# SEASONAL ABUNDANCE OF MAJOR INSECT PESTS AND NATURAL ENEMIES OFCORIANDER AND THEIR RELATIONSHIP WITH BIOTIC AND ABIOTIC FACTORS




## ABSTRACT

The experiment on seasonal abundance of Major Insect Pests and natural enemies of Coriander and their relationship with biotic and abiotic factorswas conducted at Agronomy Farm, S.K.N. College of Agriculture, Jobner during *Rabi,* 2021-22 and 2022-23. The aphid, *Hyadaphiscoriandri* and seed midge, *Systole albipennis*have been recorded as major insect pests of coriander crops.The infestation of *H.coriandri*and *S.albipennis*commenced in the second and the last week of January, during both years, respectively. The population of *H.coriandri* and *S.albipennis*peaked in the fourth week of February and the third week of March, during both years, respectively. The *H.coriandri* population had a significant positive correlation (r=0.65) with maximum temperature during *Rabi*, 2022-23, whereas non- significant correlation with minimum temperature, average relative humidity and the total rainfall during both the years. Seed damaged by *S.albipennis*showed a significant correlation with maximum temperature (r= 0.99 & r= 0.71) and minimum temperature (r= 0.98 & r= 0.95), whereas non-significant correlation with total rainfall during *Rabi*, 2021-22 and 2022-23, respectively. The population of *C. septempunctata* and *M. sexmaculatus*had showed a significant positive correlation with coriander aphid, *H.coriandri* and non-significant correlation with *S.albipennis*during both the years.

**Key words:** *Coriandrum sativum*, *Hyadaphiscoriandri*,*Systole albipennis,*Population, Germination,Temperature, Relative Humidity, Biotic and Abiotic Factors

## INTRODUCTION

"Coriander is one of the important winter season seed spice crops belonging to the family Apiaceae (Umbelliferae), native to the Mediterranean region. It is popularly known as "*Dhaniya*". India is the largest producer, exporter, and consumer of coriander in the world. Coriander crop is extensively grown in the arid and semi-arid regions of India, covering an area of about 711.47 thousand with a production of 947.76 thousand metric tonnes" (Anonymous,2021-22). "In India, Rajasthan and Gujrat states have emerged as seed spice bowl and together contribute more than 80 per cent of the total coriander production. In Rajasthan, it is cultivated in 103.58 thousand-hectares area with an annual production of 135.81 thousand metric tonnes" (Anonymous,2021-22).

"Insect pests are one of the major limiting factors for affecting the quantity and quality production of coriander. The insect pests *viz., Hyadaphiscoriandri* (Das), *Systole albipennis* (Walker), *Bemisiatabac*i (Genn.), *Thrips tabaci*(Linn.),and*Petrobia latens* (Mullar)have been found infesting coriander crops" (Meena *et al.*, 2017). "Among the various insect pests, the coriander aphid, *H. coriandri*and seed midge, *S. albipennis* have been reported as a regular and major pest of coriander in Rajasthan and other parts of the country. Both the nymphs and adults stage of *H. coriandri* cause qualitative and quantitative losses to seed yields by sucking cell sap from inflorescence/ umbels during February-March" (Pareek *et al*., 2013 and Meena *et al*., 2017). "If plant protection measures are not applied on time, it causes nearly 40-50 per

cent yield losses" (Meena *et al.,* 2016). It is well known that the attack of insect pests depends upon crop growth stage, climatic conditions, and the presence of natural enemies at a particular time. The interaction between biotic and abiotic factors helps during predictive models that in turn forecast the pest incidence.

## MATERIAL AND METHODS

To study the seasonal abundance of major insect pests of coriander and their correlation with biotic and abiotic factors, coriander variety RCr-435 was sown in five plots separately and allowed natural infestation of insect pests. The crop was sown on 16$^{th}$ November and 14$^{th}$ November, during two seasons *i.e., Rabi,* 2021-22 and *Rabi,* 2022-23, respectively. The plot size was 3.0 x 2.0 m$^2$ with row-to-row and plant-to-plant distances of 30 cm and 10 cm, respectively.Geographically,Jobneris located at75º 28' East longitude,26º06'North latitude,andanelevation (attitude)of427metersaboveMeanSea Level (MSL) in the Jaipur district of Rajasthan.

The population of *H. coriandri* and their predators were counted on the whole plant in the early stage of the crop and later on, the population of *H. coriandri* was counted on three inflorescence/ umbels from five randomly selected and tagged plants in each plot at weekly intervals from appearance to the harvesting of the crop. The population of *H. coriandri* and natural enemies *viz.*, ladybird beetles was counted visually or by adding a magnifying lens.

The number of damaged seeds by *S.albipennis*was recorded on nine umbels (three umbels each from primary, secondary, and tertiary umbels) from each of the same five tagged plants. the total number of seed/ umbel and damaged seeds was counted with the help of a magnifying lens. The appearance of a black spot or insect exit hole on

the seeds was considered as damaged seed and per cent infestation was calculated.

The simple correlation was computed between the mean population of major insect pests, natural enemies, and weather parameters, *viz.,* maximum and minimum temperatures, average relative humidity, and rainfall (Panse and Sukhatme, 1967). The correlation was also computed between weather parameters and predators.

**RESULTS AND DISCUSSION**

The infestation of *H. coriandri*on coriander crop commenced in the second week of January (2$^{nd}$ SMW) during both years (0.2 Aphids per five plants during both the year), continued thereafter for a long period and reached a peak of 244.6 and 254.0 aphids per five plants in the fourth week of February (9$^{th}$ SMW) during *Rabi*, 2021-22 and 2022-23, respectively. After reaching the peak, the population of aphids started to decline and reached to low level in the second week of March during both the years. The current findings are in accordance with those of Pareek *et al.* (2013), Purti*et al.* (2017), swami *et al.* (2018),and Choudhary *et al.*(2022) were reported the incidence of aphid started in the second week of January to third week of February and the peak population of aphid from the first February to last week of March, which are in support of the present findings. The somewhat variation in commencement of incidence and peak period as reported by the above researchers might be due to the difference in agro-climatic conditions of the locality and time of sowing. The aphid population had non- significant correlation with maximum temperature (r= 0.45), minimum temperature (r= 0.20), average relative humidity (r= -0.53), and total rainfall (r= -0.37) during *Rabi*, 2021-22, whereas, significant positive correlation with maximum temperature (r= 0.65) and non- significant correlation with minimum temperature (r = 0.49),

average relative humidity (r= -0.60) and total rainfall (r= -0.16) during *Rabi*, 2022-23. This indicated that the meteorological parameters did not affect the aphid population significantly during *Rabi*, 2021-22 and 2022-23, however, an increase in maximum temperature (up to 30-35 $^{0}$C) results in a significant increase in the population of aphids during 2022-23.The present finding on the association of aphid population with the abiotic factors are confirmed by the findings of Pareek *et al.* (2013), Purti*et al.* (2017), swami *et al.* (2018), Mamta (2020) and Choudhary *et al.*(2022) who reported that aphid population had a significant positive correlation with maximum temperature and non-significant correlation with minimum temperature, relative humidity, and total rainfall.

The incidence of *S. albipennis*commenced in last week of January (5$^{th}$ SMW) during both the years, *i.e.,Rabi,* 2021-22 and 2022-25 (0.2 and 0.25 per cent seed damage per five plants, respectively) and reached to its peak in the third week of March (12$^{th}$ SMW) with 19.25 and 17.0 per cent seed damage per five plants during *Rabi*, 2021-22 and 2022-23, respectively and continued up to crop harvest. Patel and Patel (2003), Ram and Sharma (2015), Purti*et al.* (2018),and Mamta (2020) reported that the incidence of seed midge started from the second week of December to the second week of February and peak population from the third week of March to second week of April, which supports the present investigation.The correlation matrix indicated that per cent seed damage by *S. albipennis* had a significant positive correlation with maximum temperature (r= 0.99 and r= 0.71), and minimum temperature (r= 0.98 and r= 0.95) and non- significant correlation with total rainfall (r= -0.46 and r= -0.42) during both years, respectively. The per cent seed damage by *S. albipennis*had a significant positive correlation with average relative humidity (r= -0.95) during *Rabi,* 2021-22 whereas, non- significant correlation with average relative humidity (r= -0.24) during *Rabi,* 2022-23.

These results are in agreement with those of Ram and Sharma (2015) and Shewale and Boad (2020) who reported the per cent seed damage had a positive significant correlation with maximum temperature, minimum temperature, and relative humidity and non- significant correlation with total rainfall. Purti*et al.* (2018) reported a significant correlation between seed midge damage and maximum temperature and nonsignificant with minimum temperature, relativehumidity, and rainfall supporting the present finding.

The population of *C. septempunctata*commenced in the third week of January (3rd SMW) during both years, *i.e.,Rabi,* 2021-22 and 2022-23 (0.2 population per five plants in each year), continued thereafter for a long period and reached to its peak in fourth week of February (9th SMW) with 12.2 and 14.8 coccinellid per five plants during *Rabi*, 2021-22 and 2022-23, respectively. After reaching the peak, the population of *C. septempunctata*started to decline and reached to low level in the second week of March during both the years.The present findings are alike with those of Pareek *et al.* (2013), Swami *et al.* (2018), and Mamta (2020) who reported that the population of *C. septempunctata* started in the last week of January to the last week of February and reached to its peak in the third and fourth week of February and thereafter its population started a decline.

The population of *M. sexmaculatus*commenced in the fourth week of January (4th SMW) during both years, *i.e.,Rabi,* 2021-22 and 2022-23 (0.2 population per five plants in each year), and continued thereafter for a long period and reached to its peak in fourth week of February (9th SMW) with 3.6 and 3.8 coccinellid per five plants during *Rabi*, 2021-22 and 2022-23, respectively. After reaching the peak, the population of *M. sexmaculatus*started to decline and reached to low level in the second week of March during both the years. Pareek *et al.* (2013) who were

reported that the population of *M. sexmaculatus* appeared in the first week of February and reached a peak in the last week of February and after a decline which is agreement with present investigation. The correlation studiesrevealed that the population of *C. septempunctata* and *M. sexmaculatus*had showed a significant positive correlation with coriander aphid, *H. coriandri*and a non-significant correlation with seed midge, *S. albipennis* during *Rabi*, 2021-22 and 2022-23, respectively.

## CONCLUSION

In present investigation, the coriander crop has been found infested by aphid, *H.coriandri*,seed midge, *S.albipennis*, whitefly, *B.tabaci*, thrips, *T.tabaci*, and mite, *P. latens*. Among these, the coriander aphid and seed midge were reported to be major insect pests infesting coriander. The natural enemies *C. septempunctata*and *M.sexmaculatus*were observed predating on aphids.

## DISCLAMER (ARTIFICIAL INTELLIGENCE)

Authors hereby declare that no generative Al technologies such as large language models and text-to-image generators have been used during the writing or editing of manuscripts.



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**Table-1 Seasonal abundance of major insect pests of coriander and their natural enemies in relation to weather parameters during *Rabi,* 2021-2022**

| S. No. | SMW* | Temperature $^0$C (Maximum) | Temperature $^0$C (Minimum) | Average RH (%) | Total Rainfall (mm) | Aphids / five plants | *Coccinella Septempunctata* /Five plants | *Menochilussexmaculatus* /Five Plants | Seed Damage (%) by Seed midge / Five plants |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 2 | 17.3 | 4.5 | 69 | 31.6 | 0.2 | 0.0 | 0.0 | - |
| 2 | 3 | 18.9 | 3.9 | 65 | 0.0 | 3.4 | 0.2 | 0.0 | - |
| 3 | 4 | 18.9 | 3.4 | 66 | 0.0 | 19.6 | 0.4 | 0.2 | - |
| 4 | 5 | 23.5 | 4.1 | 61 | 0.0 | 56.2 | 1.6 | 0.4 | 0.20 |
| 5 | 6 | 23.5 | 5.1 | 58 | 1.5 | 120.0 | 2.4 | 1.0 | 0.90 |
| 6 | 7 | 26.3 | 4.7 | 50 | 0.0 | 167.4 | 5.4 | 1.4 | 4.50 |
| 7 | 8 | 29.0 | 7.4 | 51 | 0.0 | 207.0 | 7.8 | 2.2 | 7.25 |
| 8 | 9 | 30.1 | 8.0 | 49 | 0.0 | 244.6 | 12.2 | 3.6 | 9.23 |
| 9 | 10 | 31.6 | 9.8 | 50 | 0.0 | 126.0 | 7.2 | 2.0 | 11.50 |
| 10 | 11 | 36.5 | 12.7 | 41 | 0.0 | 10.2 | 0.6 | 0.4 | 14.90 |
| 11 | 12 | 38.1 | 15.2 | 38 | 0.0 | - | - | - | 19.25 |

*Standard Meteorological Week

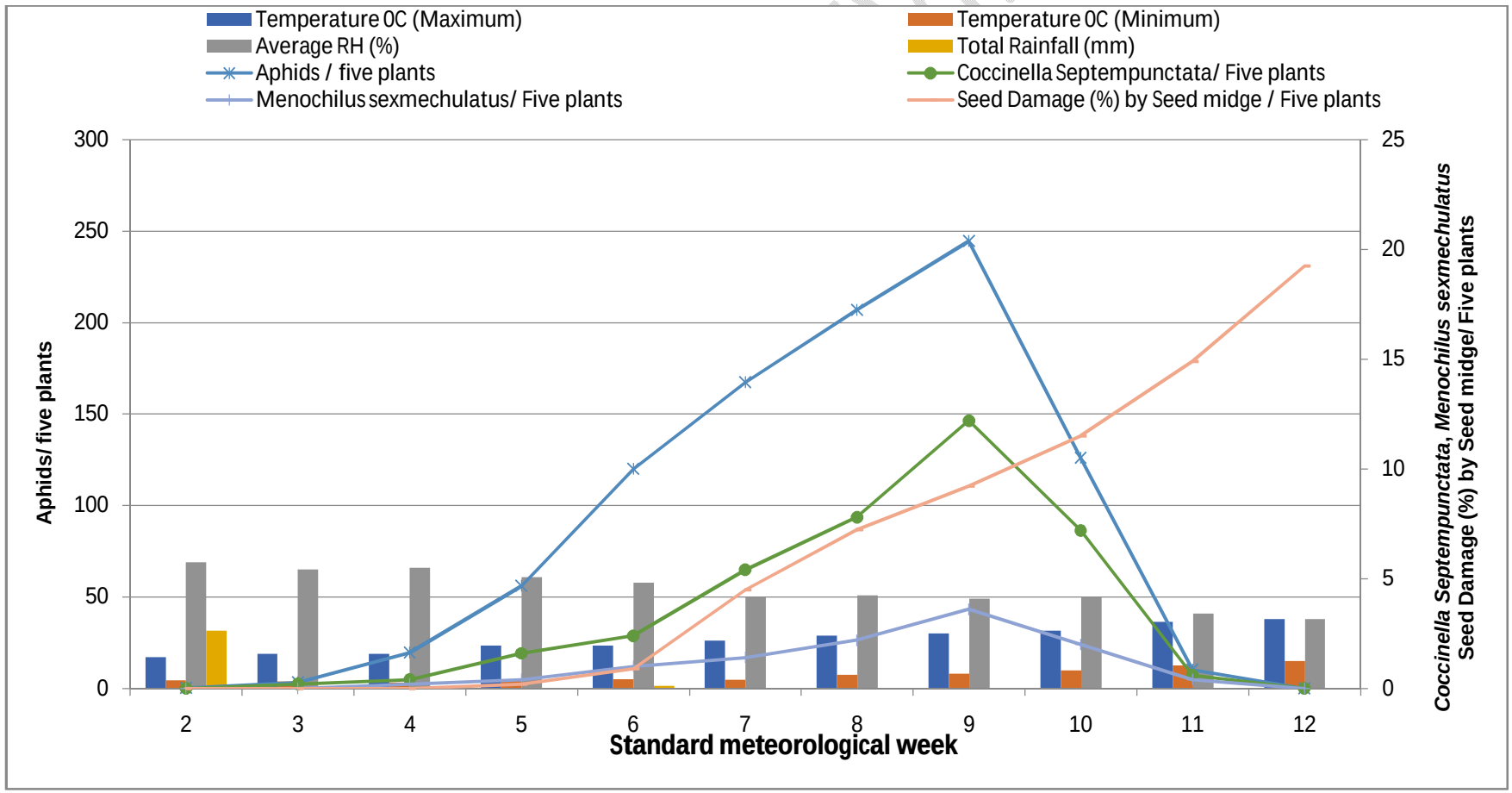
Temperature 0C (Maximum)
Temperature 0C (Minimum)
Average RH (%)
Total Rainfall (mm)
Aphids / five plants
Coccinella Septempunctata/ Five plants
Menochilus sexmechulatus/ Five plants
Seed Damage (%) by Seed midge / Five plants
300
250
200
150
100
50
0
25
20
15
10
5
0
2
3
4
5
6
7
8
9
10
11
12
Aphids/ five plants
Coccinella Septempunctata, Menochilus sexmechulatus
Seed Damage (%) by Seed midge/ Five plants
Standard meteorological week

**Fig.1 Seasonal abundance of major insect pests of coriander and their natural enemies in the relation to weather parameters during *Rabi*, 2021-2022**



**Table-2 Seasonal abundance of major insect pests of coriander and their natural enemies in relation to weather parameters during *Rabi,* 2022-2023**

| S. No. | SMW * | Temperature $^0$C (Maximum) | Temperature $^0$C (Minimum) | Average RH (%) | Total Rainfall (mm) | Aphids / five plants | *Coccinella Septempunctata* /Five plants | *Menochiluss exmaculatus*/ Five Plants | Seed Damage (%) by Seed midge / Five plants |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 2 | 24.5 | 4.9 | 55 | 0.0 | 0.2 | 0.0 | 0.0 | - |
| 2 | 3 | 20.1 | -0.5 | 55 | 0.0 | 4.2 | 0.2 | 0.0 | - |
| 3 | 4 | 21.3 | 3.6 | 61 | 0.0 | 22.0 | 0.4 | 0.2 | - |
| 4 | 5 | 22.0 | 5.2 | 69 | 17.0 | 60.4 | 1.8 | 0.6 | 0.25 |
| 5 | 6 | 26.9 | 6.9 | 56 | 0.0 | 123.0 | 2.8 | 1.2 | 2.45 |
| 6 | 7 | 28.4 | 5.8 | 51 | 0.0 | 176.0 | 5.4 | 1.6 | 5.20 |
| 7 | 8 | 31.9 | 9.8 | 49 | 0.0 | 228.8 | 8.2 | 2.4 | 8.20 |
| 8 | 9 | 32.1 | 12 | 49 | 0.0 | 254.0 | 14.8 | 3.8 | 10.65 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 9 | 10 | 30.7 | 11.3 | 53 | 3.0 | 138.2 | 7.6 | 1.6 | 12.60 |
| 10 | 11 | 32.8 | 13.8 | 55 | 1.5 | 12.0 | 0.6 | 0.4 | 15.75 |
| 11 | 12 | 28.5 | 13.1 | 62 | 3.0 | - | - | - | 17.00 |

*Standard Meteorological Week

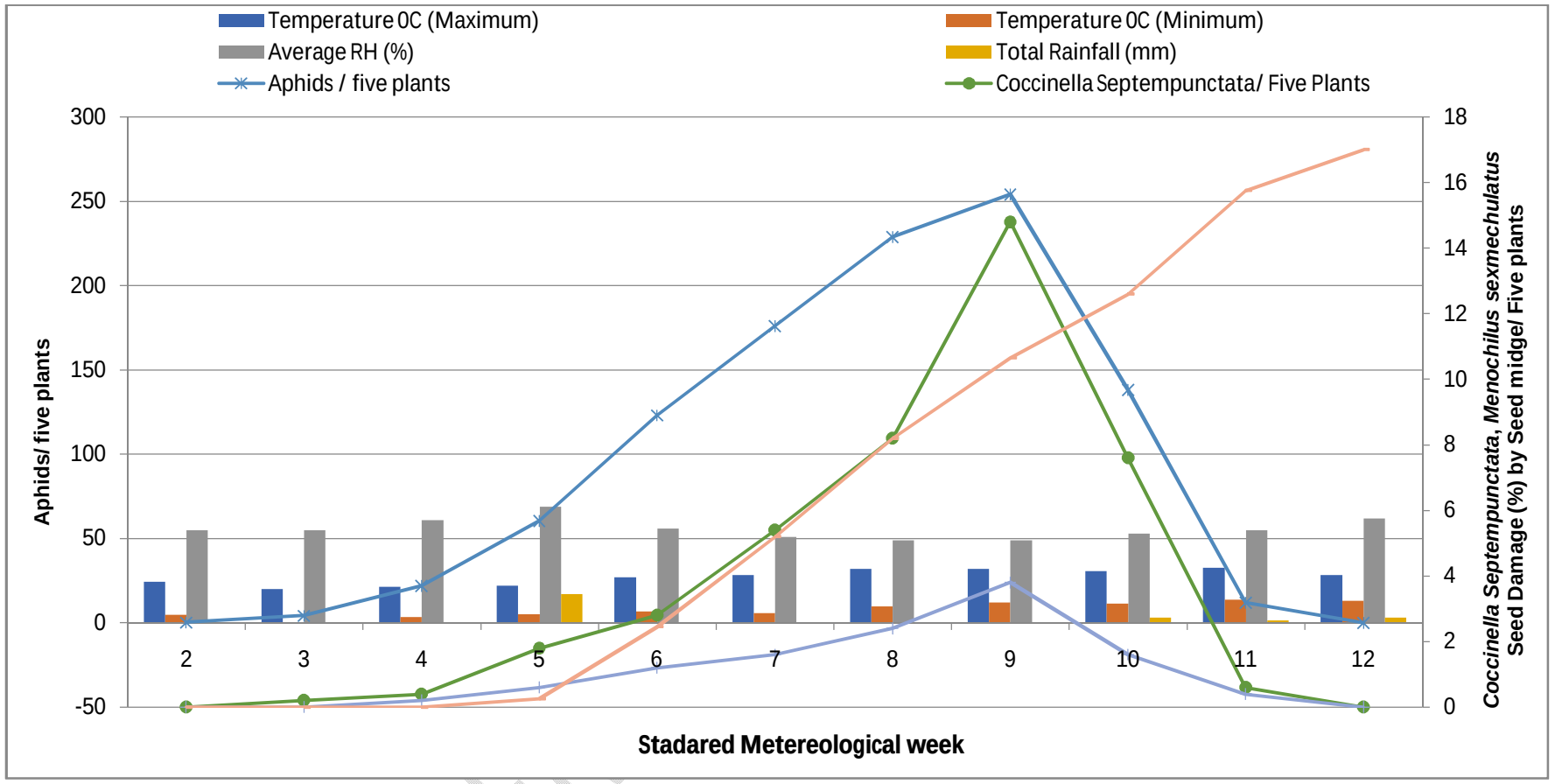


**Fig.2 Seasonal abundance of major insect pests of coriander and their natural enemies in the relation to weather parameters during*Rabi,* 2022-2023**

**Table-3 Correlation coefficient (r) between population of major insect pests, predators and abiotic factors during *Rabi,* 2021-22**

| Particular | Correlation coefficient (r) | | | |
|---|---|---|---|---|
| | Insect pests | | Predators | |
| | ***H. coriandri*** | **Seed damage (%) By *S. albipennis*** | ***Coccinella septempunctata*** | ***Menochilussexmaculatus*** |
| Maximum temperature | 0.45(NS) | 0.99** | 0.53(NS) | 0.56(NS) |
| Minimum temperature | 0.20(NS) | 0.98** | 0.34(NS) | 0.39(NS) |
| Average RH | -0.53(NS) | -0.95** | -0.56(NS) | -0.58(NS) |
| Total rainfall | -0.37(NS) | -0.46(NS) | -0.33(NS) | -0.34(NS) |
| *Coccinella septempunctata* | 0.94** | 0.22(NS) | - | - |
| *Menochilussexmaculatus* | 0.94** | 0.25(NS) | - | - |

**Significant at 1 % level, NS- non significant

**Table-4 Correlation coefficient (r) between population of major insect pests, predators and abiotic factors during *Rabi,* 2022-23**

| Particular | Correlation coefficient (r) | | | |
|---|---|---|---|---|
| | Insect pests | | Predators | |
| | ***H. coriandri*** | **Seed damage (%) By *S. albipennis*** | ***Coccinella septempunctata*** | ***Menochilussexmaculatus*** |
| Maximum temperature ($^0$C) | 0.65* | 0.71* | 0.66* | 0.69* |
| Minimum temperature ($^0$C) | 0.49(NS) | 0.95** | 0.57(NS) | 0.58(NS) |
| Average RH (%) | -0.60(NS) | -0.24(NS | -0.60(NS) | -0.60(NS) |
| Total rainfall | -0.16(NS) | -0.42(NS) | -0.15(NS) | -0.17(NS) |
| *Coccinella septempunctata* | 0.92** | 0.25(NS) | - | - |
| *Menochilussexmaculatus* | 0.96** | 0.17(NS) | - | - |

*Significant at 5% level,**Significant at 1% level, NS- non significant