

Monitoring and assessment of mustard aphid, *Lipaphis erysimi* in North-Western Haryana with yellow sticky trap

Dalip Kumar^{1*}, Rakesh Punia², Ram Avtar², Anil Kumar³ and Neeraj Malik²

¹ Assistant Scientist Entomology, Oilseeds Section, Department of Genetics and Plant Breeding, CCS Haryana Agricultural University, Hisar, Haryana, India

² Oilseeds Section, Department of Genetics and Plant Breeding, CCS Haryana Agricultural University, Hisar, Haryana, India

³ Department of Agricultural Meteorology, CCS Haryana Agricultural University, Hisar, Haryana, India

Correspondence Author: Dalip Kumar

Received 2 March 2024; Accepted 2 April 2024; Published 15 April 2024

Abstract

Production of rapeseed-mustard (*Brassica* sp.) is severely hampered by aphid infestation in India, specifically *Lipaphis erysimi* (Kalt.). Impact of weather on the occurrence and multiplication of mustard aphids is very crucial and should be taken into consideration when developing an aphid management plan. Keeping this in view, an experiment was conducted at Oilseeds Section, Department of Genetics and Plant Breeding, CCS HAU, Hisar using yellow chrome painted smeared with transparent grease of 1kg tin box, five in number, height maintained at 30-45 cm above the crop canopy. Maximum numbers of aphid catches were recorded in 10th and 11th standard week. Sunshine hour seems to favour the presence of aphid in significant positive association in both the crop season 2020-21 and 2021-22. Maximum and minimum of temperature of exhibited positive correlation to the numbers of aphid. Presence of numbers of aphid can be in surrounding mustard field can decide the volume of infestation in forthcoming period through the catch of aphid via yellow chrome smeared tin box to be vigil to manage it.

Keywords: mustard, insect pests, integrated pest management, weather factors

Introduction

Mustard crop comes under the genus *Brassica* that belongs to the family *Brassicaceae*. Rapeseed and mustard are grown in 53 countries across the globe and are cultivated in India during the *Rabi* season in a variety of agro-climatic conditions ranging from the North-Eastern/North-Western highlands to the low lands, under irrigated/rainfed, timely/late sown and mixed cropping and is widely used as edible oil and cattle feed. The total area of rapeseed-mustard in India is about 6.7 million ha with a total production of 10.21 million tonnes (Anonymous, 2021) [4]. Insect-pests are one of the major biotic constraints in attaining the full yield potential of oleiferous *Brassica* from germination to maturity of crop. For successful cultivation of mustard crop, albeit of among other production related restrictions, crop needs repeated attention in respect of diseases and insect-pests that attract application of congruous insecticides. About 50 insect species have been recorded infesting *Brassica* spp. in India (Patel et al., 2019) [8], among them mustard aphid, *Lipaphis erysimi* is the most destructive pest (Ali and Rizvi, 2008) [1] of rapeseed-mustard and causes significant losses to the crop. The infestation of this pest varies with place to place also depends upon the environmental factors (Ali and Rizvi, 2012) [2]. The attack is very severe in those areas where the numbers of cloudy days are more during the period of pest activity (Patel et al., 2004) [9]. In order to understand the synchronization of aphid infestation in field with abiotic factors through installed traps, an experiment was carried out during 2021-22 crop season.

Materials and method

Experiment was conducted during *Rabi*, 2020-21 and 2021-22 at the research area of Oilseeds Section, Department of Genetics and Plant Breeding, CCS Haryana Agricultural University, Hisar, situated at 29.1492°N, 75.7217°E at an elevation of 215 meters above sea level. It falls under agro-climatic zone II, summer temperature prevails as high as 46 degrees Celsius and temperature falls in winter up to 1.5 degree Celsius. South-West monsoon usually brings showers from July to September with an average of 450 mm. Observation on aphid was also recorded on yellow (chrome) painted smeared with transparent greasy material on 1 kg tin box serving as purpose of sticky traps installed at five locations at 1.5 m above ground from first week of October onwards. The height of trap was adjusted so that it remained approximately 30-45 cm above the crop canopy. Numbers of alate mustard aphid was recorded daily trapped on yellow sticky trap and alate aphid population was correlated with different weather parameters.

Statistical analysis

The data collected during studies in the above experiments were subjected to statistical analysis and significant differences were set at $p \leq 0.05$ and $p \leq 0.01$ to work out simple correlation between the population of mustard aphid and weather parameters *viz.*, Temperature (maximum and minimum), Relative Humidity (morning and evening) and rainfall as per procedures of Sheoran *et al.*, 1998 [10] for the statistical analysis of the data.

Results and discussion

Five yellow sticky traps made up of tin smeared with transparent grease, were installed and maintained approximately at 30-45 cm (\approx 1-1.5 feet) above the crop canopy in mustard field to record the mustard aphid (alate form) population from 1st week of October onwards till harvesting of mustard crop on daily basis so as to ascertain the exact

appearance of aphid. Subsequently, traps were cleaned and smeared with grease daily and aphid population thus recorded was subjected to correlate with different weather parameters *viz.* temperature (maximum and minimum), relative humidity (morning and evening hours), rainfall (mm), average wind speed (km/hr) and sunshine (hours).

Table 1: Monitoring of alate mustard aphid on sticky traps at Hisar, 2020-21

Standard meteorological week	Meteorological observations					Mean mustard aphid (Alate) population per trap	
	Temp.(°C)		RH (%)		Sunshine hours		Rainfall (mm)
	Max.	Min.	M	E			
47	23.1	7.7	88	43	6.5	0.0	
48	23.3	8.4	92	42	6.6	1.7	
49	25.5	9.1	90	53	5.9	0.0	
50	20.8	5.0	96	63	5.3	0.0	
51	19.7	3.0	92	42	6.2	0.0	
52	19.5	2.6	96	51	5.8	0.0	
1	17.5	9.6	96	82	1.8	8.9	
2	15.8	4.6	98	72	2.7	0.0	
3	16.4	6.7	99	74	2.7	0.0	
4	18.8	4.9	96	59	5.2	0.0	
5	22.6	5.2	94	46	7.5	8.7	
6	22.6	5.5	98	53	6.7	0.0	
7	25.2	8.4	100	51	5.6	0.0	
8	27.6	9.1	97	43	7.1	0.0	
9	29.3	9.7	93	34	8.4	0.0	
10	30.7	14.1	91	43	6.8	0.0	
11	30.7	13.9	89	40	6.0	1.2	
12	31.4	14.5	88	37	5.9	4.4	
13	33.5	14.3	75	26	7.7	0.0	
14	35.0	13.3	69	18	8.2	0.0	
Mean	24.5	8.5	91.9	48.6	5.9	1.2	

Note: Weather data provided by the department of Agricultural Meteorology, CCS HAU, Hisar

Aphid was not recorded on sticky trap during crop season in 46th to 52nd standard meteorological week (SMW). Number of aphid ranged from 0.4 to 120.2 aphids/trap during the mustard

crop season that started in 1st SMW with 0.4 aphid/trap that hit the highest in 11th SMW (Table1). Average number of aphid in during the season was existed 25.4 aphid per tarp.

Table 2: Monitoring of alate mustard aphid on sticky traps, 2021-22

Standard Meteorological Week	Meteorological observations					Mean mustard aphid (Alate) population per trap	
	Temp. (°C)		RH (%)		Sunshine hours		Rainfall (mm)
	Max	Min	Morn	Even			
47	26.9	8.2	90.8	32.0	5.8	0.0	
48	26.9	8.2	90.1	29.7	7.0	0.0	
49	23.3	9.2	96.4	54.1	4.0	0.0	
50	24.2	7.9	97.7	47.8	6.3	0.0	
51	20.2	5.0	95.7	47.1	4.9	0.0	
52	20.5	4.4	91.8	42.8	6.3	0.0	
1	19.6	5.5	95.0	56.0	4.1	1.2	
2	18.7	10.2	99.3	67.6	3.1	40.0	
3	15.2	6.8	95.4	77.4	1.5	0.0	
4	14.2	7.1	95.9	81.1	0.8	2.6	
5	16.0	5.9	99.2	61.5	3.7	21.4	
6	20.2	6.6	97.4	64.9	5.2	0.0	
7	21.7	7.8	95.1	45.6	7.3	5.8	
8	25.2	6.9	97.6	48.3	8.4	0.0	
9	25.0	10.2	87.1	48.0	7.6	0.0	
10	24.3	8.7	94.3	46.7	8.2	0.0	
11	27.8	10.8	92.5	42.0	7.4	0.0	
12	33.5	16.3	88.7	40.3	7.9	0.0	
13	34.9	16.2	86.5	29.0	7.6	0.0	
14	37.8	15.9	71.0	15.7	8.3	0.0	
Mean	23.8	8.9	92.9	48.9	5.8	3.6	

Note: Weather data provided by the department of Agricultural Meteorology, CCS HAU, Hisar

Aphid was not observed from 47th to 52nd standard meteorological week (SMW) on yellow sticky trap, however, aphid population started to appear from first week (0.8) that mounted to peak 363.7 aphid/trap in 11th SMW, which ultimately diminished to 12.1aphid/trap in 14th standard week during the mustard crop season with overall seasonal mean 71.6 aphid per trap. Maximum ($r= 0.673$) and minimum ($r= 0.702$) of temperature exhibited significant positive correlation with number of trapped aphids, while relative humidity of evening was found to be in inversely proportional to the numbers of mustard aphid, *Lipaphis erysimi* in season of year 2020-21. A sunshine hour seems to favour the presence of aphid in the way of significant positive association in both the crop season 2020-21 and 2021-22. In late sown crop season, both maximum and minimum of temperature exhibited positive correlation, while in early season it shown negative association. Abiotic factors such as sunshine hours, relative humidity also exhibited a negative correlation with aphid multiplication (Ali and Rizvi, 2012) [2]. Mustard aphid, in some instances, could not establish it's relationship with temperature, relative humidity and rainfall, the reason may be due to the fact that population of aphid was not synchronized with onset of respective abiotic parameters. Findings of present study are in agreement of earlier report of Ansari et al, 2007 [3], Bishnoi et al, 1992 [5], Chattopadhyaya et al, 2005 [6], Ali and Rizvi, 2012 [2] and Gami et al, 2002 [7].

Table 3: Number of aphids on yellow sticky trap vs. climate factors

Climatic factors	Correlation coefficients (r)	
	Numbers of aphids on sticky trap	
	2020-21	2021-22
Temperature (max)	0.673**	0.105 ^{NS}
Temperature (min)	0.702**	0.135 ^{NS}
Relative Humidity (M)	-0.167 ^{NS}	0.060 ^{NS}
Relative Humidity (E)	-0.424**	0.010 ^{NS}
Sun shine (Hours)	0.335*	0.371*
Rainfall (mm)	-0.040 ^{NS}	-0.120 ^{NS}

*Significant at 5% ($p=0.05$), **Significant at 1% ($p=0.01$), ^{NS}Non-significant

Regression equation

$Y_{\text{aphid}} = -215.6737612 -$

$20.80459656 * T_{\text{max}} + 28.75337555 * T_{\text{min}} + 2.742960721 * RH_{\text{M}} + 0.329937023 * RH_{\text{E}} + 43.14802677 * SSH - 2.271198639 * Rf$

Conclusion

From the present studies, it can infer that different weather parameters cumulatively able to decide the number of mustard aphid in environment. Projection of aphid population in respect of prevailing weather changes may help in formulating a contingent plan through long term study to formulate a predictive model for the timely management of insect-pests particularly of aphid in rapeseed and mustard through monitoring with the use of yellow sticky trap.

Acknowledgements

All sort of assistance rendered by Director of Research and Oilseeds section, Department of Genetics and Plant Breeding, CSS Haryana Agricultural University, Hisar, India for the above study is gratefully acknowledged.

References

1. Ali A, Rizvi PQ. Effect of varying temperature on the survival and fecundity of *Coccinella septempunctata* (Coleoptera: Coccinellidae) fed on *Lipaphis erysimi*. J. Entomol. 2008;5:133-137.
2. Ali A, Rizvi PQ. Influence of abiotic and biotic factors on the population dynamics of mustard aphid, *Lipaphis erysimi* (Kalt.) on Indian mustard, *Brassica juncea* with respect to sowing dates. Academic Journal of Plant Sciences. 2012;5(4):123-127.
3. Ansari MS, Hussain B, Qazi NA. Influence of abiotic environment on the population dynamics of mustard aphid, *Lipaphis erysimi* (Kalt.) on *Brassica* germplasm. J. Biol. Sci. 2007;7:993-996.
4. Anonymous. India Stat. Retrieved from <https://www.indiastat.com/table/agriculture/area-production-productivity-rapeseed-mustard-indi/17372> 2021.
5. Bishnoi OP, Singh H, Singh R. Incidence and multiplication of mustard aphid (*Lipaphis erysimi*) in relation to meteorological variables. Indian J. Agri. Sci. 1992;62:710-712.
6. Chattopadhyaya C, Agrawal R, Kumar A, Singh YP, Roy SK, Khan SA, et al. Forecasting of *Lipaphis erysimi* on oilseed *Brassicas* in India-a case study. Crop Protect. 2005;24:1042-105.
7. Gami JM, Bapodra JG, Rathod RR. Population dynamics of mustard aphid (*Lipaphis erysimi* Kalt.) in relation to weather parameters. Indian J. Pl. Protec. 2002;30:202-204.
8. Patel S, Singh CP, Yadav SK. Monitoring of insect-pest complex on rapeseed mustard at Pantnagar. J. Entomol. Res. 2019;43(1):73-76.
9. Patel SR, Awasthi A, Tomar RK. Assessment of yield losses in mustard (*Brassica juncea* L.) due to mustard aphids (*Lipaphis erysimi* Kalt.) under different thermal environment in eastern central India. Appl. Ecol. Environ. Res. 2004;2:1-5.
10. Sheoran OP, Tonk DS, Kaushik LS, Hasija RC, Pannu RS. *Statistical software package for agricultural research workers*. Recent advances in information theory, statistics and computer application by Hooda DS and Hasija RC, Department of Mathematics and Statistics, CCS HAU, Hisar, 1998, p139-143.