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Influence of Weather Parameters on Peach Leaf Curl Aphid, *Brachycaudus helichrysi* (Kaltenbach) in Peach Orchard under Lower Shiwaliks of Himachal Pradesh, India

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ABSTRACT

Peach leaf curl aphid *Brachycaudus helichrysi* (*Kaltenbach*) is one of the most destructive pests of peach during the early stages of flowering in Lower Shiwaliks of the North Western Himalayas. Keeping in view the economic importance of this pest the present study was conducted to monitor the incidence of *B. helichrysi* from February to April in the orchards of Una and Amb block, Distt. Una, Himachal Pradesh. The results revealed that mean aphid population for the year 2018, 2019 and 2020 was 111.3, 123.5 and 127.1/10 leaves, respectively which indicated the gradual increase that over the years the pest incidence has increased. The highest mean aphid population was recorded during March (218.58/10 leaves) followed by February (96.52/10 leaves) and declined in the month of April (52.85/10 leaves). A significant positive relation of aphid population was recorded with the relative humidity during 2018, 2019 and 2020. Significantly positive correlation of aphid population with maximum temperature was observed during the month of February (0.580), whereas correlation was significantly negative in the month of April (–0.850). Significantly negative correlation with minimum temperature (–0.692) in the month of April was also observed. The correlation with RThe results clearly indicate that the temperature and RH plays crucial role in the build up of aphid population on peach plants.

Keywords Peach leaf curl aphid, *Brachycaudus helichrysi*, Population, Seasonal incidence.

INTRODUCTION

Peach (*Prunus persica* Batsch) is an important stone fruit of India which has a wide range of climatic adaptations in India. It is mostly cultivated in warm temperate and sub-tropical parts of Jammu & Kashmir, Himachal Pradesh, Punjab, Haryana, Uttarakhand, parts of Uttar Pradesh and North Eastern States (Josan *et al.* 2009). During 2024–25, the area under peach cultivation in India was 16.65 thousand hectare with production of 108.28 thousand MT, while in Himachal Pradesh the area was 4.75 thousand hectare with production of 3.35 thousand MT in (Government of India 2025). Rajgarh area in the Sirmour district of Himachal Pradesh is known as 'Peach Bowl of India.' The area under this crop is increasing rapidly in

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the State due to availability of suitable cultivars and higher net return as well as higher nutritional values (rich in Vitamin A, iron and proteins). Peach is generally consumed as fresh, delicious squash and other processed products could also be prepared.

Peach is grown in irrigated areas in Lower Shiwaliks of Himachal Pradesh. Insect-pests adversely affect peach productivity in Early Spring Season however ; Peach leaf curl aphid (*B. helichrysi*) is a destructive pest in peach orchards. This pest infests about 175 species in India belonging to 115 genera and 49 plant families in India (Sharma and Khokhar 2018). It damages the crop by sucking sap from leaves, flower buds, and newly formed fruits. Young leaves curl up and turn pale and fruits either do not set or fall off prematurely which results in poor yield. *B. helichrysi* causes significant reduction in leaf area and total chlorophyll content with marked decrease in fresh and dry leaf weight so considered as destructive insect pest of peach in the country (Sharma and Khokhar 2018). It also infests nectarines, almonds, apricots, prune and plum.

Programs for ecologically sound management necessitate a deeper comprehension of the ways in which the host, the pest and its environment interact. Since aphids cause significant harm to agricultural ecosystems, researchers and producers have long been interested in their population dynamics (Mondor and Roitberg 2000). The population size of an insect-pest changes over time and space due to different reasons including changes in the environment and the availability of resources. As a result, the preparation of control programs relies heavily on understanding the seasonal dynamics of pest populations. In light of the fact that the prevalence of this pest has increased over time in the Himachal, this investigation was conducted in Una district to track the seasonal activity *B. Helichrysi*.

MATERIALS AND METHODS

The research was conducted in the lower Shiwaliks of Himachal Pradesh in the Amb and Una Blocks of Una district. For each replication, a single tree was randomly chosen from three peach trees. Ten leaves from each tree, taken from all directions, were randomly selected and examined for the number of aphids present. Observations were recorded on a weekly basis during the pest's peak infestation period (February to April) for three years (2018 to 2020). Data on weather parameters viz. temperature in °C (maximum and minimum), percent relative humidity (average) and rainfall in mm were obtained from the meteorological observatory, Regional Sub Station, CSKHPKV, Akrot, Una (Fig.1 – Fig. 4). The correlation between the seasonal incidence of the pest and important weather factors, such as temperature, relative humidity, and rainfall, was statistically analyzed to determine the effect of abiotic parameters on fluctuations. Significance level of 5% for correlation was determined. SPSS software version 16.0 was used for statistical analysis following the standard procedure (Raghava Rao 1983).

RESULTS AND DISCUSSION

Incidence of peach leaf curl aphid, *B. helichrysi* on peach

The results revealed that pest incidence has increased during the three consecutive years from 2018-2020 (Table 1). The mean pest population was highest during the month of March (204.73) followed by February (90.63) and declined in the month of April (62.95). On the basis of three years observations the activity of pest commenced in the month of February and increased during pre and post blooming period with increasing warming of weather, the population started declining in the month of April (Table 1).

The aphid population was noticed on the plants in the last week of January (5th standard week) with an initial population of 72.5, 35.4 and 25.3 aphids/10 plants in the year 2018, 2019 and 2020, respectively (Table 1). The highest population of 299.4 aphids/10 leaves and 286.4 aphids/10 leaves was recorded during 11th standard meteorological week (SMW) in the year 2018 and 2019, respectively. Whereas, the aphid population was highest 299.8 aphids/10 leaves during 2020. However, lowest mean population of 24.4, 18.5 and 12.6 aphids/10 plants was recorded during 18th SMW in 2018, 2019 and 2020, respectively. The infestation of peach by this aphid has been reported by several authors (Arora *et al.* 2009; Singh

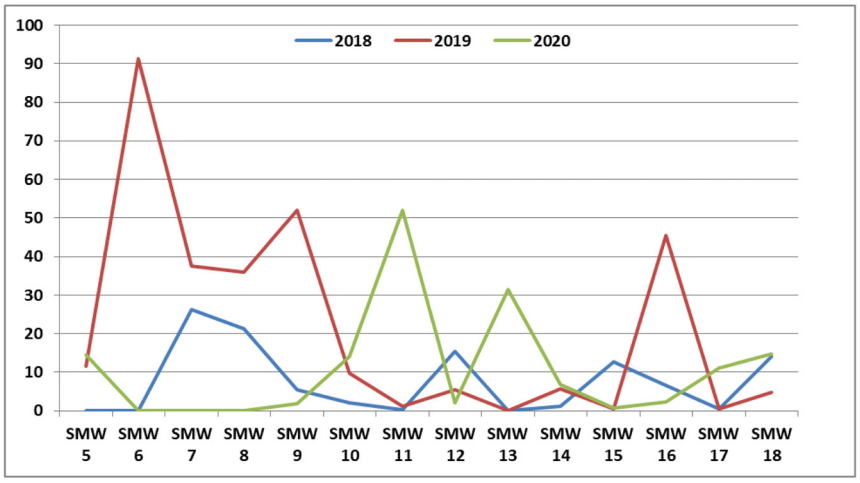

Fig. 1. Mean weekly rainfall (cm) in Una district, Himachal Pradesh during 2018-2020.

and Kaur 2015; Sharma and Khokhar 2018) and these results are in line with their findings.

During the three years of research, the aphid population progressively rose from the 5th SMW, peaked between the 10th and 11th SMW, and then gradually declined. This was mainly due to the emergence of tender, succulent buds/leaves/flowers and favorable weather conditions for aphids, while aphid populations decreased with increasing maximum and minimum temperatures, and hardening of leaf tissues. The aphid population increased till the maximum temperature was below 30°C and minimum temperature below 12°C; thereafter the population started declining with increase in maximum and minimum temperature.

Influence of weather parameters on incidence of peach leaf curl aphid

The correlation studies of mean aphid population with different weather parameters revealed that there was significant positive correlation with T_{max} (0.791) as well as T_{min} (0.689) in the month of February (Table 2) which indicated that with the increase in maximum and minimum temperature during the month of

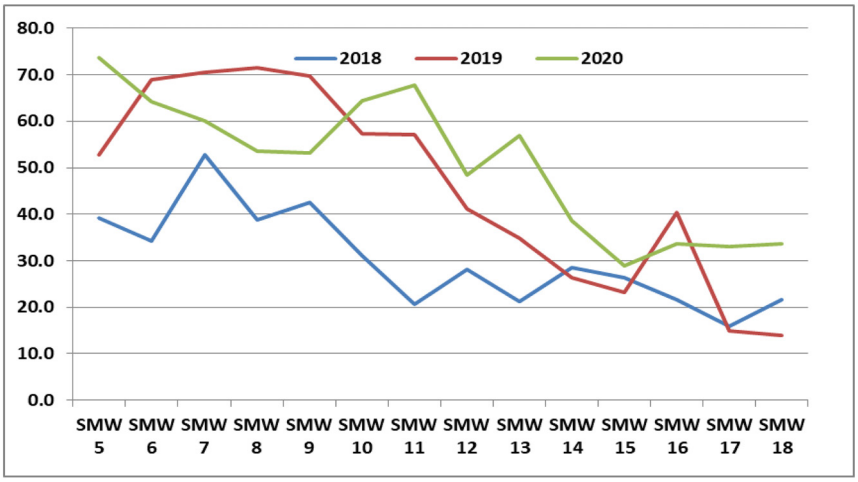

Fig. 2. Mean weekly relative humidity (%) in Una district, Himachal Pradesh during 2018-2020.

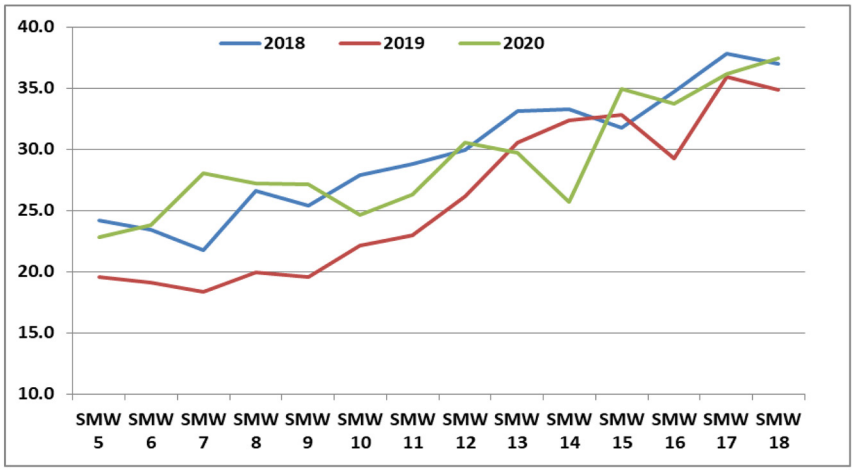

Fig. 3. Mean weekly Maximum Temperature (°C) in Una district, Himachal Pradesh during 2018-2020.

February is suitable for buildup of aphid population. During 2020 in the month of March significant but negative correlation was observed with rainfall (–0.604) as the rainfall was higher during the March month in 2020 which drastically reduced the aphid population. However, in the month of April significant negative correlation was observed with T_{max} (–0.629) and T_{min} (–0.606). The correlation studies with weather parameters revealed that temperature plays important role in the build-up as well as decline of aphid population during different months. Initially during the month of February, pest population increased with increase in temperature but declined with further increase in temperature in the month of April. Similarly, with increase in the rainfall the pest population tends to decrease. These observations suggest that among abiotic factors particularly temperature and rainfall play predominant role in determining the population of soft bodied sucking insects. The findings of the study are in line with the results Sharma and Khokhar (2018) who reported that environmental conditions especially rainfall and high temperature had adverse

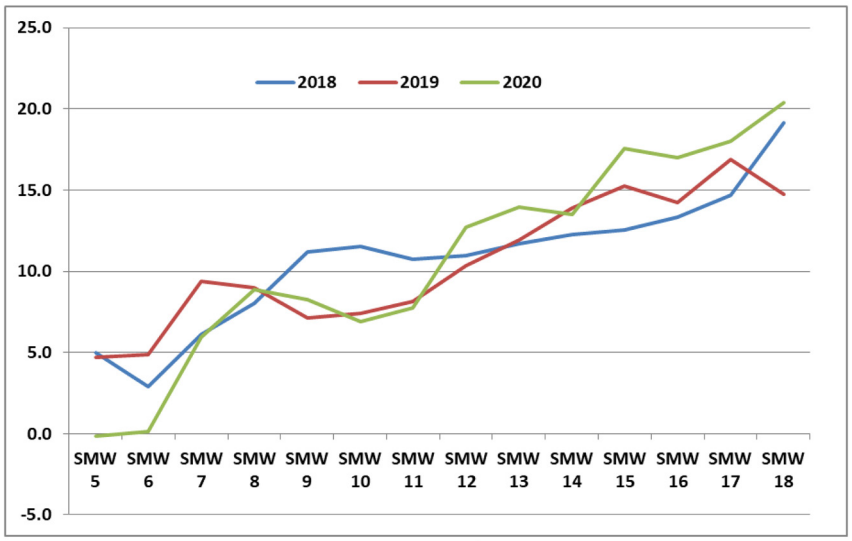

Fig. 4. Mean weekly Minimum Temperature (°C) in Una district, Himachal Pradesh during 2018-2020.

Table 1. Peach leaf curl aphid, *B. helichrysi* population and weather conditions in peach orchards. SMW*=Standard meteorological weeks **Jan-January, Feb-February.

Months**	SMW*	Number of aphids/10 leaves			Mean monthly number of aphids/10 leaves
		2018	2019	2020	
Jan-Feb I	5	72.5	35.4	25.3	
Feb II	6	105.4	42.8	84.1	
Feb III	7	78.4	62.1	159.2	
Feb IV	8	127.6	108.5	186.3	90.63
Feb- March I	9	144.8	84.6	223.7	
March II	10	252.7	197.1	299.8	
March III	11	299.4	286.4	147	
March IV	12	187.3	254.3	217.2	
March V	13	142.5	188.3	145.8	204.73
April I	14	118.2	119.2	108.1	
April II	15	79.2	99.1	85.4	
April III	16	59.7	48.4	73.9	
April IV	17	35.9	29.9	31.8	
April V	18	24.4	18.5	12.6	62.95
Mean		123.42	112.47	128.58	

Table 2. Relationship of mean incidence of *B. helichrysi* on peach with weather parameters during spring season from 2018–2020. *Significant at 5%, ** Significant at 1%.

Weather parameters	February No of aphids/10 leaves	March No of aphids/10 leaves	April No of aphids/10 leaves
Relative humidity (%)	0.467^{NS}	-0.209^{NS}	0.304^{NS}
T_{max} (°C)	0.791**	0.022^{NS}	–0.629*
T_{min} (°C)	0.689**	-0.125^{NS}	–0.606*
Rainfall (mm)	-0.080^{NS}	–0.604*	-0.265^{NS}

effects on the population of *B. helichrysi*. Similarly, Ghosh (2017) reported significant negative influence of aphid (*Aphis gossypii*) incidence with total rainfall. These results are in line with Kumar and Paul (2017), Yadav *et al.* (2018) and Sangma *et al.* (2018) who have also reported significant negative correlation between infestations of aphid with temperature.

CONCLUSION

It can be concluded from the present study that the aphid population peaked in 10th and 11th MSW and declined thereafter. The aphid population has a significant positive relationship with maximum and minimum temperature and negative relationship with total rainfall. Maximum temperature below 30°C and minimum temperature below 12°C were congenial for aphid population buildup ; temperatures above these limits substantially reduced the population. In the future, proper integrated pest management measures for the control of this insect are required, particularly during peak infestation periods, as it can cause significant losses in fruit yield.

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