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POPULATION DYNAMICS OF THE CORIANDER APHID AND ITS COCCINELLID PREDATORS

D.K. MEENA, R. SWAMINATHAN, K.K. BHATI AND H.K. JAIN

Department of Agriculture Zoology and Entomology, Rajasthan College of Agriculture, Udaipur.

ABSTRACT

Population dynamics of the coriander aphid and its coccinellid predators were studied in the Department of Entomology, Rajasthan College of Agriculture, MPUAT, Udaipur-313001, during *rabi* 2008-09. The incidence of coriander aphid, *Hyadaphis coriandari* (Das.) began in the second week of January 2009 that gradually increased in numbers reaching to the maximum (584.16 per 3-plant total) in the first week of February 2009. The aphid population was negatively correlated with mean atmospheric temperature and relative humidity. The predatory activity of the coccinellids, *C. septempunctata* and *M. sexmaculata* also began in the second week of January, and during January to February their population ranged from 0.5 to 15 beetles per 3-plant. The adult coccinellids had a significant positive correlation with atmosphere temperature; whereas, with relative humidity the correlation was significantly negative. The adult coccinellids as well as grubs had a significant negative correlation with the aphid population.

Key word: coccinellid predators, coriander aphid, population dynamics

Coriander, *Coriandrum sativum* (L) commonly known as "*dhania*" is a winter season seed spice crop that belongs to family Apiaceae. Rajasthan contributes more than 70 percent of the total production of coriander in India. The area, production and productivity happens to be 2, 41, 386 hectares, 3, 00, 000 tons and 1186 kg per hectare, respectively (Annual Report, Directorate of Horticulture, 2005-06). It is well documented that coccinellids are very efficient predators of several aphid species (Trouve *et al*. 1997; Cardoso and Lazzari, 2003). Among the insect-pests of coriander, the aphid, *Hyadaphis coriandari* (Das.) has been reported as a regular and major pest in Rajasthan and other parts of the country (Hameed *et al*., 1975; Jain, 1984, Jain and Yadava, 1988). The other pests include: *Bemisia tabaci* (Genn), *Agonoscelis nubile* (Fab.), *Spodoptera exigua* (Hub.), *Myzus persicae* (Sulzer), *Thrips tabaci* (Lindeman), and the mite, *Petrobia latens* (Muller) (Jain and Yadava, 1988). Meena *et al*. (2002) recorded the population of aphids to exist between 20-25 °C (maximum temperature), 2-6 °C (minimum temperature) and 60-65% (relative humidity); while the population of coccinellid beetles corresponded to population of coriander aphid. The coefficient of correlation between the coriander aphid and coccinellid predator population was positive and highly significant.

MATERIALS AND METHODS

The present investigation was conducted at Horticulture Farm, Rajasthan College of Agriculture, Udaipur (Raj.) during 2008-2009. The experimental plots were ploughed twice with desi plough and leveled with heavy plank 15 days before sowing the crop. Half of the recommended dose of nitrogenous fertilizers (60 kg/ha) and full dose of phosphatic (40 kg/ha) and potassic (25 kg/ha) fertilizers were applied at the time of last ploughing and the rest half of the nitrogenous fertilizer was applied through top dressing at the time of flowering. Before sowing the seeds were crushed into halves by rubbing with hands and treated with Thiram and Bavistin in the portion of 1:1 @ 2 g/kg seed. Sowing was done by manually operated hand driven plough keeping row to row distance of 30 cm with seed rate of 10 kg/ha. Five irrigations were applied at an interval of 20 – 25 days. First irrigation was applied just after sowing. Thinning was done 30 days after sowing keeping the plant to plant distance at 10 cm. Other cultivation practices were followed as per recomendation and on a need basis. Data on weather factors, such as daily minimum and maximum temperature, relative humidity and rainfall were obtained from the meteorological observatory of the Agronomy farm, RCA, Udaipur. The population of aphid obtained from experimental fields was subjected to statistical analysis (analysis of variance). The study on incidence of coriander aphid and its natural enemies were made on the crop sown in 6 plots each of 4m x 3m. Three plants were selected, tagged and observed early in the morning on umbels of the tagged plants for aphids. The prevailing atmospheric temperature and relative humidity were recorded. The population data of the aphids as well as the natural enemies were correlated and regression equations computed wherever the r-values were significant.

Table 1: Mean population of the coriander aphid and predatory coccinellids

Date of observation	Average Tempe. (°C)	Average Rel. Hum. (%)	Aphids* (No./3-Plant)	Coccinellids* adults (No./3-Plant)	Coccinellids* grubs (No./3-Plant)
11/1/2009	14.85	71.0	11.66	0.50	0.00
12/1/2009	14.60	76.5	9.16	1.33	0.00
13/1/2009	17.40	74.0	10.00	0.66	0.00
14/1/2009	19.25	67.0	10.83	0.83	0.00
15/1/2009	20.35	72.0	17.50	1.33	0.00
16/1/2009	19.75	65.5	19.60	0.66	0.50
17/1/2009	21.55	59.0	20.50	0.83	0.00
18/1/2009	20.80	67.0	30.00	1.00	0.00
19/1/2009	19.95	67.0	58.20	1.50	0.00
20/1/2009	19.30	65.0	67.66	2.33	0.50
21/1/2009	18.80	73.5	72.66	1.83	0.00
22/1/2009	18.65	59.0	81.00	1.83	0.00
23/1/2009	19.15	48.0	90.50	1.00	0.33
24/1/2009	19.40	56.5	139.83	0.50	0.00
25/1/2009	18.70	54.5	188.16	0.66	0.00
26/1/2009	18.35	59.0	160.83	1.33	0.33
27/1/2009	17.70	58.0	257.50	1.00	0.33
28/1/2009	17.80	61.0	315.00	1.50	0.66
29/1/2009	17.30	57.0	345.83	1.50	1.66
30/1/2009	18.00	56.5	367.50	1.83	1.50
31/1/2009	20.75	44.5	392.50	2.00	2.16
01/2/2009	16.70	57.0	418.33	1.00	2.66
02/2/2009	18.05	54.0	473.33	1.66	1.16
03/2/2009	18.50	50.0	505.00	2.00	3.00
04/2/2009	18.90	50.5	528.33	2.66	3.50
05/2/2009	19.55	55.0	584.16	1.16	4.00
06/2/2009	18.70	58.0	579.16	0.50	5.33
07/2/2009	19.30	44.5	569.16	0.83	6.33
08/2/2009	18.40	58.5	545.83	0.83	6.66
09/2/2009	18.90	54.0	528.33	1.00	7.66
10/2/2009	19.00	54.5	495.83	2.33	6.00
11/2/2009	17.40	53.0	434.16	1.50	5.16
12/2/2009	16.80	55.0	384.83	1.50	8.33
13/2/2009	18.05	51.5	342.83	1.16	9.16
14/2/2009	19.60	54.0	248.33	3.66	6.16
15/2/2009	20.10	39.0	165.00	4.16	6.00
16/2/2009	19.90	43.5	47.33	9.16	7.83
17/2/2009	18.80	55.5	35.33	10.00	6.83
18/2/2009	20.10	46.5	16.83	13.00	10.33
19/2/2009	20.00	42.5	6.33	14.83	10.50
20/2/2009	20.50	46.0	1.66	15.00	11.83

* Population data are mean of 6 replications.

RESULTS AND DISCUSSION

The infestation of aphids started in the second week of January 2009 (aphid per 3- plants) that gradually increased reaching to the maximum of 584.16 per 3- plant total when the mean atmospheric temperature was 19.55°C and relative humidity was 55 per cent. The linear relationship between the aphid population and abotic factors of the environment showed a varied response. The coefficient of correlation between aphids and temperature (r = -0.1707) and relative humidity (r = -0.3546) was negative; though in the latter case the correlation coefficient was significant.

During the present study only two species of coccinellid predator's *viz*., *Coccinella septempunctata* Linneaus and *Menochilus sexmaculata* Fab. were recorded feeding on the coriander aphid colony. Of these *M. sexmaculata* was recorded more in numbers during the initial period from 11th January to 7th February 2009; later, *C.septumpunctata* dominated. The coccinellid foraging on aphids began in the second week of January and their population ranged from 0.5 to 15 beetles per 3- plants.

The adult coccinellids (including *C. septumpunctata* and *M. sexmaculata*) had a significant positive correlation (r = 0.3300) with the atmosphere temperature whereas with relative humidity the correlation was significantly negative (r = -0.4829). The linear relationship between the aphids and the adult coccinellids established a significant negative correlation (r = -0.3517); similarly, relationship between the aphids and grubs of the coccinellids also showed a significant negative correlation (r = -0.3930).

Meena *et al*. (2002) observed that the population of coccinellid beetles appeared in 1st week of February and reached a peak in 2nd week of March corresponding to the high population of coriander aphid. The population of aphid existed between 20-25 °C (maximum temperature), 2-6 °C (minimum temperature) and 60-65% (relative humidity). The correlation between the coriander aphid and coccinellid predator population was positive and highly significant. The weather was cloudy, the prevailing average temperature was 16.70 – 19.3°C, and average relative humidity ranged between 44.5 to 57 percent. Cloudy weather favoured the multiplication of coriander aphids. Earlier, Singh (1982), Mishra (1999), Gour (2001) and Deepak *et al*. (2002) reported the temperature range from 20 to 25°C to be most favourable for the multiplication of aphids (*Rhopalosiphum maidis* and *L. erysimi*). During the present study, the observations indicated that with an increase in aphid population there was a slight increase in predator population, following the density-dependent pattern. However, as aphids multiply parthenogenetically, significant reduction in aphid population could not be seen; instead the crop growth was retarded. Our findings conform to the reports by Chandra and Kushwaha (1987), who worked on *L. erysimi* infesting cruciferous crops.

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