations were selected, Palhallan and Nihalpora from district Baramulla; and Harwan and Shalimar from district Srinagar. District Baramulla recorded the highest seasonal incidence of pear psylla, followed by Srinagar. This can be explained by the altitudinal variations between these two districts *viz*., Baramulla (1593 m a.s1) and Srinagar (1589 m a.s1).According to Catling (1969), the population of *Trioza erytreae* is likewise restricted by high temperatures and tends to grow with altitude. The infestation of pear psylla began in May (20th SMW) at all the experimental locations and a peak was recorded in June and July. These results corroborate with those obtained by Radjabi and Behechti (1975). Nonetheless, the *Cacopsylla pyri* peak population was noted by Stratopoulou and Kapatos (1992) in May and June. According to Akbar *et al*. (2017), June was the month when the first and second nymphal instars of *Cacopsylla bidens* reached their peak population. According to Meinaz *et al*. (2017), the first week of July showed the peak incidence of adult psylla.

The results obtained on the correlation between the pear psylla population and abiotic variables, such as rainfall, and maximum and minimum temperature revealed that the pest population had a positive significant correlation with both the maximum and minimum temperatures but negative and weakly correlated with rainfall. Similarly maximum relative humidity had a negative but significant correlation with the pest population while minimum relative humidity had a positive significant correlation with the pest population as well as a week negative correlation with the pest population. The current studies have revealed that temperature is the primary factor influencing the fluctuations in the pear psylla population. The observations of Lakra *et al.* (1983) and Khan *et al.* (1984) support this observation for citrus psylla (*Diaphorina citri).* Our findings are supported by studies of Khan *et al*. (1984) on Citrus psylla, who found a high activity period in June and July along with an increase in temperature and a decline in population along with an increase in relative humidity and rainfall. In Meghalaya, Rao and Pathak (2001) also noted the highest number of adult *Diaphorina citri* in June and discovered a positive correlation with the lowest temperature, which was also noted in this investigation. Our results are consistent with the findings of Ahmed *et al.* (2014) who discovered strong positive correlations in the case of the leucana psyllid *(Heteropsylla cubana*) between psyllid damage and mean minimum temperature, mean maximum temperature, and mean daily temperature. A decrease in the number of psyllids in the eucalyptus psyllid, *Blastopsylla occidentalis*, was observed by Soufo and Tamesse (2015), in response to an increase in relative humidity and rainfall. Rainfall and psyllid populations were found to have a weakly positive correlation by Virender *et al.* (2007) in their studies on olive psylla *(Euphyllura pakistanica*).

Cyantraniliprole has proven to be highly effective against pear psylla due to its unique mode of action as a diamide insecticide, targeting ryanodine receptors in insect muscle cells, leading to paralysis and death (Cordova *et al*., 2006). Its systemic and translaminar properties allow it to protect all parts of the plant, ensuring comprehensive pest control. The insecticide offers long-lasting residual activity, reducing the need for frequent reapplications (Lahm *et al.,* 2007). Additionally, it is effective against pear psylla at all life stages, ensuring broad-spectrum control and life cycle disruption (Dinter *et al.,* 2014).

Acetamiprid was the second most effective treatment, with a reduction rate of 89.19–92.11%, similar to Youssef and Seham’s (2015) findings. Dimethoate showed 89.70% effectiveness, consistent with earlier studies (Pielou & Downing, 1960; Rajagopal *et al.,* 1990). Spinosad, with 82.43% efficacy, has notable knockdown effects but loses potency after 5-8 days (Bangels *et al.,* 2010). Flubendiamide, primarily targeting lepidopterans, was less effective against pear psylla due to its hemipteran nature.

1. CONCLUSION

Pest population during maximum and minimum temperatures showed a significant positive correlation, while rainfall and pest population at all locations showed a negative correlation. Maximum relative humidity showed a negative but statistically significant correlation and minimum relative humidity showed positive as well as negative relation with pest population. After rainfall and the minimum temperature, the maximum temperature was the main cause of the population fluctuations. There were more psyllids when the temperature was between 27-29 o C, as this was the ideal range for psylla development. The results of the evaluation of different insecticides revealed that cyantraniliprole 10.26% OD with an efficacy of 92.74%, proved to be the most effective followed by Acetamiprid 20% SP (90.87%).

**Conflict of interest**

1. **There is no conflict of interest regarding this manuscript**

**I have worked on this pear psylla I have not taken this data from any resources its my own data**

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