***Original Research Article***

# Impact of weather parameters on population dynamics of cabbage aphid (*Brevicoryne brassicae* L.) on kale (*Brassica oleracea* var.*acephala*)


## ABSTRACT

Studies on "population dynamics of Cabbage Aphid (*Brevicoryne brassicae* L.) on Kale (*Brassica oleracea* var. *acephala*)'' in relation to weather parameters revealed cabbage aphid (*Brevicoryne brassicae* L.) as a major pest on Kale. The incidence of cabbage aphid commenced from16$^{th}$standard meteorological week (SMW)with a population of 2.02 (aphids/plant). The population of cabbage aphid started increasing and reached its peak in 25$^{th}$ SMW with a population of 137.16 (aphids/plant) after that the population started declining gradually in 26$^{th}$ SMW with a population of 83.14 (aphids/plant). However, the mean population of nymphs during 16$^{th}$ SMW was (2.02 ± 0.46) which gradually started increasing and was highest in 25$^{th}$ SMW (32.68 ± 0.74). The mean population of adults during 17$^{th}$ SMW was (8.24 ± 0.38) and was highest during 25$^{th}$ SMW (62.12 ± 0.50) and the mean population of winged aphids during 18$^{th}$ SMW was (7.10 ± 0.42) which gradually started increasing and attained its peak during 25$^{th}$ SMW (42.36 ± 0.41) respectively. Correlation between maximum and minimum temperature showed positive correlation with cabbage aphid population. Relative humidity of morning showed non-significant negative correlation while relative humidity of evening exhibited positive non-significant correlation. Rainfall werefound non-significant positive correlation.



**Key words:**Cabbage Aphid, *Brevicoryne brassicae*,Kale, *Brassica oleracea* var. *acephala*, Weather parameters


## INTRODUCTION

Vegetables play a vital role in human diets and are essential for feeding the world's population. In the Kashmir Valley, a variety of vegetable crops are cultivated, categorized into groups based on the parts utilized, such as cucurbits, solanaceous fruits, cole crops, root crops, and bulb crops.Among these groups, cruciferous vegetables or cole crops constitute an important category, encompassing a wide variety of leafy vegetables such as cabbage, knol khol, cauliflower, broccoli, kale, mustard, and collard greens (Ahuja *et al*., 2010). Kale (*Brassica oleracea var. acephala*), originating from the eastern Mediterranean region, is one of the oldest members of the cabbage family. It is cultivated across all agro-climatic conditions in the Union Territory of Jammu and Kashmir, ranging from subtropical to temperate to cold arid zones.

Kale (*B.oleracea* var. *acephala*) belongs to the Brassicaceae family, renowned for its green leafy vegetables (Fahey, 2003). Beyond its nutritional value, kale provides notable health benefits. Its leaves offer a plethora of medicinal advantages: it aids in reducing

cholesterol levels, thus mitigating the risk of heart disease; it contains various disease-fighting compounds, is abundant in beta-carotene, and serves as an excellent source of ascorbic acid and phylloquinones (Tiwari and Joshi, 2020).

Normally kale is cultivated both during *Rabi* and *Kharif* season vegetable and also for seed production (Anonymous, 2010). In India, knol-khol is extensively cultivated in regions such as Jammu & Kashmir and West Bengal, and to a lesser extent, it is considered a rare exotic vegetable grown in select areas of Maharashtra, Assam, Uttar Pradesh, and Punjab (Thamburaj and Singh, 2016).

In Jammu and Kashmir, kale enjoys popularity as a vegetable among people from all walks of life, whether rich or poor. It is grown in nearly every kitchen garden and serves as a commercial crop in the vicinity of cities and towns. In Kashmir alone, it is cultivated across an area of 3456.6 hectares, yielding a production of 103,698.6 metric tons (Anonymous, 2022). Its demand remains high year-round due to the diverse sizes of coloured knobs and leaves it offers(Anonymous, 2019). Some of the popular cultivars of kale grown in Kashmir include Heenz hak, Kawdari hak, Khanyar hak, G. M. Dari hak, Wantipuri hak, Koker hak, Pumb hak and Achari hak (Khan *et al*., 2010).

The damage inflicted by the pest complex, ranging from germination to harvest, stands as a primary constraint in the production of cole crops. In India, a total of 37 insect pests have been documented on cole crops (Lal, 1975).A total of nine species of insect pests on cabbage, cauliflower and kale in Kashmir have been reported, which include cabbage semilooper (*Thysanoplusia orichalcea* Fab.), cabbage butterfly (*Pieris brassicae* L.), diamondback moth (*Plutella xylostella* L.), two species of aphids, mustard aphid (*Lipaphis erysimi* Kalt.) and cabbage aphid -*Brevicoryne brassicae* L.(Malik *et al*., 1972). These insect pests are a threat to global agriculture and cause huge yield and economic losses in *Brassica* crop production. The attractiveness and susceptibility of different cruciferous crops differs for different insect pests and their intensity of damage (Hiiesaar *et al*., 2006). The present investigation was initiated by taking into account the crucial role that the kale crop plays in our lives and the prevalence of one of its major insect pests, the cabbage aphid. This pest significantly impacts both the quantitative and qualitative aspects of kale yield.

## MATERIALS AND METHODS

To study the population dynamics of kale an experimental trial was laid during *Kharif* 2021 in which the seedlings of kale (*Brassica oleracea* var. *acephala*) cv. G M Dari were

transplanted in the 1st week of March 2021 in a plot size of 2×1m with three replications. All the recommended packages of practices were followed to raise a healthy crop. The incidence of cabbage aphid was recorded throughout the growing season. The number of individuals of damaging stages of insect pest in respect of nymphs and adults were counted on fiverandomly selected plants of each plot on weekly basis throughout the crop season. Population assessment was based on the counts of aphid, nymphs and adults and observation of aphid was recorded from plant measured at weekly interval from initial stage of appearance to final disappearance up to harvest. The nymphal population was counted with the help of a magnifying glass. The data on weather parameters viz., maximum, minimum temperature, relative humidity and rainfallwas also collected because this data was correlated against aphid numbers (Choudhury and Pal, 2009).

**Observations recorded**

**Population of Nymph (per plant):** The total number of cabbage aphid nymphs were recorded from five randomly selected plants per plot.

**Population of Adult (per plant):** The total number of cabbage aphid adults were recorded on five randomly selected plants per plot.

**Population of winged aphid (per plant):** The total number of cabbage winged aphids were recorded on five randomly selected plants per plot.

**Abiotic factors (temperature, relative humidity, rainfall):** The average aphid population during different periods of the crop growth were examined, in relation to ambient temperature condition, relative humidity and the influence of rainfall on aphid populations was collected from Division of Agronomy.

The data collected on these characters were subjected to standard statistical analysis.



## RESULTS

**Incidence of cabbage aphid (*Brevicoryne brassicae* L.) on kale (*Brassica oleracea* var.*acephala*) during crop season *Kharif* 2021**

The results revealed that cabbage aphid was found associated with the kale crop in the experimental field trial during the entire growing season (Table 1). During the study it was observed that cabbage aphid remained closely associated with the crop and its appearance started from 16th standard meteorological week (SMW) with a population of (2.02

aphids/plant) and it gradually started increasing during the growing season and attained peak in the 25th standard week (SMW) with a population of (137.16 aphids/plant). However, the mean population of nymphs during 16th SMW was (2.02 ± 0.46) which gradually started increasing and was highest in 25th SMW (32.68 ± 0.74 nymphs/plant). The mean population of adults during 17th SMW was (8.24 ± 0.38) and was highest during 25th SMW (62.12 ± 0.50) and the mean population of winged aphids during 18th SMW was (7.10 ± 0.42) which gradually started increasing and attained its peak during 25th SMW (42.36 ± 0.41), respectively(Fig no.1).

**Studies on correlation of cabbage aphid with weather parameters**

The population of cabbage aphid showed a great sensibility to weather fluctuations prevailed over the period under study (Fig no 1).The mean population per plant of cabbage aphid exhibited a highly significant positive correlation with both maximum temperature (r= 0.627*) and minimum temperature (r= 0.845**) whilesignificant negative correlation with morning relative humidity (r= -0.003$^{NS}$) and pest exhibited non-significant correlation with evening relative humidity (r= 0.057$^{NS}$) and rainfall (r= 0.486 $^{NS}$) (Table 2).

## DISCUSSION

**Incidence of cabbage aphid on kale**

During the studies cabbage aphid (*Brevicoryne brassicae* L.) was observed to be the major insect pest on kale crop during *Kharif* 2021. The first appearance of the cabbage aphid population was recorded during 16th SMW 2.02 aphid/plant and thereafter pest population increased and reached at its peak 137.16 aphids/plant during 26th SMW. The population started to decline onwards and was less during 27th SMW with 83.14 aphids/plant. The present findings are in agreement with the studies of Gami *et al*. (2002) and Sinha *et al*. (1989).

**Correlation of weather factors with the population dynamics of cabbage aphid on kale**

The insect pest exhibited a significant positive correlation with both maximum temperature (r = 0.627) and minimum temperature (r = 0.845) while a non-significant negative correlation with relative humidity morning (r= -0.003 $^{NS}$) and non-significant positive correlation with relative humidity evening (r= 0.057 $^{NS}$) and rainfall (r= 0.486 $^{NS}$). The present findings are in agreement with the studies of Sinha *etal*. (1989), Shonga and Getu(2020),Juglan *et al*. (1988), Sahu *et al* (2020) and Venkateshwarlu *et al*. (2011)

## CONCLUSION

The incidence of cabbage aphid commenced from 16$^{th}$ SMW with a population of (2.02 aphids/ plant) which gradually started increasing. The peak population of cabbage aphid was observed during 25$^{th}$ SMW with a population of (137.16 aphids/plant).The mean population of nymphs during 16$^{th}$ SMW was (2.02 ± 0.46) which gradually started increasing and was highest in 25$^{th}$ SMW (32.68 ± 0.74). The mean population of adults during 17$^{th}$ SMW was (8.24 ± 0.38) and was highest during 25$^{th}$ SMW (62.12 ± 0.50) and the mean population of winged aphids during 18$^{th}$ SMW was (7.10 ± 0.42) which gradually started increasing and attained its peak during 25$^{th}$ SMW (42.36 ± 0.41) respectively.The correlation data revealed that maximum temperature, minimum temperature showed positive correlation with cabbage aphid population while as relative humidity morning showed non-significant negative correlation and relative humidity evening showed positive non-significant correlation whereas rainfall showed non-significant positive correlation.



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**Table-1. Incidence of cabbage aphid (*Brevicoryne brassicae*) on kale (*Brassica oleracea* var. *acephala*) during *Kharif* 2021**

| SMW | Temperature | | Relative humidity | | Rainfall (mm) | Nymphs/plant | Adults/plant | Winged Aphids/plant | Total population |
|---|---|---|---|---|---|---|---|---|---|
| | Max | Min | RHM | RHE | | | | | |
| 14 | 28 | 4.5 | 75 | 23 | 10.3 | 0.00± 0.0* | 0.00± 0.0 | 0.00± 0.0 | 0.00 |
| 15 | 26.5 | 5 | 80 | 39 | 9.7 | 0.00± 0.0 | 0.00± 0.0 | 0.00± 0.0 | 0.00 |
| 16 | 28 | 6 | 89 | 30 | 8.3 | 2.02± 0.46 | 0.00± 0.0 | 0.00± 0.0 | 2.02 |
| 17 | 27.5 | 5 | 80 | 19 | 11.10 | 6.80± 0.58 | 8.24±0.38 | 0.00± 0.0 | 15.04 |
| 18 | 29 | 9 | 90 | 24 | 11.4 | 14.48± 0.75 | 18.66± 0.33 | 7.10± 0.42 | 40.24 |
| 19 | 27.5 | 7.5 | 81 | 29 | 11.1 | 18.40± 0.5 | 22.54± 0.34 | 13.48± 0.70 | 54.42 |
| 20 | 30.5 | 9 | 80 | 34 | 10.70 | 21.30± 0.71 | 34.02±0.64 | 22.40± 0.71 | 77.72 |
| 21 | 28.5 | 8 | 90 | 40 | 10.8 | 16.20± 0.45 | 29.20± 0.36 | 23.86± 1.05 | 69.26 |
| 22 | 29.5 | 9.5 | 81 | 41 | 9.5 | 16.70± 0.87 | 41.60± 0.38 | 19.9± 0.26 | 78.20 |
| 23 | 31 | 10 | 66 | 22 | 10.1 | 24.42± 0.77 | 54.60± 0.39 | 33.38± 0.47 | 112.40 |
| 24 | 31.5 | 13 | 82 | 30 | 10.2 | 27.20± 2.25 | 59.08± 0.52 | 37.86± 1.26 | 124.14 |
| 25 | 27 | 10.5 | 94 | 54 | 10 | 32.68± 0.74 | 62.12± 0.50 | 42.36± 0.41 | 137.16 |
| 26 | 34.5 | 12.5 | 82 | 41 | 9.5 | 17.80± 0.73 | 42.30± 0.63 | 23.04± 0.36 | 83.14 |

- *** Mean of three replications,± Standard Error, SMW = Standard meteorological week**

**Table-2. Correlation coefficient between cabbage aphid population and Abiotic factors on kale during crop season *Kharif* 2021**

| Weather parameters | Nymphs | Adults | Winged Aphid |
|---|---|---|---|
| Max. temperature | 0.625* | 0.657* | 0.627* |
| Min. temperature | 0.839** | 0.896** | 0.845** |
| RH-M | -0.019NS | -0.061NS | -0.003NS |
| RH-E | 0.119NS | -0.004NS | 0.057NS |
| Rainfall | 0.393NS | 0.426NS | 0.486NS |

*Significant at p≤0.05; Max. Temp = Maximum temperature; Min.Temp = Minimum temperature; R.f = Rainfall; RH= Relative humidity.

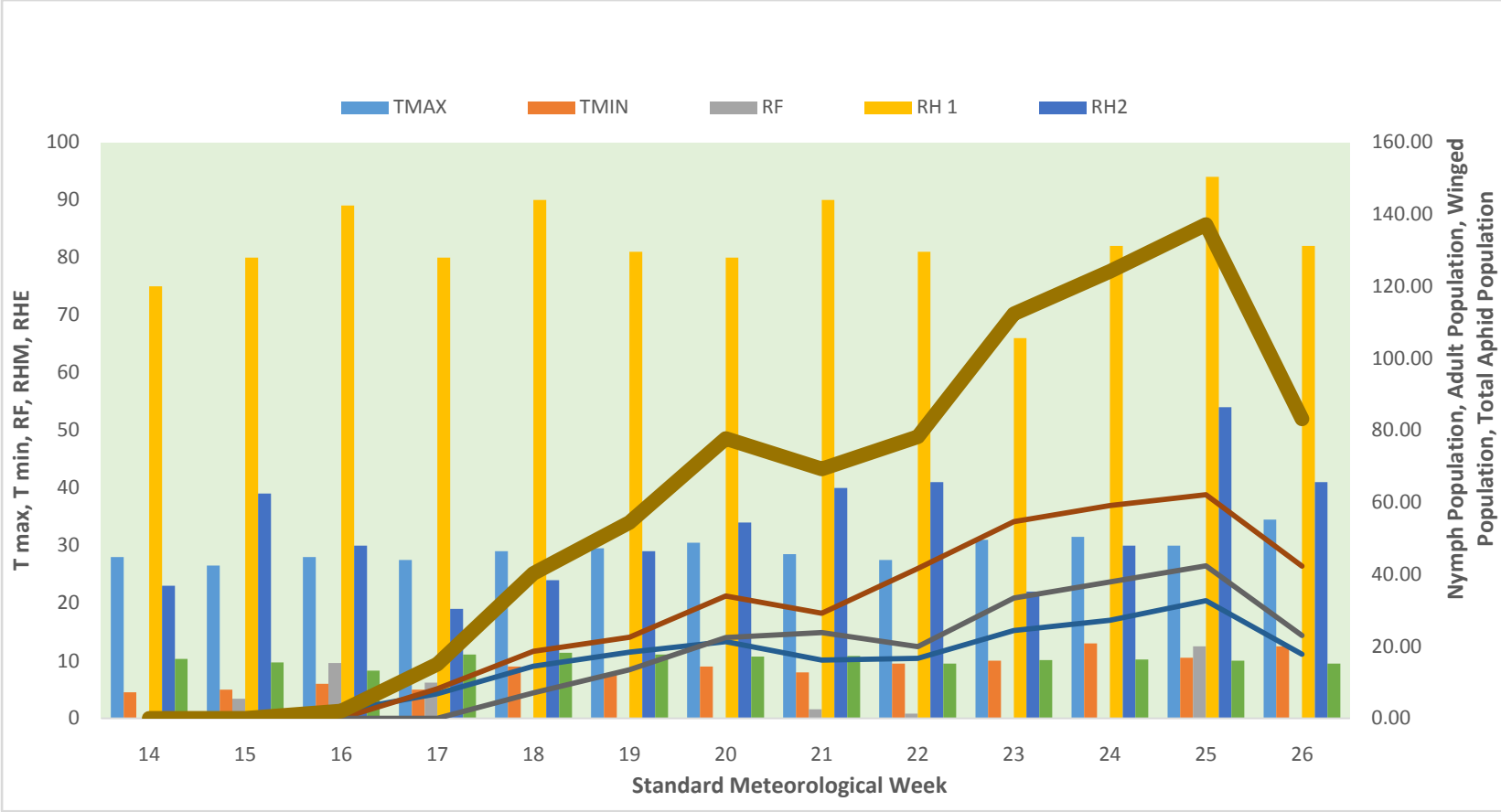


**Fig. 1. Population dynamics of Cabbage aphid (*Brevicoryne brassicae* L.) on Kale (*Brassica oleracea* var. *acephala*) during crop season*Kharif*2021**