Research Article

Correlation between the Incidence of Coriander Aphids (*Hyadaphis Coriandri*), Their Natural Enemies (Coccinellids) and Abiotic Factors of the Environment

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Abstract

For this experiment coriander (*Coriandrum sativum* L.) crop was raised in the research area of department of Vegetable Science, CCS Haryana Agricultural University, Hisar, during the '*rabi*' season of 2014-15 following recommended agronomical practices. The incidence of aphids was first recorded in the third week of February. The maximum population of aphid was observed in the first week of March and there was a sharp decline in population of aphid in 2nd week of March. Population of coccinellids was first observed during the last week of February, 2015. The highest observation of coccinellids (both adults and grubs) was observed in the 2nd week of March and the lowest population of coccinellids was observed in the end of March. The maximum temperature and relative humidity (morning) had positive effect on population of aphids. Minimum temperature, relative humidity (evening), wind speed and sunshine hours had non - significant effect on population of aphids. Similarly, correlation worked out between population of coccinellids (both grubs and adults) with different weather parameters revealed that sunshine hours and rainfall had positive effect on population of coccinellids. Maximum temperature, minimum temperature, relative humidity (both morning and evening), wind speed and had non- significant effect on population of coccinellids.

Keywords: Coriander, aphid, *Hyadaphis coriandri*, weather parameters, natural enemies

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Introduction

Coriander is an important seed spice crop. All parts of the plant are edible, but the fresh leaves and the dried seeds are the parts most commonly used in cooking. Dhania word is commonly used in India. In Haryana, total area of coriander under cultivation is 2400 ha and production is 4400 tonnes in 2015-16 (NHB database, 2015-16). Coriander aphid, *Hyadaphis coriandri,* Bodenheimer and Swirski (Aphididae: Hemiptera) is a major pest and responsible for reduction in crop yield. Its seed yield and quality often seriously affected by the coriander aphid, *Hyadaphis coriandri* [1, 2]. *H. coriandri* has been reported to be the main aphid species in India infesting coriander and causes about 19 per cent losses [3]. In general, the infestation of aphid attack is followed by the appearance of their natural enemies mainly the coccinellids. Correlation studies are necessary between the incidence of pest population, their natural enemies and different weather parameters to develop the ecologically based management strategy. So, keeping in view the above things the experiment was conducted.

Material and Methods

For this experiment, coriander (*Coriandrum sativum* L.) crop (all the ten varieties/germplasm) was raised in the research area of Department of Vegetable Science, CCS Haryana Agricultural University, Hisar, during the '*rabi*' season of 2014-15 following recommended agronomical practices. Crop was sown on November 20th, 2014. The experiment was laid out in randomized block design, with three replications and plot size of 3m x 2m. Data on population of aphids were recorded by counting the number of aphids (both nymphs and adults) from top 10 cm twig including umbel on ten randomly selected plants from each plot. These observations on aphid infestation were recorded till harvest. The population of grubs/adults of coccinellid predators of coriander aphid was also recorded simultaneously along with the aphid population. Three species of coccinellids *viz.*, *Coccinella septempunctata, Chilomenes sexmaculata* and *Hippodamia variegata* were recorded during the season and these coccinellids were first observed during the last week of February, 2015. In general, the population of *C. septempunctata* was predominantly

higher as compared to other coccinellids. The data on important weather parameters *viz.*, maximum temperature, minimum temperature, relative humidity (both morning and evening), wind speed, sunshine hours and rainfall were obtained from the Meteorological Observatory, Department of Agricultural Meteorology, CCS Haryana Agricultural University, Hisar. The incidence of aphid and their natural enemies on coriander crop was correlated with different weather parameters. The data obtained from the field studies were tabulated and subjected to the analysis of variance (ANOVA). For satisfying the assumption of analysis of variance the data on population of aphids and natural enemies subjected to square root transformation. Correlation of population fluctuations of aphid and natural enemies with different meteorological parameters was worked out.

Results and Discussion

The population of aphid, *H. coriandri* differed substantially amongst different varieties/germplasm of coriander during the *'rabi'* season of 2014-15 (**Table 1**). The incidence of aphids was first recorded in the third week of February. The maximum population of aphid was observed in the first week of March and there was a sharp decline in population of aphid in 2nd week of March as shown in the **Figure 1**. Graphical representation of biotic factor like population of aphid and weather parameters is represented in **Figure 2**. Earlier Jain and Yadav [4] observed aphid population ranging from 25 to 107.25 aphids/umbel. The infestation of *H. coriandri*, started in the 3rd week of February and increased with the advancement of season and its peak was recorded during the first week of March. Similar results were also obtained by Kalra and co-workers [5], while working on this pest under Haryana agroclimatic conditions.

Table 1 Correlation co-efficient between the incidence of aphids and their natural enemies and abiotic factors of the environment

Abiotic factors of environment	*Hyadaphis coriandri*	Natural enemies (coccinellids)
Maximum temperature (ºC)	0.501*	-0.117
Minimum temperature (ºC)	-0.241	-0.324
Relative Humidity morning (%)	0.609*	0.135
Relative Humidity evening (%)	-0.126	-0.357
Wind speed (kmph)	-0.396	0.077
Sunshine (hrs)	0.127	0.592*
Rainfall (mm)	0.098	0.736*
*Significant at P = 0.05		

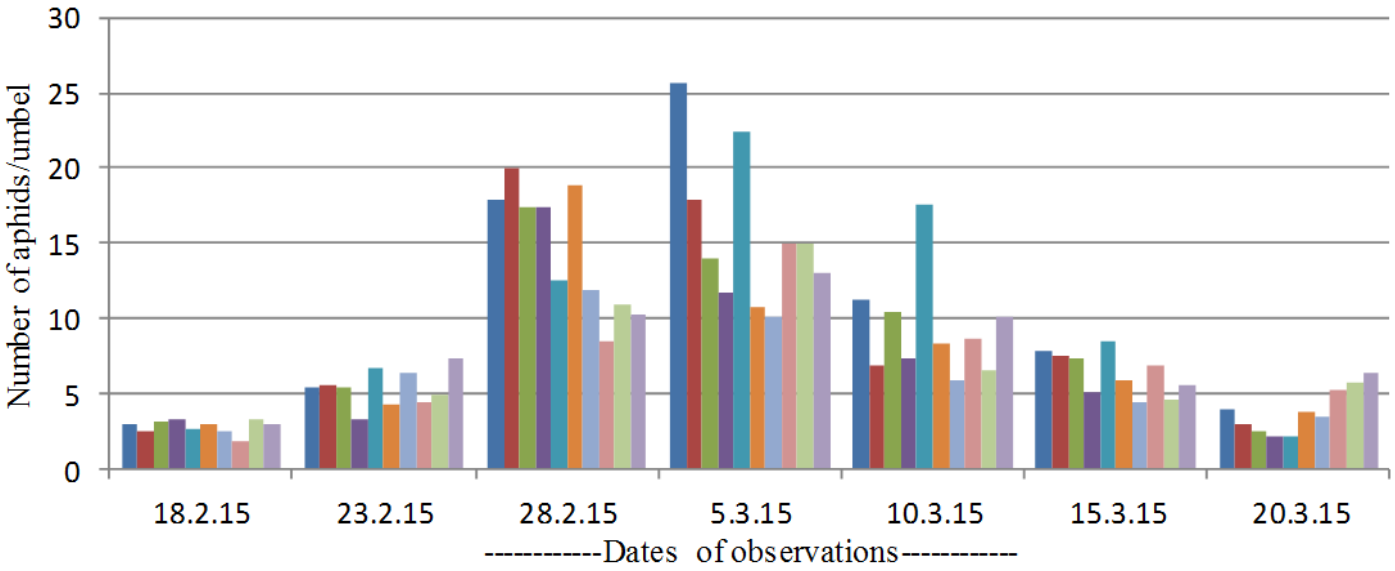

Figure 1 Graphical presentation of population dynamics of coriander aphid in different varieties/germplasm

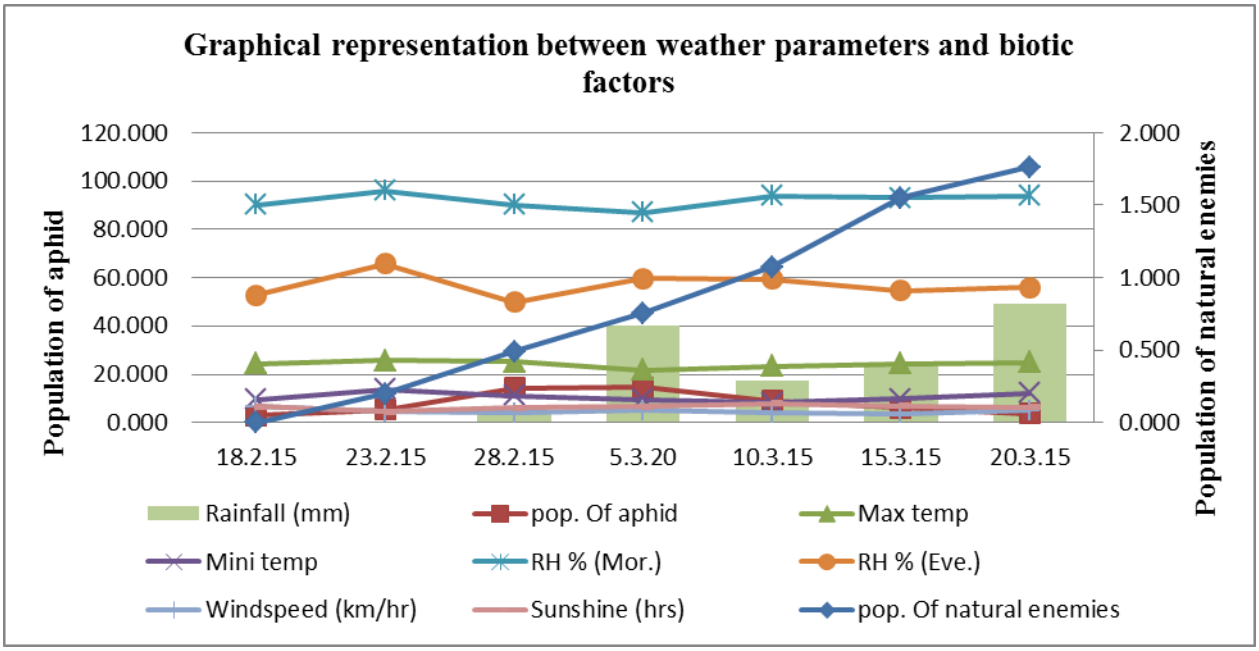

Figure 2 Graphical representation of population of aphid and weather parameters

The first appearance of coccinellids on aphid colonies was recorded on 23rd February on different varieties/germplasm. Three species of coccinellids *viz., Coccinella septempunctata, Chilomenes sexmaculata* and *Hippodamia variegata* were recorded during the season and these coccinellids were first observed during the last week of February, 2015. In general, the population of *C. septempunctata* was predominantly higher as compared to other coccinellids. Similarly, the highest observation of coccinellids (both adults and grubs) was observed in the 2nd week of March due to abundantly presence of host and the lowest population of coccinellids was observed in the end of March because of unavailability of host as shown in **Table 2**. Similar observations were reported by Meena and co-workers [6] who worked out a positive correlation between the aphid infestation and coccinellid predator's population. Population of coccinellids reached a peak in 2nd week of March. The results given in these studies are in line with those reported earlier by Sagar and Kumar [7], who reported six species of predator (*Coccinella septempunctata, Chilomenes sexmaculata, Brumoides suturalis, Chrysoperla carnea, Episyrphus balteatus and Ischioden scutellaris*) as the natural enemies of the *H. coriandri*. Of these, *C. septempunctata* was found to be the predominant species during the peak period of pest activity.

Table 2 Population dynamics of natural enemies (coccinellids) of *Hyadaphis coriandri* in different coriander varieties/germplasm

Sr. No.	Varieties/ germplasm	Number of coccinellids* per plant						Season's av.
		23.2.15	28.2.15	5.3.15	10.3.15	15.3.15	20.3.15	
1.	Hisar Anand	0.10** (1.05)***	0.15(1.26)	1.67(1.63)	0.15(1.26)	1.37(1.54)	1.20(1.48)	0.92(1.39)
2.	Hisar Sugandh	0.20 (1.10)	0.50 (1.22)	0.93 (1.39)	0.43 (1.20)	0.90 (1.38)	2.27 (1.71)	0.87 (1.37)
3.	Hisar Surbhi	0.13(1.06)	0.93(1.39)	1.30(1.52)	1.70(1.64)	1.33(1.53)	3.57(2.14)	1.49(1.57)
4.	DH-220	0.07(1.03)	0.83(1.35)	0.77(1.33)	1.67(1.68)	2.17(1.78)	2.70(1.92)	1.37(1.53)
5.	DH-206	0.20(1.10)	0.17(1.08)	0.13(1.06)	0.77(1.33)	0.90(1.38)	1.37(1.54)	0.59(1.26)
6.	Hisar Bhoomit	0.10(1.05)	0.13(1.06)	0.13(1.06)	0.33(1.15)	0.50(1.22)	0.83(1.35)	0.34(1.16)
7.	DH-2	0.30(1.14)	0.07(1.03)	0.37(1.17)	0.37(1.17)	1.00(1.41)	0.97(1.40)	0.51(1.23)
8.	Pant Haritima	0.17(1.08)	0.47(1.21)	1.10(1.45)	2.47(1.86)	3.30(2.07)	1.17(1.47)	1.45(1.56)
9.	DH-236	0.30(1.14)	0.87(1.37)	0.73(1.32)	0.150(1.26)	1.07(1.44)	1.47(1.57)	0.84(1.36)
10.	DH-306	0.30(1.14)	0.43(1.20)	1.33(1.53)	1.77(1.66)	2.80(1.95)	1.50(1.58)	1.36(1.53)
	C.D.(P=0.05)	(0.07)	(0.10)	(0.08)	(0.16)	(0.14)	(0.19)	(0.13)

**Coccinella septempunctata, Hippodamia variegata and Chilomenes sexmaculata*
**Average of 10 plants
***Figures in parentheses are √n+1 transformation

Table 3 Meterological data for correlation of coriander aphid, *Hyadaphis coriandri* and natural enemies with weather parameters

Dates of observations	Population of natural enemies	Population of aphids	Mean values of weather parameters						
			Max. temp. (ºC)	Mini. Temp. (ºC)	RH % (Mor.)	RH % (Eve.)	Wind speed (kmph)	Sunshine (hrs)	Rainfall (mm)
18.2.15	0	2.822	24.314	9.471	90.143	52.857	6.600	6.600	0.000
23.2.15	0.197	5.371	25.757	13.714	95.857	65.857	4.400	4.543	0.000
28.2.15	0.489	14.212	25.143	11.157	90.143	49.857	4.057	6.143	3.700
5.3.20	0.754	14.450	21.686	9.586	87.000	59.571	5.086	6.529	40.400
10.3.15	1.073	9.046	23.229	8.157	93.714	59.286	3.943	7.957	17.500
15.3.15	1.552	6.193	24.286	9.729	93.143	54.714	3.686	6.900	23.700
20.3.15	1.761	3.802	25.000	12.171	93.857	56.000	5.143	6.429	49.000

Correlation of biotic (*Hyadaphis coriandri* and their natural enemies) and abiotic (minimum and maximum temperature, relative humidity, wind speed, sunshine hours and rainfall) factors was worked out to know the relationship, if any. The maximum temperature and relative humidity (morning) had positive effect on population of aphids. Minimum temperature, relative humidity (evening), wind speed and sunshine hours had non - significant effect on population of aphids. Similarly, correlation worked out between population of coccinellids (both grubs and adults) with different weather parameters revealed that sunshine hours and rainfall had positive effect on population of coccinellids. Maximum temperature, minimum temperature, relative humidity (both morning and evening), wind speed and had non- significant effect on population of coccinellids. Similar observations were reported by Meena and co-workers [3] who worked out a positive correlation between aphid population and coccinellid predator's population. While the coefficient of correlation with temperature and relative humidity was negative. However, studies conducted by Kumar and co-workers [8] showed a positive correlation between aphid population and coccinellids population. The coefficient of correlation between mean temperatures was found to be positive, while it was negative with mean relative humidity. Kumari and Yadav [9] reported that correlation and regression analysis of pooled data of two years revealed that the aphid population during its ascending phase, showed positive correlation with the maximum, minimum and mean temperatures while negative association ship with the relative humidity. Reverse was the trend during descending phase. Regression analysis showed that the combined effect of these metreological parameters on aphid population varied widely from 71.3 to 99.4 %.

Its seed yield and quality often seriously affected by the coriander aphid, *Hyadaphis coriandri* (Homoptera: Aphididae) [1, 7].

Conclusion

The incidence of insect population, their natural enemies and their correlation with different weather parameters are necessary because it provides the ecologically based management strategy. Because, there is a great role of different weather parameters in the management of insect population. To know the effect of weather parameters on population of insect-pests correlation studies are necessary.

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