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OCCURRENCE OF APHID, *APHIS GOSSYPII* GLOVER AND COCCINELLIDS ON ISABGOL

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ABSTRACT

Aphid *Aphis gossypii* Glover was found to be the major pest of isabgol in the semi-arid regions of the Rajasthan. The infestation of aphid initiated from 2nd standard meteorological week (SMW) with 6 aphids/ plant and fluctuated till 13th SMW. The peak activity of aphids observed on 8th SMW which gradually reached to the level of 56.13 aphids/ plant and thereafter gradually decreased up to 7.87 aphids/ plant in the fourth week of March when the crop matured. The activities of three coccinellid beetles viz. *Brumoides suturalis* Fabricius, *Cheilomenes sexmaculata* Fabricius and *Coccinella septempunctata* Fabricius were also studied, and their peak population was noticed from 8th to 10th SMW (19th February to 5th March, 2022). The significant positive correlation of aphid population was found with bright sunshine and all three species of coccinellids. *C. sexmaculata* and *C. septempunctata* have the significant positive correlation with bright sunshine, maximum temperature and average temperature while negative non-significant correlation with relative humidity.

Key words: Isabgol, blond psyllium, *Plantago ovata,* aphid, *Aphis gossypii*, ladybird beetles, *Brumoides suturalis, Cheilomenes sexmaculata, Coccinella septempunctata,* population dynamics

Isabgol (*Plantago ovata* Forst.) commonly known as psyllium, belongs to family Plantaginaceae and is native to Persia (Dhar et al., 2005). The name is originated from two Sanskrit words, '*asp*' and '*ghol*' referring horse ear as the seed resembles to horse ear, also refers to the boat shaped seeds. India is the largest producer and exporter of Isabgol in the world. Isabgol is an economically important medicinal plant commonly cultivated in different parts of India, Pakistan, Iran and some part of Europe (Singh et al., 2009). In India, it is mainly cultivated in north Gujarat, western Rajasthan and Madhya Pradesh. The isabgol husk is an ayurvedic herb, used in health care for many centuries in South Asia, and is now widely used for its medicinal properties all over the world. Psyllium seed husk provide health benefits for diabetes, constipation, diarrhoea, inflammatory bowel disease, irritable bowel syndrome symptoms, abdominal pain, obesity, hypercholesterolaemia and lowering blood cholesterol level (Jalanka et al., 2019, Clark et al., 2020, Franco et al., 2020). Furthermore, psyllium polysaccharides are potential natural antioxidant, anti-carcinogenic agent and also have antiulcerogenic property (Patel et al., 2019). It is also added to shakes, juices, yogurt, syrups, soups, bread and even in ice creams to improve the fiber content of the food (Belorio and Gomez, 2022). Plantago seeds contains of 6.85% ash, 23.5% crude fiber, 8.7% protein and 50.65% carbohydrates (Pendse et al., 1976). The yield of isabgol is mainly affected by biotic and abiotic factors. Aphid, *Rhopalosiphum maidis* (Fitch) is the major insect pest (Kumawat, 2008) whereas the other pests viz. field cricket, *Gryllus* sp; whitefly, *Bemisia tabaci* (Genn.); aphid, *Aphis gossypii* (Glover) and termites, *Odontotermes obesus* Rambur and *Microtermes obesi* Holmgren are also reported on isabgol by Jindla et al. (1984), Farooqi and Sreeramu (2001) and Reddy (2009). The aphids are active sap suckers at bud and later causing considerable loss to the crop, and use of man-made insecticides for its control may reduce profit and export potential both. Aphids are reported to be the major pests of isabgol in Punjab and Madhya Pradesh (Upadhyay and Mishra, 1999) causing serious losses to crop. Regular occurrence of aphid on isabgol crop in Rajasthan caused enormous economic yield losses. Very few research works has been done on the management of aphids in Rajasthan. Therefore, to get the scenario of aphid infestation on isabgol, the present study was conducted to know the population dynamics of aphids and its coccinellid predators.

MATERIALS AND METHODS

The experiment was conducted at the Instructional Farm, College of Agriculture, Jodhpur, during *Rabi* season of 2021-22. It is situated at 26°15' North

latitude, 73°01' East longitude with altitude (elevation) of 231 meters above mean sea level in western part of Rajasthan.

The field experiment was carried out on isabgol variety RI– 1. The crop was sown in three replication of 10 m × 10 m plot size at spacing of 30 cm× 5 cm and all the recommended agronomic practices were followed. The crop was left for natural infestation by the pest; no plant protection measures were taken throughout the crop season. The incidence of aphid was recorded on five plants selected randomly from each quadrate to record the aphid population at weekly interval and the aphids were counted on three bristle or three leaves from each tagged plant. The observations on coccinellids and their grubs were counted per plant, and mean observation of five randomly selected plants were recorded. The data of meteorological parameters and insect population were recorded for statistical analysis. The simple correlation was computed between the mean populations of aphid and natural enemies with weather parameters by using the Microsoft Excel.

RESULTS AND DISCUSSION

The aphid population on isabgol during *Rabi* 2021-22 was ranged from 6 to 56.13 aphids/ plant. The aphid infestation was initiated from 2nd standard meteorological week (SMW) i.e. January 8-14, 2022 when the pest started its multiplication from 6 aphids/ plant and fluctuated till 13th SMW (26th March, 2022). The peak activity of aphids was observed on 8th SMW which reached to the level of 56.13 aphids/ plant, when the prevailing sunshine, minimum temperature, maximum temperature, evening relative humidity and morning relative humidity were 9.20 hrs., 17.70°C, 28.90°C, 46.40% and 59.70%, respectively. A negligible rainfall was occurred during the season. Thereafter, the aphid population started to decline gradually with maturity of crop in the ending of March. The correlation between aphid population and weather parameters were non-significant positive with minimum temperature (r = 0.136), maximum temperature (r = 0.395) and average temperature (r = 0.267) while significant positive correlation when the factor was bright sunshine (r = 0.652).

These results are in partially agreement with Prajapati et al. (2020) that the aphid infestation was started from 1st week of January (1st standard meteorological week) and gradually increased up to 4th week of February (8th standard meteorological week) with a peak population of 2.40 aphid index. Ghetiya and Butani (1995) and Khinchi and Kumawat (2012) also observed that the population of aphid increased up to the last week of January, highest population were observed during January and February. The results of correlations are in close accordance with the findings of Prajapati et al. (2020) revealed that aphid population had non-significant and negative correlation with evening relative humidity, wind velocity and rainfall. These results are also collaborate with the findings of Kataria and Kumar (2015) showed that maximum population of aphids were observed in the months of November to February which gradually started declining in March and a positive correlation was found between aphid population and maximum temperature whereas a negative correlation found with minimum temperature, relative humidity and rainfall.

The natural enemies played an important role in minimizing the pest population. In the present study, the population of three striped ladybird beetle, *Brumoides suturalis* Fabricius; six spotted zigzag ladybird beetle, *Cheilomenes sexmaculata* Fabricius and seven spotted ladybird beetle, *Coccinella septempunctata* Fabricius was recorded. The population of *B. suturalis* commenced on crop in the 2nd week of January (five week after sowing) when minimum and maximum temperature remained 10.90°C and 16.10°C, evening relative humidity and morning relative humidity was 69.70 and 88.10 per cent and sunshine was 6 hrs, respectively (Table 1). A very negligible rainfall was occurred during the crop period. After that the population fluctuated till reached to its peak in the 10th standard meteorological week (1.20 grubs and adults/ plant). Thereafter, the population started to decline gradually with maturity of crop in the ending of March. The population of *C. sexmaculata* reached to its peak in the 8th standard meteorological week with 2.33 grubs and adults/plant while *C. septempunctata* reached to maximum (4.27 grubs and adults/plant) in the 9th standard meteorological week. Correlation between aphid and coccinellids were observed significantly positive with *C. septempuctata* (r = 0.821), *B. suturalis* (r = 0.914) and *C. sexmaculata* (r = 0.853).

The positive correlation of *B. suturalis* population was found with bright sunshine (r = 0.699), maximum temperature (r = 0.607), minimum temperature (r = 0.387) and average temperature (r = 0.503). The negative correlation was found with rainfall (r = -0.619), morning RH (r = -0.520), evening RH (r = -0.426), average RH (r = -0.506) and rainfall (r = -0.502). The positive correlation of *C. sexmaculata* population was found with bright sunshine (r = 0.757), maximum temperature (r = 0.759), average temperature (r = 0.673) and minimum temperature (r = 0.572). The negative correlation was

Table 1. Population dynamics of *A. gossypii* and its natural enemies with weather parameters on isabgol

SMW[#]	Date of observation	Temp. (°C)		Avg. temp. (°C)	RH (%)		Avg. RH (%)	Rainfall (mm)	Bright sunshine (hrs.)	Mean no. of aphids / plant	Mean No. of natural enemies/ plant		
		Min.	Max.		Morning	Evening					*Brumoides suturalis*	*Cheilomenes sexmaculata*	*Coccinella septempunctata*
50	Dec. 10, 2021	13.40	23.00	18.20	80.60	55.90	68.25	0.00	8.51	0.00	0.00	0.00	0.00
51	Dec. 17, 2021	11.90	22.90	17.40	72.10	43.30	57.70	0.00	7.82	0.00	0.00	0.00	0.00
52	Dec. 24, 2021	13.40	20.60	17.00	82.70	77.60	80.15	3.40	4.56	0.00	0.00	0.00	0.00
1	Jan. 01, 2022	12.90	20.20	16.55	82.90	57.00	69.95	10.00	5.18	0.00	0.00	0.00	0.00
2	Jan. 08, 2022	10.90	16.10	13.50	88.10	69.70	78.90	0.00	6.00	6.00	0.33	0.00	0.00
3	Jan. 15, 2022	12.80	22.20	17.50	78.70	47.80	63.25	0.00	6.38	16.07	0.40	0.27	0.67
4	Jan. 22, 2022	11.70	19.80	15.75	84.80	56.10	70.45	6.00	7.04	15.93	0.53	0.53	1.87
5	Jan. 29, 2022	11.70	24.20	17.95	80.90	51.90	66.40	0.00	8.07	23.27	0.60	0.87	2.47
6	Feb. 05, 2022	14.40	23.80	19.10	78.60	53.40	66.00	0.50	8.84	30.13	0.80	1.40	3.07
7	Feb. 12, 2022	16.90	26.60	21.75	75.70	70.50	73.10	0.00	9.31	42.07	0.93	1.87	3.53
8	Feb. 19, 2022	17.70	28.90	23.30	59.70	46.40	53.05	0.00	9.20	56.13	1.07	2.33	3.67
9	Feb. 26, 2022	18.60	29.40	24.00	70.90	44.40	57.65	0.00	9.35	47.67	1.20	2.27	4.13
10	Mar. 05, 2022	21.60	33.60	27.60	53.30	32.70	43.00	0.00	9.18	37.20	1.13	2.13	4.27
11	Mar. 12, 2022	26.30	34.00	30.15	66.50	33.60	50.05	0.00	6.21	30.07	1.00	1.73	4.07
12	Mar. 19, 2022	28.60	35.10	31.85	77.20	45.20	61.20	0.00	8.46	23.07	0.73	1.67	3.67
13	Mar. 26, 2022	30.90	36.30	33.60	47.40	35.90	41.65	0.00	9.63	7.87	0.53	1.53	2.27
Correlation coefficient of minimum temperature (°C)										0.136^{NS}	0.387^{NS}	0.572^{NS}	0.526^{NS}
Correlation coefficient of maximum temperature (°C)										0.395^{NS}	0.607*	0.759*	0.732*
Correlation coefficient of average temperature (°C)										0.267^{NS}	0.503^{NS}	0.673*	0.636*
Morning RH (%)										-0.368^{NS}	-0.520^{NS}	-0.674*	-0.508^{NS}
Correlation coefficient of evening RH (%)										-0.204^{NS}	-0.426^{NS}	-0.479^{NS}	-0.497^{NS}
Correlation coefficient of average RH (%)										-0.307^{NS}	-0.506^{NS}	-0.619*	-0.539^{NS}
Correlation coefficient of rainfall (in mm)										-0.502^{NS}	-0.619*	-0.340^{NS}	-0.208^{NS}
Correlation coefficient of bright Sunshine (hrs.)										0.652*	0.699*	0.757*	0.620*
Correlation coefficient of mean aphids										-	0.914*	0.853*	0.821*

[#]SMW- Standard Meteorological Week *Significant at (p= 0.05) NS – Non significant Correlation coefficient- r values

observed with morning RH (r = -0.674), average RH (r = -0.619), rainfall (r = -0.340) and evening RH (r = -0.479). The positive correlation of *C. septempunctata* population was found with bright sunshine (r = 0.620), average temperature (r = 0.636), maximum temperature (r = 0.732) and minimum temperature (r = 0.526). Negative correlation was found with morning RH (r = -0.508), evening RH (r = -0.497), average RH (r = -0.539) and rainfall (r = -0.208). The results on population of lady bird beetles were supported by the other earlier workers. According to Prajapati et al., 2020 the population of lady bird beetles was increased throughout the crop season and reached at peak (2.56 adults/plant), in second week of March (10th SMW). Kataria and Kumar (2015) found that the maximum temperature shows positive correlation in the case of aphid population and relative humidity shows positive correlation in case of its associated insects such as coccinellids and ant population. Khinchi and Kumawat (2012) also observed that the population of *C. septempuctata* was non-significantly correlated with the meteorological parameters but was positively correlated with the aphid population.

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AUTHOR CONTRIBUTION STATEMENT

RSO: Conducted research, written manuscript, MMK: Conceptualized, planned and guided during the study and corrected manuscript, SP: Planned the work and provided the materials for the study. DR: Provided the technical guidance during the study.

CONFLICT OF INTEREST

No conflict of interest.

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