

INSECT- PESTS SUCCESSION, NATURAL ENEMIES AND THEIR CORRELATION WITH WEATHER PARAMETERS IN MUSTARD CROP

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Abstract: A field experiment was conducted at research station Ambikapur, (C.G.) during Rabi season, 2017-18 to assess the insect- pests succession in mustard crop and their natural enemies and its correlation with weather parameters. The incidence of Aphid and Flea beetle population commenced from 1st week of December with 1.32 aphid/ plant 5cm apical twig and 2.4 beetle/plant. The peak infestation of aphid occurred in 7th SMW which was favored by min. temp. of 11.6 °C and max. temp. of 24.3°C with morning 91% and evening 44% humidity. Flea beetle was recorded attained its peak level of 15.8 beetle/plant/m² in 1st week of February (6th SMW) which was favoured by max. temp. 26.5°C and min.temp.11.6°C with morning 85% and evening 35% relative humidity. The Diamond back moth was observed 2nd week of December and saw fly was recorded from third week December and reached its peak activity 1.96 adult/plant in the 2nd week of February (7th SMW). Painted bug was observed 4th week of December with peak activity (3.8 bug/plant) 2nd week of February (7th SMW) which was favoured by max. temp. 24.3°C and min. temp. 11.4°C with morning 91% and evening 44% relative humidity. Bihar hairy caterpillar commenced from 2nd week of December in (50th SMW) and Semilooper commenced from 1st week of January in (1st SMW). While various natural enemies were found on mustard crop. The lady bird beetle (*Coccinella septempunctata*) and Syrphid fly found on mustard on 4th week of December to 2nd week of March. The *Diaretella rapae* was noticed on mustard crop on second week of January to first week of March.

Keywords: Aphid, Natural enemies, Weather parameters

INTRODUCTION

Oilseed crops play a vital role in Indian agriculture economy. Mustard, *Brassica juncea* L. is one of the first domesticated oilseed crops in Rabi season belongs to the plant family Cruciferae. Oilseeds have been the backbone of agricultural economy of India since long. India accounts for 14.8 % of rapeseed mustard production at global level and occupies prime position in the World (Singh, 2014). Rapeseed-mustard (*Brassica spp.*) crop, grown in India are grown in diverse agro-climatic conditions ranging from north-eastern/north-western hills to down south under irrigated/rainfed, timely/late sown, saline soils and mixed cropping over an area of 6.34 million hectare with a production of 7.82 million tones and productivity of 1234 kg/ha in 2012-13 in India (Thomas *et al.* 2014). In Chhattisgarh, rapeseed mustard is cultivated over 113.10 thousand hectare area with a production of 24.2 thousand tones and productivity of 430 kg/ha.(Anonymous, 2016). In Sarguja district mustard crop is cultivated in an area about 30.8 with the production of 6.5(000t) and productivity 652 (kg/ ha), respectively (Anonymous, 2013).

According to Bakhetia and Sekhon (1989), 38 insect pests are known to be associated with different stages of mustard growth in India. Among these aphid is major limiting factor causing 6-7 percent reduction in oil content (Shylesha *et al.* 2006). Both nymph and adult causes severe damage to the plants by sucking plant sap from the tender parts of the plants. Infested plant become weak and leads to undersized seeds in the pods.

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MATERIALS AND METHODS

A field experiment was conducted at research station Ambikapur, (C.G.) during Rabi season, 2017-18. *Brassica juncea* cultivar “Chhattisgarh sarson” was sown on 20 November with row to row and plant to plant distance as 30 cm and 15 cm respectively. This experiment was conducted in a randomized block design with three replication. The crop was raised after following standard agronomical practices in large plot for recording observations of insect pests and its natural enemies, whole plot was divided into five equal plots The plots were kept free from any insecticidal spray throughout the crop period. The observations recorded at weekly interval soon after their appearance during crop season till harvesting of the crop.

Five plants were selected randomly and tagged with label for recording the observation of aphid population at weekly interval and note the first appearance of aphid on plants from each plot. At flowering stage, the aphid population was recorded from upper per 5 cm twig. Number of coccinellids and syrphid fly's grub and adult on the five plants from each five plots were recorded at weekly interval. The population of parasite of aphid *Diaretellia rapae* MacIntosh, was recorded by counting number on each selected plant at weekly interval.

RESULTS AND DISCUSSION

Insect- pests succession, natural enemies and weather parameters on mustard crop depicted in table 1. and table 2.

Mustard aphid, *L. erysimi* (kalt.)

The initial incidence of mustard aphid, was recorded during first week of December (49th SMW) with (1.32 aphid per five cm terminal twig). Its multiplication varies from (1.32 to 169.2 aphid per five cm terminal twig). The nymph and adult population of aphid was found maximum in 2nd week of February (7th SMW) which was favored by maximum temperature 24.3 and minimum temperature 11.4 with morning 91% and evening 44% relative humidity. Thereafter, from the fourth week of February onward there was a sudden decreasing trend were observed in aphid population 102.3 aphid per five cm terminal twig. In the 2nd week of March 2018 declined in the aphid population (38.5 aphid per five cm terminal twig). The aphid population seems to be declining in subsequent weeks as the crop moved towards maturity. Present finding are in agreement with Singh *et al.* 2009 and Singh *et al.* 2012.

Flea beetle (*Phyllotreta striolata*)

The first appearance of incidence of flea beetle per plant recorded at weekly interval during 2017-18 on the mustard crop revealed that the population of flea beetle started from 1st week of December (49th SMW) with 2.4 beetle per plant and continue till 1st week of February ranged from 2.4 to 15.8 beetle per plant in the 1st week of February (6th SMW). There after the population of flea beetle gradually decreased upto (6.3 beetle per plant) in the 2nd week of March and then again increased with 7.2 beetle per plant.

Painted bug, (*Bagrada hilaris*)

The first appearance of painted bug per plant recorded at weekly interval during 2017-2018 indicated that the infestation of painted bug, *Bagrada hilaris* started from 4th week of December (52nd SMW) with 0.26 bug per plant. Thereafter slowly increased in population and reached to peak of 3.8 bug per plant in second week of February (7th SMW). During the peak period of painted bug the maximum temperature 24.3 and minimum temperature 11.4 with morning 91% and evening 44% relative humidity. Thereafter the population gradually decreased up to 2nd week of March.

Saw fly (*Athalia lugens proxima*)

The first appearance of incidence of saw fly, *A. lugens proxima* occurred from 3rd week of December (51st SMW) to 3rd week of February (7th SMW) in the range of 0.12 to 1.96 larvae per plant. The larvae population slowly increased and reached to peak 1.96 larvae per plant in 2nd week of February which was favored by maximum temperature 24.3 and minimum temperature 11.4 with morning 91% and evening 44% relative humidity. There after larval population showed decreasing trend and showed minimum of 0.2 larvae/plant in the last week of February (9th SMW). The incidence of saw fly disappeared in 2nd week of March from the crop.

Diamond back moth, (*Plutella xylostella*)

The first appearance of incidence of Diamond back moth per plant recorded at weekly interval during 2017-2018 indicated that the infestation of Diamond back moth, (*Plutella xylostella*) started from 2nd week of December (50th SMW) with 0.12 larvae per plant. Thereafter slowly increased in population and reached to peak of 1.26 larvae per plant in last week of January (5th SMW). Thereafter the population gradually decreased up to 3rd week of February in (8th SMW).

Bihar hairy caterpillar, (*Spilosoma obliqua*)

The incidence of Bihar hairy caterpillar per plant recorded at weekly interval during 2017-2018 indicated that the infestation of, Bihar hairy caterpillar (*Spilosoma obliqua*) started from 2nd week of December (50th SMW) with 0.02 larvae per plant. The number of Bihar hairy caterpillar ranged from 0.02 to 0.12 larvae per plant.

Semilooper, *Trichoplusia ni* (Hubner)

The incidence of cabbage Semilooper larvae per plant recorded at weekly interval during 2017-2018 indicated that the infestation of cabbage Semilooper, started from 1st week of January (1st SMW) with 0.02 larvae per plant. The number of Semilooper ranged from 0.02 to 0.12 larvae per plant.

lady bird beetle, (*Coccinella septempunctata*)

The first appearance of population of Coccinellids occurred from (52nd SMW) and continue till 2nd week of march (11th SMW) ranged from 0.28 to 4.8 lady bird beetle per plant and attained highest level of lady bird beetle population (4.8 per plant) in (7th SMW) There after the number of lady bird beetle gradually decreased up to 2nd week of March with 1.8 lady bird beetle per plant in (11th SMW).

Syrphid fly, (*Eristalis tenax*)

The weekly observation on activity of Syrphid fly on the crop revealed that the Syrphid fly firstly appeared in the 4th week of December (52nd SMW) with 0.28 larvae per plant. The population of Syrphid fly gradually increased up to 2nd week of February (7th SMW) range of 0.28 to 1.34 adult per plant. There after the number of Syrphid fly gradually decreased up to 2nd week of March with 0.2 adult per plant.

***Diaeretiella. rapae* MacIntosh**

The first appearance of population of *Diaeretiella. rapae* MacIntosh on the crop noticed that from 2nd week of January (2nd SMW) and continue till 1st week of March (10th SMW) in the range of 0.17 to 0.94 adult per plant. *Diaeretiella. rapae* population reached to its peak 0.94 adult per plant in 2nd week of February (7th SMW). There after adult population showed decreasing trend and showed minimum of 0.42 adult/plant in the 1st week of March (10th SMW). The population of *Diaeretiella. rapae* MacIntosh disappeared in 2nd week of March from the crop.

Correlation studies between insect pests of mustard with weather parameters

Correlation studies revealed that mustard aphid was negatively correlated with relative humidity and

positive correlation with maximum temperature, minimum temperature and rainfall but all the correlation was non-significant. Ishwarbhai (2015) were also found aphid population exhibited positive correlation with maximum and minimum temperature and negative correlation with morning and evening relative humidity.

The population of Flea beetle exhibit positive non-significant correlation with Maximum Temperature ($r = 0.128$), Minimum Temperature ($r = 0.106$) and Rainfall ($r = 0.095$) whereas, morning RH ($r = -0.319$), evening RH ($r = -0.499$) showed non-significantly positive correlation.

The weather parameters, Maximum Temperature ($r = 0.444$) were positively non-significantly and Minimum Temperature ($r = 0.522^*$) significantly correlated with Painted bug population, Rainfall ($r = 0.386$) were positively and non-significantly correlated with Painted bug population. Whereas, morning RH ($r = -0.559$), were negatively and significantly correlated with Painted bug population and evening RH ($r = -0.450$) were negatively and non-significantly correlated with Painted bug population. Nagar (2011), Laxminarayan (1987) were also reported the painted bug population showed positive correlation with Maximum and Minimum Temperature and negative correlation with morning and evening relative humidity.

The correlation between Saw fly and weather parameter are presented in table -3. The weather parameters, Maximum Temperature ($r = -0.346$), Minimum Temperature ($r = -0.111$) were negatively and non-significantly correlated with Saw fly population. Rainfall ($r = -0.585^*$) positively and significantly correlated with Painted bug population. Whereas, morning RH ($r = 0.145$), and evening RH ($r = 0.128$) were positively and non-significantly correlated with Saw fly population. Singh (2012), Bhatt and Bapodra (2004), Patel (2005) and Singh (2012) also reported the saw fly population showed negative correlation with Maximum and Minimum Temperature and positive correlation with morning and evening relative humidity.

Diamond back moth and weather parameter on mustard crop. The result revealed that there was negative significant correlation with Maximum Temperature ($r = -0.602^*$) and negative non-significant correlation with Minimum Temperature ($r = -0.510$) while non-significant positive correlation with morning RH ($r = 0.267$), and evening RH ($r = 0.052$) and Rainfall ($r = 0.313$).

The correlation between Cabbage semilooper and weather parameter are presented in table -3. The weather parameters, Maximum Temperature ($r = -0.367$), Minimum Temperature ($r = -0.382$), evening RH ($r = -0.123$) and Rainfall ($r = -0.083$) were negatively and non-significantly correlated with the pest population. Whereas, morning RH ($r = 0.096$) had positively and non-significant correlation with Cabbage semilooper population.

The correlation between Bihar hairy caterpillar and weather parameter are presented in table -3. The weather parameters viz; Maximum Temperature ($r = -0.193$), Minimum Temperature ($r = -0.138$), and Rainfall ($r = -0.083$) had were negatively and non-significantly correlated with the pest population. Whereas, morning RH ($r = 0.385$) and evening RH ($r = 0.321$) had positively and non-significant correlation with Bihar hairy caterpillar.

Correlation studies between natural enemies of mustard aphid with weather parameters

Correlation studies revealed that Maximum Temperature ($r = 0.334$), Minimum Temperature ($r = 0.476$) and Rainfall ($r = 0.479$) was positive and non-significant correlation with Ladybird beetle population Whereas, morning RH ($r = -0.480$) and evening RH were found to be negatively correlated ($r = -0.480, -0.321$ respectively) with Ladybird beetle population. Ishwarbhai (2015) was also agree with that the aphid population increased, the natural enemies population was also increased visa-versa.

Correlation studies revealed that Maximum Temperature ($r = 0.232$), Minimum Temperature ($r = 0.388$) and Rainfall ($r = 0.488$) had positive and non-significant correlation with *D. rapae* population. Whereas, morning RH ($r = -0.293$), and evening RH ($r = -0.218$) had negative and non-significant correlation with *Diaeretiella rapae* population.

Correlation studies revealed that Maximum Temperature ($r = 0.148$), Minimum Temperature ($r = 0.228$) and Rainfall ($r = 0.384$) had exhibited positively and non significantly correlated with population of Syrphid fly. Whereas, morning RH ($r = -0.342$), and evening RH ($r = -0.394$) showed negative and non-significant correlation with population of Syrphid fly.

Khedar (2011), Achintya (2012) and Kewad (2013) were also reported the natural enemies showed positive correlation with Maximum and Minimum Temperature and negative correlation with morning and evening relative humidity.

CONCLUSION

It may be concluded from the result that peak activity of mustard aphid, flea beetle, painted bug, saw fly, diamond back moth, bihar hairy caterpillar and semilooper were observed during 7th, 6th, 7th, 7th, 5th, 5th and 2nd SMW respectively. Population of mustard aphid was negatively correlated with relative humidity and positive correlation with maximum temperature, minimum temperature and rainfall but all the correlation was non-significant. While significant and positive correlation was observed between population buildup of painted bug and minimum temperature. Whereas the flea beetle population showed positive correlation with maximum temperature, minimum temperature and rainfall and negative correlated with morning and evening relative humidity. The saw fly negatively

and non-significantly correlated with maximum temperature, minimum temperature and positive correlation with rainfall, morning and evening relative humidity. Diamond back moth showed negative significant correlation with Maximum Temperature and negative non-significant correlation with Minimum Temperature while non-significant positive correlation with morning RH and evening RH and Rainfall. The correlation between natural enemies and weather parameters revealed that the

Maximum Temperature, Minimum Temperature and Rainfall was positive and non-significant correlation. Whereas, morning RH and evening RH were found to be negatively correlated with Ladybird beetle population and syrphid fly. The *Diaeretiella rapae* population showed positive and non-significant correlation with Maximum Temperature, Minimum Temperature and Rainfall. Whereas, morning RH and evening RH were found to be negatively and non-significantly correlated.

Table 1. Succession of insect pests of mustard and their natural enemies during 2017-18.

SMW	Insect pest of mustard							Natural enemies		
	Aphid	Flea beetle	Painted bug	Saw fly	Diamond back moth	Semi looper	Bihar hairy caterpillar	Coccinellid	Syrphid fly	<i>D. rapae</i>
49	1.32	2.4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
50	6.04	4.6	0.00	0.00	0.12	0.00	0.02	0.00	0.00	0.00
51	13.2	5.2	0.00	0.12	0.36	0.00	0.12	0.00	0.00	0.00
52	22.4	7.8	0.26	0.26	0.48	0.00	0.00	0.28	0.28	0.00
1	39.6	8.3	0.64	0.44	0.62	0.02	0.00	0.46	0.44	0.00
2	52.4	8.6	0.8	0.68	0.88	0.12	0.00	0.94	0.62	0.17
3	75.6	10.2	1.8	0.88	1.17	0.00	0.00	1.8	0.74	0.27
4	108.5	10.6	2.4	0.94	1.22	0.00	0.00	2.6	0.98	0.32
5	118.3	15	2.8	1.06	1.26	0.00	0.00	3.4	1.12	0.68
6	146.7	15.8	3.2	1.85	1.26	0.00	0.00	4.2	1.26	0.86
7	169.2	10.4	3.8	1.96	1.18	0.0	0.00	4.8	1.34	0.94
8	102.3	10.9	3.6	0.6	0.2	0.00	0.00	3.4	1.18	0.62
9	125.6	13.2	3.4	0.2	0.00	0.00	0.00	3.00	1.06	0.68
10	67	6.3	2.8	0.00	0.00	0.00	0.00	2.9	0.78	0.42
11	38.5	7.2	1.6	0.00	0.00	0.00	0.00	1.8	0.2	0.00

Table 2. Correlation between insect pest infesting mustard and weather parameter during Rabi, 2017-18.

Insect pests and natural enemies	Weather parameter				
	Temperature °C		Rainfall (mm)	Relative humidity %	
	Maximum	Minimum		Morning	Evening
Aphid	0.146	0.279	0.500	- 0.300	- 0.276
Flea beetle	0.128	0.106	0.095	- 0.319	- 0.499
Painted bug	0.444	0.522*	0.386	-0.559*	-0.450
Saw fly	-0.346	-0.111	0.585*	0.145	0.129
DBM	-0.602*	-0.510	0.313	0.267	0.052

Bihar hairy caterpillar	-0.193	-0.138	-0.083	0.385	0.321
Cabbage semilooper	-0.367	-0.382	-0.083	0.096	-0.123
Syrphid fly	0.148	0.228	0.384	-0.342	-0.394
Coccinellid	0.334	0.476	0.479	-0.480	-0.321
D. rapae	0.232	0.388	0.488	-0.293	-0.218

*Significant at 5% level of significance

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