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

ABSTRACT

The experiment on “Bio-ecology and Management of Major Insect Pests of Coriander (*Coriandrum sativum* L.) in Semi-arid Region of Rajasthan” were conducted at Agronomy Farm and the Laboratory Department of Entomology, S.K.N. College of Agriculture, Jobner during *Rabi,* 2021-22 and 2022-23. The aphid, *Hyadaphiscoriandri* and seed midge, *Systole albipenni*shas been recorded as major insect pests of coriander crop.The infestation of aphidand seed midgecommenced in second and last week of January, during both the years, respectively. The population of aphid and seed midge reached to its peak in fourth week of February and third week of March, during both the years, respectively. The aphid population had significant positive correlation (r=0.65) with maximum temperature during *Rabi*, 2022-23, whereas non- significant correlation with minimum temperature, average relative humidity and total rainfall during both the years. Seed damaged by seed midge showed significant correlation with maximum temperature (r= 0.99 & r= 0.71), 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 significant positive correlation with coriander aphid and non-significant correlation with seed midgeduring 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 belongs to family Apiaceae (Umbelliferae), native of 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 hectare with the production of 947.76 thousand metric tonnes (Anonymous,2021-22). In the 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 hectare 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 quantitative and quality production of coriander. The insect pests *viz., Hyadaphiscoriandri* (Das), *Systole albipennis* (Walker), *Bemisiatabac*i (Genn.), *Thripstabaci*(Linn.)*,*and*Petrobialatens*(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* has 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 not applied on time, it causes nearly 40-50 per cent yield

losses (Meena *et al.,* 2016). It is well known that attack of insect pests depends upon crop growth stage, climatic conditions and presence of natural enemies at a particular time. The interaction between biotic and abiotic factors helps during predicative 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 allow natural infestation of insect pests. The crop was sown on 16th November and 14th 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 distance of 30 cm and 10 cm, respectively.Geographically,Jobneris located at75º 28' East longitude,26º06'North latitudeandatanelevation (attitude)of427metersaboveMeanSea Level (MSL) in Jaipur district of Rajasthan.

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

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

seeds were 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 coccinellids predators.

RESULTS AND DISCUSSION

Aphid, *Hyadaphiscoriandri*

The infestation of coriander aphid, *H. coriandri*on coriander crop commenced in the second week of January (2nd SMW) during both the years (0.2 Aphids per five plants during both the year), continued thereafter for a long period and reached to its peak of 244.6 and 254.0 aphids per five plants in the fourth week of February (9th SMW) during *Rabi*, 2021-22 and 2022-23, respectively. After reaching the peak, the population of aphid 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) who were reported the incidence of aphid started from 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 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 do not affect the aphid population significantly during *Rabi*, 2021-22 and 2022-23, however, increase in maximum temperature (up to 30-35 ^{0}C) results in increase in population of aphids affect the aphid population significantly during 2022-23.The present investigation on 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) those were reported that aphid population had significant positive correlation with maximum temperature and non-significant correlation with minimum temperature, relative humidity and total rainfall.

Seed midge, *Systole albipennis*

The incidence of seed midge*, S. albipennis*commenced in last week of January (5th 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 third week of March (12th 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) were reported the incidence of seed midge started from the second week of December to second week of February and peak population from third week of March to Second week of April, which, supports the present investigation.

The correlation matrix indicated that per cent seed damage had significant positive correlation with maximum temperature (r= 0.99 and r=

0.71), minimum temperature (r= 0.98 and r= 0.95) whereas, non-significant correlation with total rainfall (r= -0.46 and r= -0.42) during both the years, respectively. The per cent seed damage caused by seed midge had 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 positive significant correlation with maximum temperature, minimum temperature and relative humidity and non- significant with total rainfall. Purti*et al.* (2018) reported significant correlation between seed midge damage and maximum temperature and non- significant with minimum temperature, relativehumidity and rainfall supports the present finding.

Coccinellaseptempunctata

The population of *C. septempunctata*commenced in third week of January (3rd SMW) during both the 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 finding are in conformity with those of Pareek *et al.* (2013), Swami *et al.* (2018) and Mamta (2020) who reported that the population of *C. septempunctata* started in last week January to last week of February and reached to its peak in third and fourth week of February and thereafter its population started decline.

Menochilussexmaculatus

The population of *M. sexmaculatus*commenced in fourth week of

January (4th SMW) during both the 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* were appeared in first week of February and reached at peak in last week of February and after decline which are agreement with present investigation.

The correlation studiesrevealed that the population of *C. septempunctata* and *M. sexmaculatus*had showed significant positive correlation with coriander aphid, *H. coriandri*and non-significant correlation with seed midge, *S. albipennis* during *Rabi*, 2021-22 and 2022-23, respectively.

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 writing or editing of manuscripts.

COMPETING INTERESTS

No Competing interest

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

S. No.	SMW *	Date of observation	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	10.01.2022	17.3	4.5	69	31.6	0.2	0.0	0.0	-
2	3	17.01.2022	18.9	3.9	65	0.0	3.4	0.2	0.0	-
3	4	24.01.2022	18.9	3.4	66	0.0	19.6	0.4	0.2	-
4	5	31.01.2022	23.5	4.1	61	0.0	56.2	1.6	0.4	0.20
5	6	07.02.2022	23.5	5.1	58	1.5	120.0	2.4	1.0	0.90
6	7	14.02.2022	26.3	4.7	50	0.0	167.4	5.4	1.4	4.50

7	8	21.02.2022	29.0	7.4	51	0.0	207.0	7.8	2.2	7.25
8	9	28.02.2022	30.1	8.0	49	0.0	244.6	12.2	3.6	9.23
9	10	07.03.2022	31.6	9.8	50	0.0	126.0	7.2	2.0	11.50
10	11	14.03.2022	36.5	12.7	41	0.0	10.2	0.6	0.4	14.90
11	12	21.03.2022	38.1	15.2	38	0.0	-	-	-	19.25

*Standard Meteorological Week

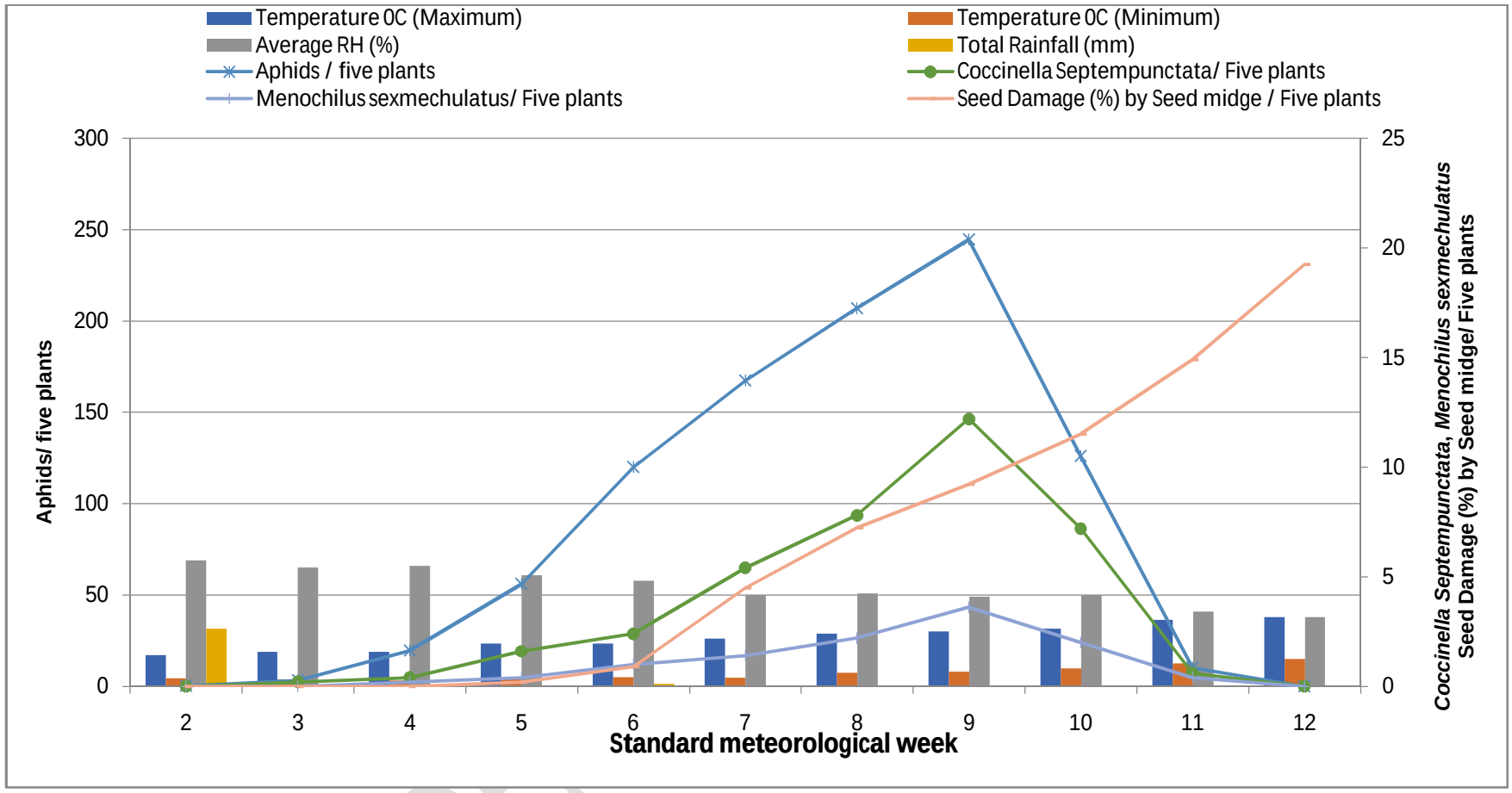

Fig.1 Seasonal abundance of major insect pests of coriander and their natural enemies in the relation to weather parameters during *Rabi*, 2021-2022

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

S. No.	SMW *	Date of observation	Temperature ^{0}C (Maximum)	Temperature ^{0}C (Minimum)	Average RH (%)	Total Rainfall (mm)	Aphids / five plants	*Coccinella Septempunctata* /Five plants	*Menochiluss exmaculatusl* Five Plants	Seed Damage (%) by Seed midge / Five plants
1	2	09.01.2023	24.5	4.9	55	0.0	0.2	0.0	0.0	-
2	3	16.01.2023	20.1	-0.5	55	0.0	4.2	0.2	0.0	-
3	4	23.01.2023	21.3	3.6	61	0.0	22.0	0.4	0.2	-
4	5	30.01.2023	22.0	5.2	69	17.0	60.4	1.8	0.6	0.25
5	6	06.02.2023	26.9	6.9	56	0.0	123.0	2.8	1.2	2.45
6	7	13.02.2023	28.4	5.8	51	0.0	176.0	5.4	1.6	5.20
7	8	20.02.2023	31.9	9.8	49	0.0	228.8	8.2	2.4	8.20
8	9	27.02.2023	32.1	12	49	0.0	254.0	14.8	3.8	10.65
9	10	06.03.2023	30.7	11.3	53	3.0	138.2	7.6	1.6	12.60
10	11	13.03.2023	32.8	13.8	55	1.5	12.0	0.6	0.4	15.75
11	12	20.03.2023	28.5	13.1	62	3.0	-	-	-	17.00

*Standard Meteorological Week

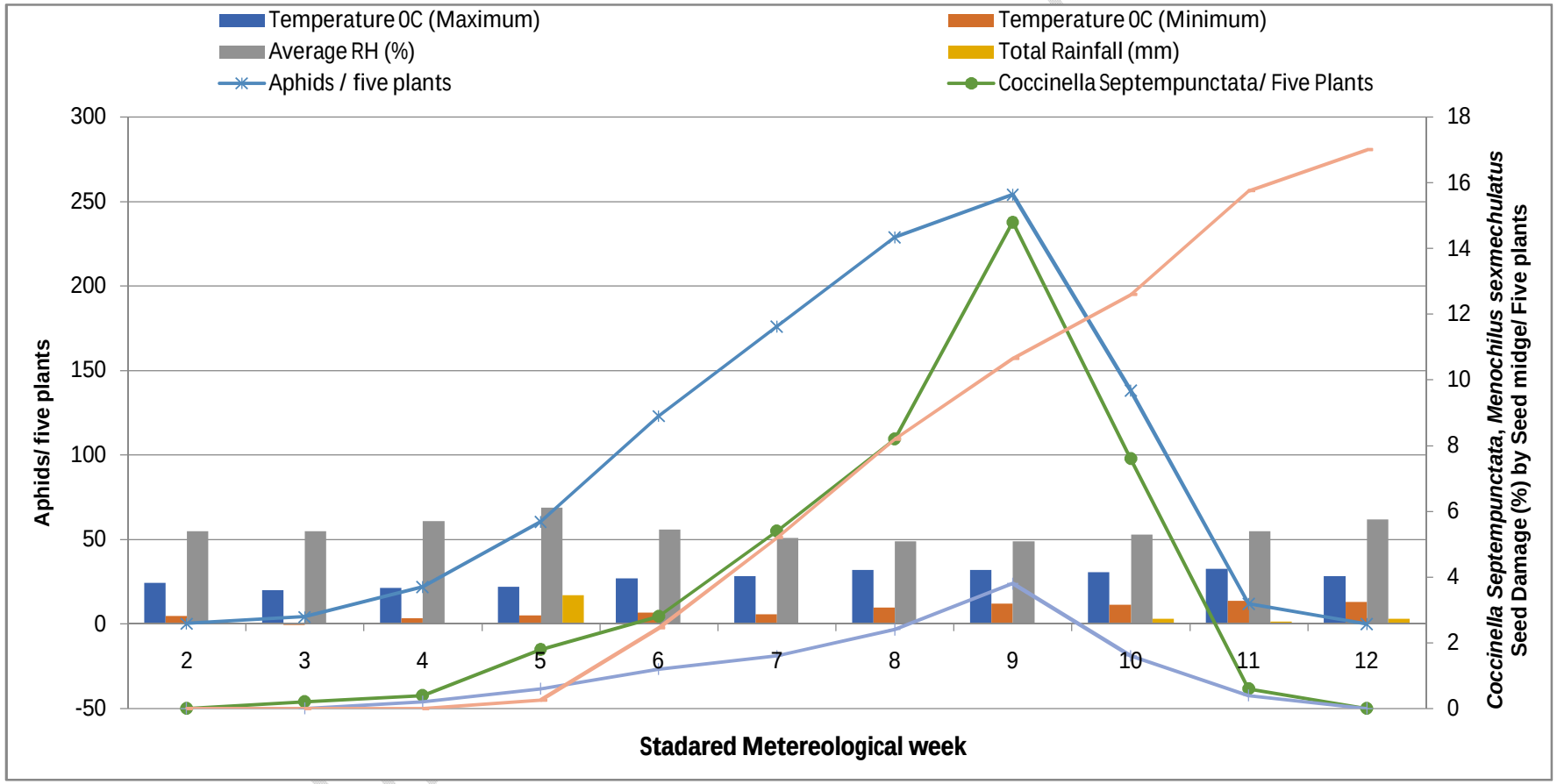

Fig.2 Seasonal abundance of major insect pests of coriander and their natural enemies in the relation to weather parameters during*Rabi,* 2022-2023

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	
	Aphid	Seed damage (%) By Seed midge	*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)
Coccinellaseptempunctata	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	
	Aphid	Seed damage (%) By Seed midge	*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)

Coccinellaseptempunctata	0.92**	0.25(NS)	-	-
Menochilussexmaculatus	0.96**	0.17(NS)	-	-

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