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# Population dynamics of psyllid and it's correlation with weather parameters in *Dodi* under middle Gujarat condition

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**Abstract**
An experiment was conducted under field conditions at Anand Agricultural University, Anand during December, 2021 to December, 2022. The incidence of psyllids started from the 50th SMW *i.e.*, 2nd week of December, 2021. Initially, it's population was low (6.25 psyllids per 10 cm twig per plant) and attained peak level of psyllids population (40.15 psyllids per 10 cm twig per plant) during the 10th SMW *i.e.*, 2th week of March, 2022. The lowest population of psyllids were recorded at 38th SMW *i.e.*, 4th week of September, 2022 (0.56 psyllids per 10 cm twig per plant). While, the psyllids population gradually increased from the 40th SMW *i.e.*, 2nd week of October, 2022 (0.92 psyllids per 10cm twig per plant) to the 49th SMW *i.e.*, 2nd week of December, 2022 (5.45 psyllids per 10cm twig per plant). The higher incidence of this pest was found during the fourth week of December, 2021 to second week of July, 2022 (52nd SMW to 28th SMW). Psyllids population showed significantly positive correlated with the evaporation and bright sunshine hours. While, evening relative humidity, morning relative humidity and evening vapor pressure were found significantly negative correlated with the psyllid's population.

**Keywords:** Psyllid, Dodi, Gujarat, population dynamics

## Introduction
Dodi, *Leptadenia reticulata* (Retzius) Wight & Aruott is an important medicinal plant that belongs to the Asclepiadaceae family. It has been found in Burma, Africa, Cambodia, Nepal, Sri Lanka, Philippines, Malay Peninsula, Madagascar and Mauritius, among other tropical and subtropical places around the world. It is commonly found in Gujarat, Himalayan ranges, Punjab, Rajasthan, Sikkim, Konkan ranges, Khasi hills, Deccan Plateau, Kerala and Karnataka and it may be found up to 2000 meters in India (Godara *et al*., 2015) [6]. It is used as a pot herb in Gujarat and Kathiawar (Mammen *et al*., 2011) [9]. Herbs are more friendly with the body due to their effects; as a result, they are more suited, especially for long-term use (Borimnejad, 1999) [4]. Dodi has a sweet taste and it is beneficial for all three *doshas*, namely *vata*, *pitta* and *kapha*. The roots and entire plant are mostly utilized for therapeutic purposes; hence it also falls under the vitalizing category (Gupta, 1997) [8]. The Indian Thar desert, *L. reticulata* is a commercially important medicinal plant species (Bhandari, 1990) [3]. Along with its limited distribution and seasonal availability, *Dodi*'s natural resources are unable to meet demand. Even though companies and farmers are prepared to produce *Dodi*, its poor germination rate, lack of true propagative ingredients and lack of knowledge about its agronomic techniques create concerns about its commercial cultivation (Mishra *et al*., 2009) [10]. However, due to increased global demand and market value for *L. reticulata*, farmers may be forced to reconsider its production in recent years. Many medicinal plants are now commercially grown to meet the growing demand for plant metabolites used by industries (Sathyanarayana *et al*., 2008) [15]. Certain biotic and abiotic factors are posing a threat to the production of such a vital medicinal plant. Insect pest is one of the most significant biotic pressures. Aphids, psyllid, red spider mites, milkweed butterflies, termites, grasshoppers and scale insects are among them (Patel, 2010) [11]. Psyllids, *Diaphorina dakariensis* Boselli (family: Psyllidae; order: Hemiptera) on *Dodi* was first time reported by Varghese and chaudhari (2018) [17] from Directorate of Medicinal and Aromatic Plants Research, Boriavi, Anand, Gujarat. The infestations of psyllids on *Dodi* crops peaked over the past two to three years, which is concerning given the crop's significance for therapeutic purposes and the detrimental effects of psyllids on *Dodi* crops. Knowledge about the activity period influence of weather parameters leads to ecologically sound, timely and efficient utilization of resources for strategic

management of psyllids.

## Materials and Methods

The experiment on population dynamics of psyllids infesting *Dodi* was conducted during December, 2021 to December, 2022 at Medicinal and Aromatic Research Station, AAU, Anand. Existing field of local (broad leaf) variety of *Dodi* with the gross plot size 24.0 × 3.0 meters and net plot size was 22.80 × 1.80 meters was selected and all the agronomic practices were adopting except insecticidal application. For the recording pest population density, 20 plants were selected randomly and tagged from the net plot and 3 newly emerged twigs or fresh tender twigs of 10 cm length was randomly selected on each plant and observations were recorded at fortnightly interval and the average population was worked out. The data of population of this pest was correlated with different meteorological parameters *viz.,* evaporation, bright sunshine hours, rainfall, wind direction, wind speed, maximum and minimum temperature, vapor pressure (morning and evening), relative humidity (morning and evening) were recorded at Meteorological Observatory, AAU, Anand and correlation coefficient was worked out by using standard statistical technique (Steel and Torrie, 1980) [16].

## Result and Discussions

Populations of organisms are never completely unaltered in nature. Population density changes throughout time as a result of weather conditions. Studies were carried out in order to determine the impact of various weather variables on the psyllids population variations (Table 1) and the data on their association are provided in Table 2 and Figure 1.

### Activity of psyllids infesting *Dodi*

The data indicated that between 50th SMW *i.e.,* 2nd week of December, 2021 to 49th SMW *i.e.,* 2nd week of December, 2022 psyllids nymphal and adult populations were recorded on the *Dodi* crop. Invasion by the pest appeared in the 50th SMW *i.e.,* 2nd week of December, 2021 and persisted until the 49th SMW *i.e.,* 2nd week of December, 2022. The initial population of psyllids was started out low (6.25 psyllids per 10 cm twig per plant) at 50th SMW *i.e.,* 2nd week of December, 2021, but it was steadily increased and peaked in the 10th SMW *i.e.,* 2nd week of March, 2022 (40.15 psyllids per 10 cm twig per plant). From the 13th SMW *i.e.,* 4th week of March, 2022 (40.13 psyllids per 10 cm twig per plant) to the 38th SMW *i.e.,* 4th week of September, 2022 (0.56 psyllids per 10 cm twig per plant), the psyllids population progressively dropped. Psyllids activity was peaked from the 52nd SMW *i.e.,* 4th week of December, 2021 to the 25th SMW *i.e.,* 4th week of June, 2022 when the insect population was at its highest. While the psyllids population again gradually increased from the 40th SMW *i.e.,* 2nd week of October, 2022 (0.92 psyllids per 10cm twig per plant) to the 49th SMW *i.e.,* 2nd week of December, 2022 (5.45 psyllids per 10cm twig per plant). Varghese and Chaudhari (2018) [17] reported that the psyllid bug (*D. dakariensis*) was observed on *Dodi* throughout the year. Prabhakaran (2021) [13] reported that the psyllid incidence (0.30 psyllids/leaf) initiated during first week of February, 2020 and attained peak (4.75 psyllids/leaf) during first week of April, 2020 then it attained its second peak (9.92 psyllids/leaf) at third week of May, 2020. Thereafter, the population was decreased and then increased and reached (2.20 psyllids/ leaf) during fourth week of September, 2020. After that, psyllids population decreased (0.02 psyllids/leaf) during first week of November, 2020. Gupta and Bhatia (2000) [7] found that the peak activity of nymphs of *D. citri* (40-50 nymphs per shoot) were observed during the March-April (10th to 17th SMW) on mandarin. Chavan (2004) [5] also reported that the population of *D. citri* were observed all-round the year on citrus. Aruna *et al.* (2017) [2] observed nymphal population per 5 cm shoot was observed peak during the 2nd fortnight of April (38.00 nymph/10 cm twig) and minimum was during 1st fortnight of June (1.00 nymph/10 cm twig). Thus, above reports are more or less corroboration with the present finding.

### Correlation of psyllids with weather parameters

The correlation coefficient analysis (Table 2) revealed that the evaporation (r = 0.542**) and bright sunshine hours (r = 0.494*) were found significantly positive correlated with the psyllids population. Whereas, maximum temperature was found positive correlation but non-significant with psyllids population (r = 0.305). However, evening relative humidity (r = -0.599**), morning relative humidity (r = -0.486*) and evening vapor pressure (r = -0.473*) were found significantly negative correlated with the psyllids population. While, rainfall, wind speed, minimum temperature and morning vapour pressure were found negatively correlated (r = -0.352, r = -0.089, r = -0.233 and r = -0.312) but non-significant with the psyllids population.

Above results depicted that evaporation was highly positive significant and bright sunshine hours was significantly positive correlation with population of psyllids. Whereas, evening relative humidity was highly negative significant. While, morning relative humidity and evening vapor pressure were significantly negative correlated with the psyllids population. Prabhakaran (2021) [13] reported that the bright sunshine hour had positive correlation with psyllids and the rainfall had negative correlation. Wind speed, maximum temperature, minimum temperature, morning vapour pressure and evapotranspiration had significant positive correlation with psyllids population. While evening relative humidity and vapor pressure had negative and positive association with psyllids population, respectively. Patel *et al.* (2012) [12] reported that temperature had positive influence on the leaf bug (Psyllids) incidence on *Dodi*. While, relative humidity, rain and vapour pressure had negative association, while sunshine hours had a positive association with the psyllids. Arora *et al.* (1997) [1] reported that the positive correlation between temperature and citrus psyllids population and a negative correlation with relative humidity. Rao and Pathak (2001) [14] revealed that the positive correlation of temperature and day light hours with the population of *D. citri* on citrus. Thus, present finding is more or less similar to the earlier findings.

**Table 1:** Population dynamics of psyllids in relation to different weather parameters (December, 2021 to December, 2022) (n=25)

| Month | Week | SMW | No. of psyllids/ 10cm twig/ plant | BSS (hr/day) | RF (mm) | WS (km/hr) | Temperature (°C) | | Relative Humidity (%) | | Vapour Pressure (mm of Hg) | | EP (mm) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Max. | Min. | RH1 | RH2 | VP1 | VP2 | |
| December 2021 | II | 50 | 6.25 | 7.41 | 0.00 | 3.80 | 27.37 | 13.86 | 79.29 | 43.79 | 9.77 | 11.48 | 2.86 |
| | IV | 52 | 14.83 | 5.91 | 0.00 | 3.20 | 26.93 | 15.41 | 90.27 | 56.67 | 12.29 | 14.19 | 2.23 |
| January 2022 | II | 2 | 23.29 | 8.69 | 0.00 | 3.80 | 25.34 | 12.00 | 88.29 | 43.93 | 9.80 | 10.23 | 2.81 |
| | IV | 4 | 34.97 | 8.24 | 0.00 | 3.10 | 26.66 | 10.64 | 85.93 | 39.29 | 9.00 | 9.84 | 3.10 |
| February | II | 6 | 39.69 | 9.36 | 0.00 | 2.70 | 29.57 | 12.93 | 81.49 | 32.50 | 9.55 | 9.74 | 3.60 |
| | IV | 8 | 40.07 | 9.67 | 0.00 | 2.80 | 32.93 | 15.53 | 79.07 | 33.36 | 10.94 | 11.75 | 4.94 |
| March | II | 10 | 40.15 | 8.50 | 0.00 | 3.40 | 36.82 | 19.82 | 66.76 | 27.33 | 12.59 | 12.00 | 6.46 |
| | IV | 13 | 40.13 | 9.22 | 0.00 | 3.30 | 39.37 | 21.51 | 83.93 | 26.57 | 17.73 | 13.59 | 7.53 |
| April | III | 15 | 39.46 | 9.33 | 0.00 | 4.50 | 39.24 | 23.44 | 81.14 | 24.72 | 19.68 | 11.98 | 7.68 |
| | IV | 17 | 35.19 | 10.72 | 0.00 | 4.80 | 40.35 | 24.62 | 72.29 | 27.57 | 19.73 | 14.45 | 8.95 |
| May | II | 19 | 29.78 | 10.00 | 0.00 | 6.00 | 40.39 | 27.04 | 75.64 | 33.36 | 21.94 | 17.03 | 8.70 |
| | IV | 21 | 20.35 | 9.61 | 0.00 | 9.20 | 38.50 | 27.80 | 72.86 | 40.21 | 21.72 | 18.91 | 8.84 |
| June | II | 23 | 13.48 | 9.63 | 0.60 | 7.30 | 38.24 | 28.04 | 78.21 | 46.43 | 23.57 | 20.77 | 8.00 |
| | IV | 25 | 10.56 | 5.01 | 158.20 | 6.40 | 35.09 | 26.89 | 88.74 | 61.63 | 24.70 | 23.25 | 5.56 |
| July | II | 28 | 8.74 | 1.86 | 282.80 | 6.20 | 30.62 | 25.60 | 93.46 | 82.48 | 23.69 | 24.91 | 2.54 |
| | IV | 30 | 5.58 | 3.62 | 174.40 | 5.30 | 31.99 | 26.14 | 92.00 | 71.29 | 23.85 | 23.63 | 3.59 |
| August | II | 32 | 3.14 | 2.63 | 111.40 | 5.50 | 31.34 | 25.96 | 93.57 | 71.57 | 23.86 | 24.07 | 2.89 |
| | IV | 34 | 1.75 | 4.63 | 7.89 | 4.70 | 31.88 | 25.51 | 90.19 | 67.06 | 23.03 | 21.99 | 3.40 |
| September | II | 36 | 1.12 | 5.19 | 84.06 | 3.90 | 34.16 | 26.26 | 89.27 | 64.89 | 23.60 | 23.11 | 3.91 |
| | IV | 38 | 0.56 | 6.88 | 4.60 | 5.20 | 32.74 | 25.05 | 88.79 | 58.50 | 21.92 | 20.81 | 4.09 |
| October | II | 40 | 0.92 | 8.21 | 87.30 | 3.80 | 33.75 | 23.56 | 84.67 | 49.33 | 19.65 | 17.86 | 3.92 |
| | IV | 43 | 1.74 | 9.89 | 0.00 | 2.10 | 34.51 | 18.09 | 84.08 | 28.02 | 14.66 | 10.90 | 3.45 |
| November | II | 45 | 1.86 | 9.13 | 0.00 | 1.90 | 33.60 | 17.71 | 85.21 | 33.14 | 14.17 | 12.12 | 3.00 |
| | IV | 47 | 2.61 | 9.48 | 0.00 | 3.00 | 30.62 | 14.29 | 75.57 | 31.86 | 10.10 | 9.94 | 3.34 |
| December | II | 49 | 5.45 | 8.60 | 0.00 | 3.60 | 29.61 | 16.19 | 78.14 | 39.29 | 11.16 | 11.57 | 2.91 |

**Note:** SMW: Standard Meteorological Week, BSS: Bright Sunshine Hours, RF: Rainfall, WS: Wind Speed, MAX T: Maximum temperature, MIN T: Minimum temperature, VP1: Morning Vapor Pressure, VP2: Evening Vapor Pressure, RH1: Morning Relative humidity, RH2: Evening Relative humidity, EP: Evaporation

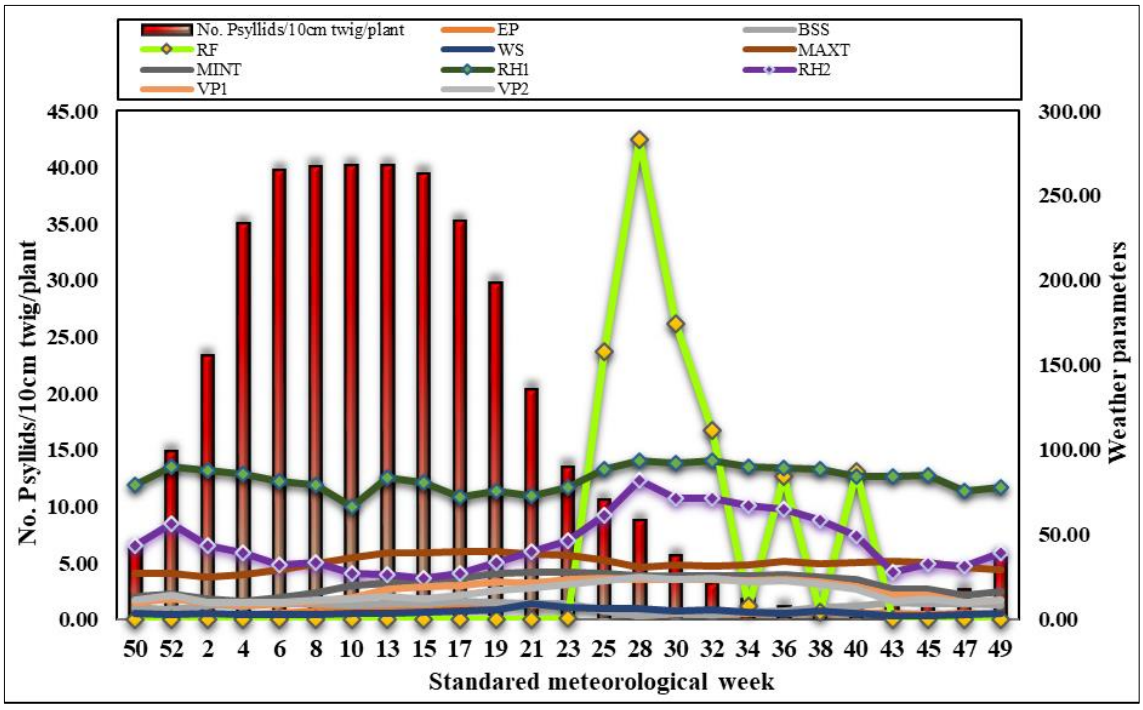


**Fig 1:** Population dynamics of psyllid in relation to different weather parameters

**Table 2:** Correlation coefficient (r) of weather parameters with psyllids population on *Dodi* (December, 2021, to December, 2022) (n=25)

| Weather Parameters | Correlation co-efficient (r) |
|---|---|
| Bright Sunshine Hours (BSS), hrs/day | 0.494* |
| Rainfall (RF), mm | -0.352 |
| Wind Speed (WS), km/hr | -0.089 |
| Maximum Temperature (MaxT), °C | 0.305 |
| Minimum Temperature (MinT), °C | -0.233 |
| Morning Relative Humidity ($RH_1$), % | -0.486* |
| Evening Relative Humidity ($RH_2$), % | -0.599** |
| Morning Vapour Pressure ($VP_1$), mm of Hg | -0.312 |
| Evening Vapour Pressure ($VP_2$), mm of Hg | -0.473* |
| Evaporation (EP), mm | 0.542** |
| *Significant at 0.05% level of significance<br>**Highly Significant at 0.05% level of significance | |

## Conclusions

From the above results, it can be concluded that the higher incidence of this pest was found during the fourth week of December, 2021 to second week of July, 2022 (52nd SMW to 28th SMW). The peak level of psyllids population (40.15 psyllids per 10 cm twig per plant) was found during the 10th SMW *i.e.,* 2th week of March, 2022. Thereafter, population was gradually decrease and recorded lowest at the 38th SMW *i.e.,* 4th week of September, 2022 (0.56 psyllids per 10 cm twig per plant). Evaporation was highly positive significant and bright sunshine hours was significantly positive correlation with population of psyllids. Whereas, evening relative humidity was highly negative significant. While, morning relative humidity and evening vapor pressure were significantly negative correlated with the psyllids population.

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