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SEASONAL ABUNDANCE OF INSECT PESTS AND THEIR MAJOR NATURAL ENEMIES IN CORIANDER *CORIANDRUM SATIVUM* LINN.

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The coriander crop was found infested by aphid, *Hyadaphis coriandri* (Das); whitefly, *Bemisia tabaci* (Genn.); thrips *Thrips tabaci* Lind. and mite, *Petrobia latens* (Muller). Among these, the coriander aphid was found as major as one and its infestation started in the last week of January and remained throughout the crop season during both the years of study (*rabi*, 2004–05 and 2005–06). The aphid population peaked in fourth week of February during both the years. The peak activity of the aphid was observed at 30.1 °C maximum and 9.7 °C minimum temperature with relative humidity 78 per cent in morning and 31 per cent in evening during *rabi*, 2004–05 and at 32.7 °C maximum and 12.1 °C minimum temperature with relative humidity 75 per cent in morning and 27 per cent in evening during *rabi*, 2005–06. A positive significant correlation was observed between aphid population and maximum temperature, whereas, minimum temperature, relative humidity and rainfall exhibited non–significant correlation. Three coccinellid species, *viz.*, *Coccinella septempunctata* L., *Menochilus sexmaculatus* (Fab.) and *Adonia variegata* (Geoze) were found to predate upon the aphid, *H. coriandri.* Out of these, *C. septempunctata* was found to be dominant one. The occurrence of predator *C. septempunctata* coincided with the population of aphids during both the years.

Key words: *Hyadaphis coriandri* (Das), *Coccinella septempunctata* L., *Menochilus sexmaculatus* (Fab.), temperature, relative humidity

Coriander, *Coriandrum sativum* Linn. commonly known as *dhaniya* is an important spice crop of winter season. India is the largest producer, consumer and exporter of seed spices in the world. Insect pests are one of the major limiting factors for higher and quality production of coriander. The insect pests, *viz.*, *Hyadaphis coriandri* (Das), *Bemisia tabaci (Genn), Agnoscalis nubila* (Feb.), *Spodoptera exigua* (Hub.), *Myzus persicae* (Sulzer), *Chrotogonus trachypterus* (Blanch.) and *Thrips tabaci* (Lind.) have been found infesting coriander crop, beside a mite, *Petrobia latens* (Muller). Among the various insect pests, the coriander aphid, *Hyadaphis coriandri* (Das) has been reported as a regular and major pest of coriander in Rajasthan and other parts of the country. Both nymphs and adults cause both quantitative and qualitative losses to seed yield. They cause damage by sucking cell sap from inflorescences/ umbels during February–March (Nayer *et al.*, 1982; Jain and Yadav, 1988; Jain and Yadav, 1989; Meena, 1999; Lekha, 2002 and Bana, 2007). Attack of insect pests depends on climatic conditions, crop growth stage and incidence of natural enemies at a particular time in the region. Substantial losses due to insect pests, which have not been fully investigated, could be prevented at minimum cost and without hazards to men and environment. Such an approach envisages the necessity to understand the ecological background while considering the entire spectrum of control methodology. Complete details of abiotic and biotic factors of environment of the pest require full investigations.

MATERIALS AND METHODS

The seeds of coriander variety RCr–41 being susceptible and recommended for the zone, were sown on 30th October in both the years (2004–05 and 2005–06) in five plots measuring 3.0 × 2.0 m^2, keeping row to row and plant to plant spacings of 0.3 m and 0.1 m, respectively. The observations on insect pests and their predatory fauna were recorded on the crop in early morning hours (before 8.00 AM) at weekly interval after one week of germination till harvesting. For this purpose, five plants were randomly selected and tagged in each plot and the population of the aphid and predators were counted visually (absolute counting), initially on whole plant and in later observations, on three inflorescence/ umbels on each randomly selected tagged plants. The population of mite and thrips were recorded by tapping them on the white paper sheet, whereas, in case of whitefly by counting nymphs and adults. Observations on aphid population on five plants were used for analyses of variance (ANOVA)

after transferring the data into $\sqrt{x + 0.5}$ values (Panse and Sukhatme, 1967). The correlation was computed between aphid population (*Hyadaphis coriandri*) and major predators (*C. septempunctata* and *M. sexmaculatus*) as well as key abiotic factors like minimum and maximum temperature, relative humidity and rainfall to see their influence on the population fluctuations of coriander aphid and the predators.

RESULTS AND DISCUSSION

1. Population of insect pests and coccinellid predators: It was observed that insect species belonging to different taxonomic orders appeared at different stages of crop growth of coriander cultivar RCr–41. Among them, coriander aphid, *Hyadaphis coriandri* (Das) was found as the major pest attacking the crop. The white fly, *Bemisia tabaci* (Genn.), thrips, *Thrips tabaci* (Lind.) and mite, *Petrobia latens* (Muller) were recorded in very low numbers, hence, were recognized as minor pests. The present results are in agreement with David and Kumaraswami (1982), Nayer *et al.* (1982), Jain (1984), Meena (1993), Meena (1999) and Lekha (2002) who reported coriander aphid, *H. coriandri* as well as brown wheat mite, *P. latens* as pests of coriander at different locations including Jobner, however, coriander aphid, *H. coriandri* has been found to be the most prominent and major insect pest and the mite, *P. latens* was next serious pest observed only during 1980–81 (Jain and Yadav, 1988).

The incidence of aphid started in last week of January and peaked in fourth week of February during both the years of study (Table 1 and 2). The results corroborate with the findings of Jain (1984), Jain and Yadav (1988), Jain and Yadav (1989), Meena (1993), Meena (1999) and Lekha (2002) who observed almost similar observations. During the studies, it was observed that the infestation of coriander aphid started in 2004–05 when the maximum temperature was 20.4 °C, minimum temperature was 4.1 °C with relative humidity of 83 per cent in morning and 36 per cent in evening. The infestation of coriander aphid started in 2005–06 when the maximum temperature was 27.9 °C, minimum temperature was 6.2 °C with relative humidity of 71 per cent in morning and 25 per cent in evening. The peak activity was observed at 30.1 °C maximum and 12.1 °C minimum temperature with relative humidity 78 per cent in morning and 31 per cent in evening during 2004–05. The peak activity was observed at 32.7 °C maximum and 9.7 °C minimum temperature with relative humidity 75 per cent in morning and 27 per cent in evening during 2005–06. These findings conform with the statements given by the earlier workers that the most of the insects are poikilothermic in nature; therefore, abiotic factors played an important role in their distribution and abundance (Singh and Saini, 1971 and Gupta *et al.*, 1976).

The quantitative survey during 2004–05 and 2005–06 revealed that three predatory species, *viz.*, *Coccinella septempuncatata* Linn., *Menochilus sexmaculatus* (Fab.) and *Adonia variegata* (Geoze) have been found preying aphid, *H. coriandri* on the coriander crop in both the years. Out of these, *C. septempuncatata* was the dominant one. During *rabi* 2004–05, *C. septempuncatata* appeared in the last week of January (1.8/ 5 plants) and reached peak in the fourth week of February (14.8/ 5 plants) when maximum and minimum temperatures were 30.1 °C and 12.1 °C and relative humidity was 78 and 31 in morning and evening, respectively (Table 1). The population of *M. sexmaculatus* (1.2/ 5 plants) appeared one week later than *C. septempuncatata, i.e.*, in the first week of February with the aphid population of 140.6 aphids per five plants, when maximum and minimum temperatures were 24 °C and 9.5 °C, respectively and relative humidity was 76 and 53 per cent in morning and evening respectively. The population reached peak (3.8/ 5 plants) in the fourth week of February with corresponding aphid population of 287.8 aphids per five plants, thereafter, the population started to decline and disappeared by the second week of March. The population of *A. variegata* was very low and remained for a very short period. However, it appeared in the third week of February (1.0/ 5 plants), maximum in fourth week of February (1.2/ 5 plants), thereafter, the population of *A. variegata* disappeared completely.

During *rabi* 2005–06, the population of *C. septempuncatata* (0.8 beetles/ five plants) appeared in the last week of January (Table 2). The population increased gradually and reached to its peak (17.8/ 5 plants) in the fourth week of February with 320.6 aphids per five plants, when the maximum and minimum temperatures were 37.7 °C and 9.7 °C, respectively and relative humidity was 75 and 27 per cent in morning and evening respectively. Thereafter, the population declined and reached to zero in the second week of March. The population of *C. septempuncatata* was influenced by the host (prey) insect as both peaked during the same time. The population of *M. sexmaculatus* during *rabi* 2005–06 appeared in the last week of January, *i.e.* one week earlier than appeared during 2004–05 and reached to peak (4.2/ 5 plants) in the fourth week of February. At the same time the aphid population was 320.6 per five plants. The maximum and minimum temperature during this period was 32.7 °C and 9.7 °C, respectively; whereas, the relative humidity in morning and evening was 75 per cent and 27 per cent, respectively; thereafter, the population declined and reached to zero during second week of March. The population as well as

Table 1. Seasonal abundance of coriander aphid, *Hyadaphis coriandri* (Das) and coccinellid predators during *rabi*, 2004–05

Date of observation	SMW	Meteorological observations							Mean population of aphids/ 5 plants	Mean population of predators/ 5 plants		
		Temp. °C			R.H. %			Rainfall				
		Max.	Min.	Av.	Mor.	Even.	Av.	mm		*C. septumpunctata*	*M. sexmaculatus*	*A. variegata*
22.01.05	4	19.2	04.4	11.8	85	40	62.5	4.6	0.0	0.0	0.0	0.0
29.01.05	5	20.4	04.1	12.25	83	36	59.5	0.0	24.0	1.8	0.0	0.0
05.02.05	6	24.0	09.5	16.75	76	53	64.5	1.0	140.6	5.2	1.2	0.0
12.02.05	7	26.7	10.3	18.5	80	30	55.0	0.0	152.8	6.0	1.2	0.0
19.02.05	8	22.3	03.2	12.75	79	29	54.0	0.0	261.0	10.2	2.4	1.0
26.02.05	9	30.1	12.1	21.1	78	31	54.5	1.5	287.8	14.8	3.8	1.2
05.03.05	10	29.2	15.2	22.25	82	37	59.5	0.0	70.6	3.2	2.0	0.0
12.03.05	11	28.6	12.1	20.35	79	25	52.2	0.0	0.0	0.0	0.0	0.0
Total	–	–	–	–	–	–	–	–	–	41.2	10.6	2.2
Per cent	–	–	–	–	–	–	–	–	–	76.30	19.63	4.07
Correlation coeff. (r) with aphid		0.30	0.03	0.19	–0.61	–0.13	–0.43	–0.20	–	0.98**	0.90**	–
Correlation coeff. (r) with *C. septempunctata*		0.37	0.09	0.24	–0.56	–0.17	–0.41	–0.16	–	–	–	–
Correlation coeff. (r) with *M. sexmaculatus*		0.54	0.33	0.45	–0.48	–0.14	–0.44	–0.16	–	–	–	–

** Significant at 1 per cent level; SMW – Standard meteorological weeks

Table 2. Seasonal abundance of coriander aphid, *Hyadaphis coriandri* (Das) and coccinellid predators during *rabi*, 2005–06

Date of observation	SMW	Meteorological observations							Mean population of aphids/ 5 plants	Mean population of predators/ 5 plants		
		Temp. °C			R.H. %			Rainfall				
		Max.	Min.	Av.	Mor.	Even.	Av.	mm		*C. septumpunctata*	*M. sexmaculatus*	*A. variegata*
22.01.06	4	22.0	2.1	12.05	78	33	55.5	0.0	0.0	0.0	0.0	0.0
29.01.06	5	27.9	6.2	17.05	71	25	48	0.0	19.0	0.8	0.8	0.0
05.02.06	6	25.4	6.8	16.1	70	22	46	0.0	158.6	4.6	2.2	0.0
12.02.06	7	31.3	9.9	20.6	64	22	43	0.0	181.4	8.2	2.4	0.0
19.02.06	8	34.4	12.4	23.4	61	23	42	0.0	288.8	13.2	3.6	0.8
26.02.06	9	32.7	9.7	21.2	75	27	51	0.0	320.6	17.8	4.2	1.2
05.03.06	10	30.7	12.3	21.5	72	40	56	1.5	82.8	4.0	2.4	0.0
12.03.06	11	27.8	11.9	19.85	80	37	58.5	4.5	0.0	0.0	0.0	0.0
Total	–	–	–	–	–	–	–	–	–	48.6	15.6	2.0
Per cent	–	–	–	–	–	–	–	–	–	73.41	23.56	3.02
Correlation coeff. (r) with aphid		0.74*	0.41	0.62	–0.58	–0.56	–0.62	–0.47	–	0.98**	0.96**	–
Correlation coeff. (r) with *C. septempunctata*		0.77*	0.42	0.64*	–0.46	–0.46	–0.49	–0.41	–	–	–	–
Correlation coeff. (r) with *M. sexmaculatus*		0.79*	0.49	0.68	–0.48	–0.48	0.55*	–0.46	–	–	–	–

*Significant at 5 per cent level; ** Significant at 1 per cent level; SMW – Standard meteorological weeks

period of incidence of *A. variegata* remained very low during both the years. It appeared in the third week of February (1.0 and 0.8/ 5 plants as against 261.0 and 288.8 aphids per five plants in 2004–05 and 2005–06, respectively). It reached peak during fourth week of February and disappeared in the first week of March.

The data recorded in relation to relative abundance of different aphidophagous coccinellids, *i.e. C. septempuncatata, M. sexmaculatus* and *A. variegata* have been represented in fig. 1 and 2. The relative abundance of all three species of coccinellids followed same order of occurrence with little variation during both the years. The relative abundance of *C. septempuncatata* was 76.30 and 73.41 per cent during 2004–05 and 2005–06, respectively followed by *M. sexmaculatus* (19.63 and 23.56% during 2004–05 and 2005–06, respectively) and *A. variegata* (4.07 and 3.02 during 2004–05 and 2005–06, respectively). Further, it was evident that the maximum occurrence was in the fourth week of February in case of *C. septempuncatata* and *M. sexmaculatus* in both the years. The abundance of *A. variegata* was very low.

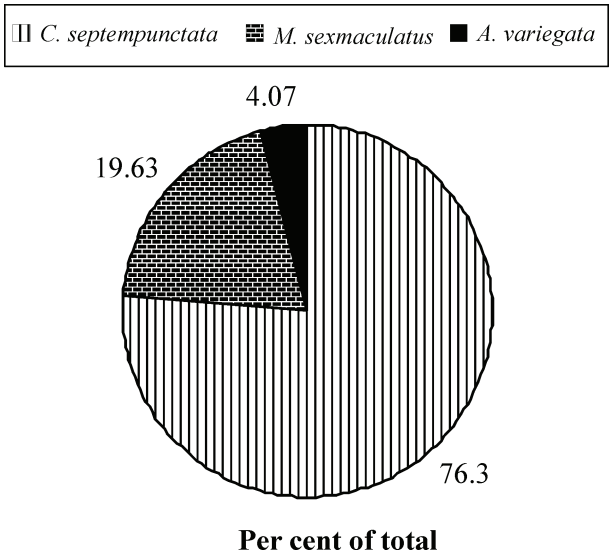


Figure 1. Relative abundance of coccinellid predators of *Hyadaphis coriandri* (Das) during *rabi* 2004–05

2. Correlation coefficient of aphid and coccinellid predators with abiotic factors: With a view to provide a sound base for the management of insect pests of coriander a quantitative estimation of population build up of coriander aphid, *H. coriandri* was carried out in relation to biotic as well as abiotic factors, like temperature, relative humidity and rainfall under the prevailing agroclimatic conditions. The data exhibited positive correlation between aphid population and maximum temperature, whereas other parameters showed non–significant effect. These observations are in partial agreement with the findings of

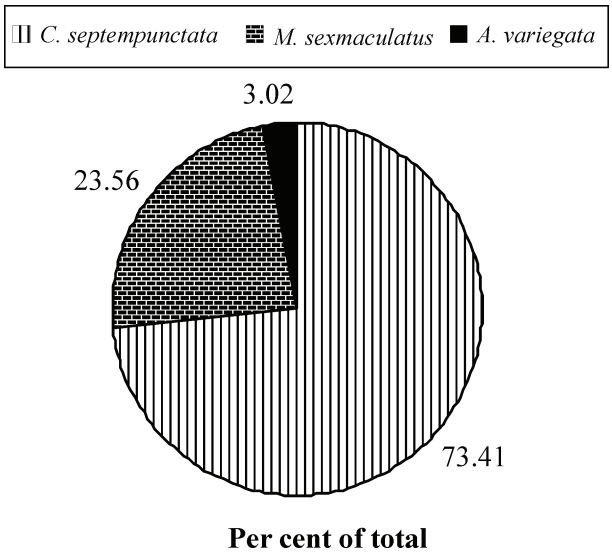


Figure 2. Relative abundance of coccinellid predators of *Hyadaphis coriandri* (Das) during *rabi* 2005–06

Jain and Yadav (1988) and Kumari and Yadav (2006). The maximum and minimum temperature, relative humidity morning, relative humidity evening and rainfall had non–significant effect on the predators, *C. septempuncatata* (r=0.37, 0.09, –0.56, –0.17 and –0.16, respectively) and *M. sexmaculatus* (r= 0.54, 0.33, –0.48 –0.14 and –0.16, respectively) in the first year (2004–05). The same trend was observed in the second year (2005–06) except maximum temperature which showed significant positive correlation with population of both the predators (r = 0.77 and 0.79).

The correlation coefficients were found to be positively significant between aphid, *H. coriandri* population and predators, *C. septempuncatata* (r=0.98 and 0.98) and *M. sexmaculatus* (r=0.90 and 0.96) in the first and second year (*Rabi*, 2004–05 and 2005–06), respectively. The maximum and minimum temperatures, relative humidity in morning and evening and rainfall had non–significant effect on aphid population in the first year (2004–05), *viz.*, r=0.30, 0.03, –0.61, –0.13 and –0.20, respectively. The same trend has been noticed in the second year (2005–06) except maximum temperature which showed significant positive correlation (r=0.74).

During present studies three predators, *viz.*, *Coccinella septempunctata* Linn. *Menochilus sexmaculatus* (Fabr.) and *Adonia variegata* (Geoze) have been found preying aphid, *H. coriandri* on the coriander crop in both the years. Similar observations were also reported by Jain and Yadav (1988) and Meena (1999) and as such, support the present findings. Out of the aphid predators, *C. septempunctata* was observed to be prominent one. Sagar and Kumar (1996) observed six

species of predators preying *H. coriandri* and *C. septempunctata* was the most prominent during the peak period of activities. Likewise, Omkar *et al.* (1997), Meena (1999), Lekha (2002) and Bana (2007) have reported *C. septempunctata* as a major predator of the coriander aphid, *H. coriandri* on coriander crop in semi–arid as well as hyper arid ecosystems. During the present studies, the peak incidence of *C. septempunctata* coincided with the peak of aphid population. The correlation matrix studies between the aphid, *H. coriandri* and the predator *C. septumpunctata* depicted significant positive correlation in both the years. Similar observations have also been made by Meena (1999) who reported that the population of predator appeared in the first week of February and peaked in the second week of March corresponding to high population of aphid.

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