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Population Dynamics of Mustard Aphid, *Lipaphis Erysimi* Kalt in Various *Brassica* Spp.

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A B S T R A C T

Population dynamics studies of mustard aphid, *L. erysimi* on three Rapeseed-mustard varieties i.e. RH 0749, HNS 0901 and BSH 1 belonging to three Brassica spp. i.e. *B. juncea*, *B. napus* and *B. rapa* revealed that mustard aphid was available in the field from 3rd Standard metrological week (SMW) (January) to 11th SMW (March). The peak aphid population (23.33-86.05 aphids/10 cm main apical shoot) was recorded during 9th SMW in all *Brassica* species (both timely and late sown) except in BSH 1 (timely sown) in which it attained peak (31.98 aphids/10 cm main apical shoot) in 6th SMW. The mustard aphid population had negative correlation with evening relative humidity under timely sown conditions and positive correlation with maximum temperature under late sown conditions in *B. juncea* (RH 0749) and *B. napus* (HNS 0901). While in *B. rapa* (BSH 1), the population of mustard aphid did not have any correlation with any of the weather parameters.

Introduction

The oilseed brassicas are the plant species belonging to the genus *Brassica* and family *Brassicaceae*. The different species are, Indian mustard (*Brassica juncea* (L.) Czern. & Coss.), toria (*B. rapa* L. var. *toria*), yellow sarson (*B. rapa* L. var. *yellow sarson*), brown sarson(*B. rapa* L. var. *brown sarson*), gobhi sarson (*B. napus L.*), karan rai (*B. carinata* Braun.) and taramira (*Eruca sativa* Mill.). All these crops are called rapeseed-mustard in vernacular language and are traditionally grown as the major groups of winter oilseed crops under irrigated and rain fed areas of India. India is one of the largest rapeseed mustard growing countries in the world, occupying the first position in area and second position in production after China (Khavse *et al.*, 2014). India accounts for 19.29 per cent and 11.13 per cent of the total acreage and production of rapeseed-mustard in the world, respectively (Anonymous, 2013). Among the seven edible oilseeds cultivated in India, rapeseed-mustard contributes 28.6% in the total oilseeds production and ranks second after groundnut

sharing 27.8% in the India's oilseed economy (Shekhawat *et al.,* 2012). In India, during 2015-16, rapeseed and mustard were grown over an area of 5.75 million ha area with production and productivity of 6.80 m tonnes and 1183 kg/ha respectively (Anonymous, 2017). Haryana is the third most important rapeseed–mustard producing state in the country with an area of 0.53 million ha, production of 0.90 million tonnes and productivity of 1721 Kg/ha (2015-2016) which is the highest in the country (Anonymous, 2017).

Insect pests are important biotic constraints that posed severe threat to mustard from germination to harvest and about 50 insect species have been found infesting the rapeseed-mustard in India (Sharma and Singh, 2010), out of which about a dozen of species are considered as major pest (Singh, 2009). Among them, the aphid species that damage rapeseed-mustard in India include *L. erysimi*, *Brevicoryne brassicae* L. and *Myzus persicae* Sulzer (Sarangdevot *et al.,* 2006). Among these, *L. erysimi* referred as both the turnip and mustard aphid is one of the major limiting factors causing up to 96 per cent yield losses and 5-6 per cent reduction in oil content (Shylesha *et al.,* 2006). Aphid sucks the cell sap from the stems, twigs buds, flowers and developing pods causing a significant loss in yield. For the efficient, economical and environmentally friendly management of the aphid, knowledge of its timing of attack in relation to weather factors is essential for timely prediction of its occurrence. It will allow growers to take timely action in an efficient manner for crop management (Chattopadhyay *et al.,* 2005). Hence, studying population dynamics will provide an opportunity by manipulating the manageable ecological parameters in the form of planting or harvesting time adjustment, varietal selection and correct time of pesticidal application.

Materials and Methods

The present investigation was carried out during *Rabi* season of the year 2015-16 at Regional Research Station, Samargopalpur, Rohtak (Haryana), India. To record the population dynamics of mustard aphids, three Rapeseed-mustard varieties i.e. RH 0749, HNS 0901 and BSH 1 belonging to three *Brassica* spp. i.e. *B. juncea*, *B. napus* and *B. rapa* were grown under recommended Package of Practices (Anon. 2006) in plot size of 4.2 × 3 m each with four repeats in randomized block design. Population of mustard aphid was recorded at weekly interval starting from the initial appearance to final disappearance of the pest. The number of aphids was recorded from top 10 cm top portion of the terminal shoot from ten randomly selected plants from each *Brassica* spp. in each replication. The data on weather parameters viz. temperature (maximum and minimum), relative humidity (morning and evening), sunshine hours, rainfall and rainy days were obtained from Indian Meteorological Department, Pune. The population of aphid was correlated with different weather parameters.

Results and Discussion

Under timely sown conditions, the initial appearance of the mustard aphid was found in the 5th standard week (SMW) on RH 0749 and HNS 0901 and 3rd SMW on BSH1. The infestation continued up to 10th SMW on RH 0749 and HNS 0901 and 8th SMW on BSH1. Under late sown conditions the mustard aphid infestation started in the 6th standard week (SMW) on RH 0749 and HNS 0901 and 3rd SMW on BSH1. The infestation continued up to 10th SMW onBSH1 and 11th SMW on RH 0749 and HNS 0901. Similar period of activity has been reported by Kumar (2015) who observed that the first appearance of mustard aphids was recorded during 4th SMW except in *B. rapa* where it appeared during

3rdSMW. The peak activity of aphids was recorded during 7th-8thSMW on most of the genotypes. Talpur and Khuhro (2004) also observed that mustard aphid appeared on leaves during 3rd week of January and on the inflorescences during 2nd week of February and continued up to harvesting. Ansari *et al.*, (2007) also observed that natural appearance of mustard aphid on *Brassica* germplasm occurred on 11thJanuary (60 DAS) and disappeared after 2nd March (110 DAS).

In present study, the mustard aphid population increased gradually and attained its peak (23.33-86.05 aphids /10 cm main apical shoot) during 9th SMW in all *Brassica* species under both timely & late sown crop (Table 1). During 9th SMW, maximum temperature, minimum temperature, morning relative humidity, evening relative humidity and sunshine hours recorded were 30 °C, 16.4 °C, 91 %, 45 % and 8.2 hrs, respectively. But in BSH1 (timely sown) it attained its peak (31.98 aphids/10 cm main apical shoot) in 6th SMW in which maximum temperature, minimum temperature, morning relative humidity, evening relative humidity and sunshine hours recorded were 22.6 °C, 9.6 °C, 91 %, 52 % and 6.8 hrs, respectively. Choudhury and Pal (2009) revealed that the mustard aphid population attained peak level from 7th to 9th SMW. Malik and Sachan (2013) also observed that the incidence of mustard aphid reached to peak level in 8th SMW i.e. 4th week of February. In the present findings, the aphids disappeared after 11th SMW (2nd week of March) which may be due to the maturation of crop and onset of summer season. Singh and Singh (1994) reported that maturation of crop create net deficit in water content in plant tissues leading to food scarcity and alate formation in aphid colonies.

The correlation (r) worked out between mustard aphid population and weather parameters presented in Table 2 could not demonstrate a precise association between them. Under timely sown conditions, the aphid population had non-significant positive correlation with maximum temperature, minimum temperature and sunshine hours. Evening relative humidity showed significant negative correlation and morning relative humidity, rainfall and rainy days showed non-significant negative correlation with aphid population in RH 0749 and HNS 0901. In BSH 1, the aphid population had non-significant positive correlation with morning and evening relative humidity. Maximum temperature, minimum temperature, sunshine hours, rainfall and rainy days showed non-significant negative correlation with aphid population. Singh *et al.*, (2007) also revealed that in early sown Indian mustard; the aphid population had a significant negative correlation with the evening relative humidity.

Under late sown conditions, in RH 0749 and HNS 0901, the aphid population had significant positive correlation with maximum temperature and non-significant positive correlation with minimum temperature and sunshine hours. Morning relative humidity, evening relative humidity, rainfall and rainy days showed non-significant negative correlation with aphid population. While in BSH 1, the aphid population had non-significant positive correlation with maximum temperature, minimum temperature and sunshine hours. Morning relative humidity, evening relative humidity, rainfall and rainy days showed non-significant negative correlation with aphid population. Rashid *et al.*, (2009) also reported a positive effect with minimum and maximum temperature. Whereas mean relative humidity showed significantly negative effect on aphid population. Similarly, Hasan *et al.*, (2009) observed a positive correlation of mustard aphid population with maximum Temperature and sun shine hours and negative correlation

with relative humidity. Pramanik and Dey (2012) observed a significant positive correlation of aphid population with maximum and minimum temperature and bright sunshine hours and a significant negative correlation with average relative humidity. Malik and Sachan (2013) also revealed positive and significant correlation with maximum temperature (Fig. 1–6).

Table.1 Population dynamics of mustard aphid, *L. erysimi* during 2015-16, at Rohtak

Standard week	Weather parameters							*No. of aphids/10 cm main apical shoot					
	Temperature (°C)		Relative humidity (%)		Sun shine hrs	Rain fall (mm)	Rainy days	Timely sown			Late sown		
	Maximum	Minimum	Morning	Evening				RH 0749	HNS 0901	BSH 1	RH 0749	HNS 0901	BSH 1
3	15.5	8.8	90	75	2.2	0.0	0	0.0	0.0	5.38	0.0	0.0	4.83
4	17.5	7.7	97	66	4.2	0.0	0	0.0	0.0	16.45	0.0	0.0	13.73
5	21.6	10.1	95	53	6.2	0.0	0	3.60	1.25	11.38	0.0	0.0	5.70
6	22.6	9.6	91	52	6.8	0.0	0	7.90	4.78	31.98	3.70	5.03	16.70
7	22.0	11.5	92	53	6.7	1.0	1	12.08	9.50	15.23	8.23	8.82	24.40
8	26.9	14.2	94	45	7.2	0.0	0	15.13	14.68	8.64	39.08	31.42	46.18
9	30.0	16.4	91	45	8.2	0.0	0	26.68	23.33	0.0	62.25	57.90	86.05
10	27.9	16.4	94	55	8.3	22.0	2	5.56	4.70	0.0	11.92	10.98	10.98

*Average of 10 plants

Table.2 Correlation of *L. erysimi* population with different weather parameters

Weather parameters	Timely sown			Late sown		
	RH0749	HNS0901	BSH1	RH0749	HNS0901	BSH1
Temperature Maximum	0.592	0.607	-0.257	0.677*	0.667*	0.516
Temperature Minimum	0.447	0.488	-0.536	0.589	0.580	0.390
RH Morning	-0.283	-0.256	0.099	-0.202	-0.233	-0.198
RH evening	-0.726*	-0.703*	0.004	-0.652	-0.650	-0.599
Sunshine	0.664	0.635	-0.050	0.578	0.590	0.518
Rainfall	-0.090	-0.077	-0.108	-0.048	-0.046	-0.168
Rainy days	-0.009	-0.011	-0.108	-0.091	-0.079	-0.150
***Significant at P = 0.05**						

Table.3 Multiple regression analysis between *L. erysimi* population and weather parameters

	Varieties	Regression equations	R^2
Timely sown	RH 0749	Y = 45.11-0.67X1	0.53
	HNS 0901	Y = 39.09-0.59X1	0.49
Late sown	RH 0749	Y = -53.95+2.90X2	0.45
	HNS 0901	Y = -47.68+2.58X2	0.44

X1 = Relative humidity (evening), X2 = Temperature (maximum)

Fig.1 Population of *L. erysimi* in relation to weather parameters in *B. juncea* cv. RH 0749 (timely sown)

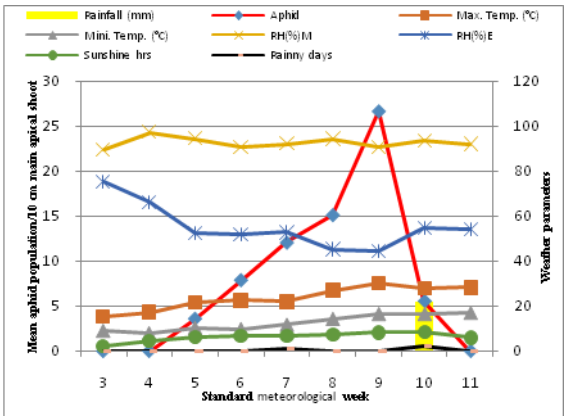


Fig.2 Population of *L. erysimi* in relation to weather parameters in *B. napus* cv. HNS 0901 (timely sown)

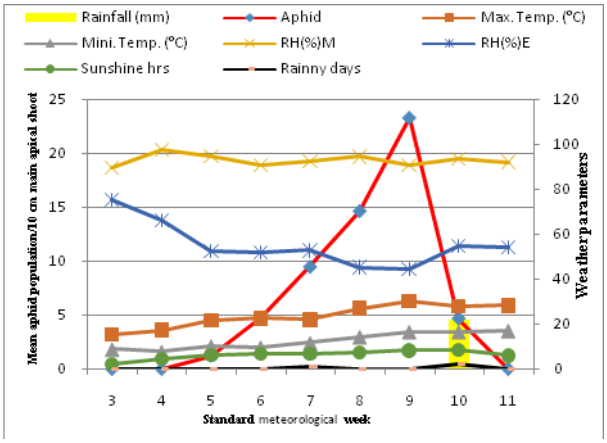


Fig.3 Population of *L. erysimi* in relation to weather parameters in *B. rapa* cv. BSH 1 (timely sown)

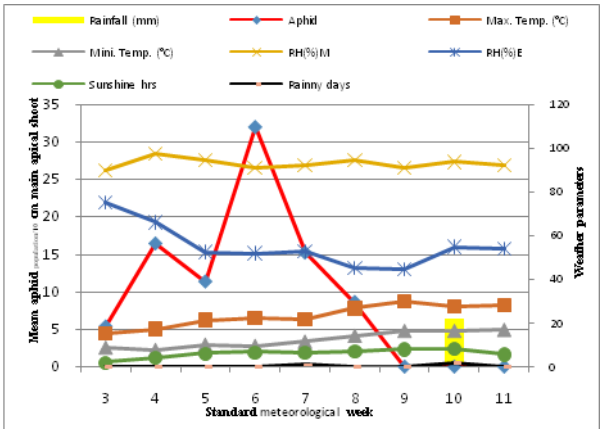


Fig.4 Population of *L. erysimi* in relation to weather parameters in *B. juncea* cv. RH 0749 (late sown)

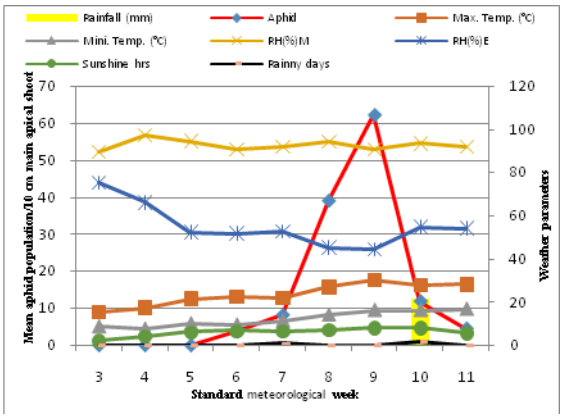


Fig.5 Population of *L. erysimi* in relation to weather parameters in *B. napus* cv. HNS 0901 (late sown)

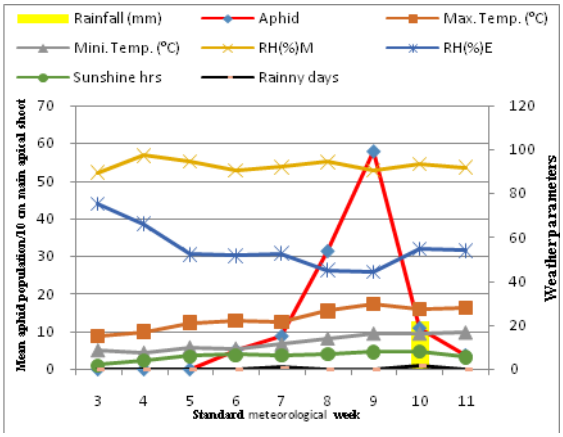
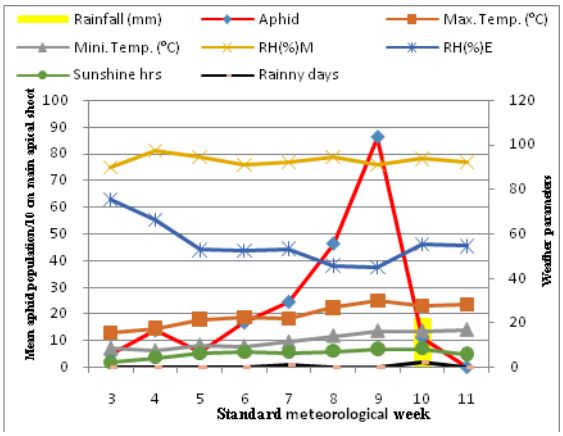


Fig.6 Population of *L. erysimi* in relation to weather parameters in *B. rapa* cv. BSH 1 (late sown)



The multiple regression analysis, which explained the average relationship between *L. erysimi* and weather parameter i.e. the amount of changes in *L. erysimi* population per unit change in weather parameters, indicated that under timely sown conditions, evening relative humidity alone accounted for 53% variability in aphid population in RH 0749 and 49% variability in aphid population in HNS 0901. Under late sown conditions, maximum temperature accounted for 45% variability in aphid population in RH 0749 and 44% variability in aphid population in HNS 0901 (Table 3).

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