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Seasonal and temporal variation in population of *Myzus persicae* on *Brassica carinata* in different dates of sowing

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Abstract
The present field experiment was carried out to study the incidence of *Myzus persicae* on *Brassica carinata* in different dates of sowing at Norman E. Borlaug Crop Research Center of G.B. Pant University of Agriculture and Technology, Pantnagar, India during Rabi 2015-16 and 2016-17. *B. carinata* was sown on five dates of sowing starting from October 3 to December 3, 2015 and 2016 at fifteen days interval. The population of *Myzus persicae* recorded on *b. carinata* in present study differ significantly with respect to different dates of sowing in both the years. regarding the date of sowing, overall mean population of green peach aphid was found the maximum in second(134.8 per 3 leaves) and fifth(114.2 per leaves)date of sowing while minimum in fourth(77.6 per leaves) date of sowing during both the seasons. however, the green peach aphid population was found higher during *Rabi* 2015-16 compared than 2016-17.

Keywords: *Myzus persicae*, rapeseed-mustard, incidence, date of sowing, weather parameters

Introduction
Rapeseed-mustard is the main oilseed crop sown during the *Rabi* season in India. It is planted on more than 80% of oilseeds. Rajasthan, Uttar Pradesh, Madhya Pradesh, Haryana and Gujarat are the leading states for mustard crop accounting for more than 70% of the total mustard area in the country. Even after the availability of good production technology mustard crop is unable to give potential yield in the country. This is because *Brassica* crops suffer heavy loss in yield due to various biotic and abiotic factors. Among the biotic constraints, insect-pests are one of the most important biotic factors in reducing the crop yield. About 50 insect species have been found infesting rapeseed-mustard in India [6]. Out of which, green peach aphid *Myzus persicae* (Sulzer) inflicts major losses to the rapeseed crop, it sucks on the phloem of different plant parts including inflorescence and seed pods resulting in substantial yield. It can attain very high densities on young plant tissues, distortion and wilting of young leaves and shoots, reduced growth rate of the plant and causes and subsequently yields loss [5]. green peach aphid, *Myzus persicae* (Sulzer) cause damage to many host plants directly by sucking the sap and producing necrotic spots in tissues and indirectly by transmitting disease causing organisms and excreting honeydew on which development of sooty mould interfere photosynthesis. The polyphagous insect infesting hundreds of host plants in over 40 plant families including Solanaceae, Chenopodiaceae, Compositae, Cruciferae and Cucurbitaceae. It causes water stress, wilting, reduces growth rate of the plant, honeydew excretion and most important as vector, transmitting more than 100 plant viruses in about 30 families [8].Knowing the importance of rapeseed-mustard and the damage caused by the *M. persicae*, this research was carried out to know the occurrence and abundance of green peach aphid on *B. carinata* with respect to different dates of sowing in Uttarakhand.

Materials and Methods
This study was conducted in Rabi season, consecutively for two years, 2015-16 and 2016-17 at Norman E. Borlaug Crop Research Center of G.B. Pant University of Agriculture and Technology, Pantnagar, India. B.carinata cv. Kiran was sown in Randomized Block Design (RBD), having three replicates. The field experiment for population build-up of *Myzus persicae* on *B. carinata* was carried out in five different dates of sowing at fifteen days of interval, as October 3 (First sowing), October 18 (Second sowing), November 3

(Third sowing), November 18 (Fourth sowing) and December 3 (Fifth sowing).The size of plot for each treatment in all replications was taken as 4.2m x 3m with a row to row and plant to plant space of 30 and 10 cm, respectively. During experimentation all the recommended agronomic practices were followed to raise the healthy crop except the plant protection measures. The weekly observations on nymph and adult of green peach aphid was recorded from three leaves *viz*., top, middle and lower leaf on 10 plants selected randomly from the date of start of initial aphid infestation up to harvest of the crop [2].The required meteorological data such as maximum and minimum temperature, morning and afternoon RH and rainfall was recorded from the meteorological observatory of G.B. Pant University of Agriculture and Technology, Pantnagar.

Statistical Analysis

The data was subjected to the analysis of variance using Randomized block design (R.B.D.) programme. Correlation and regression between weather parameters and population of green peach aphid were carried out.

Results

First Sown: 3rd October, 2015-16 and 2016-17

The data presented in Table 1 reveal the first appearance of population of *M. persicae* was observed during the 1st standard week with 53.2 per 3 leaves and remained active till the 4th standard week on *B. carinata*, which remained active till the peak population of aphid (128.2 per 3 leaves) was found in the 3rd standard week followed by 2nd standard week. similarly, during 2016-17 the first appearance of *M. persicae* was recorded in 2nd standard week and continued till 9th standard week. It was recorded 21.5 to 142.7 per 3 leaves. There was a gradual rise in population of *M. persicae* from 4th standard week and onward which attained its peak during the 7th standard week. Correlation between the population of *M. persicae* and minimum and maximum temperature, sunshine showed significant negative correlation. Morning relative humidity and wind speed exhibited positive correlation with *M. persicae.* During 2016-17, the population of *M. persicae* showed significant positive correlation with maximum temperature and sunshine. The regression revealed that the various abiotic factors were found to be most influencing factors which contributed 65 and 62 % variation in population during 2015-16 and 2016-17 (Table 2).

Second Sown: 18th October, 2015-16 and 2016-17

The first appearance of the *M. persicae* was recorded in the 4th standard week and continued until 8th standard week which was found maximum with 205.4 aphids per 3 leaves. In the 5th standard week, highest population (132.50 aphids per 3 leaves) was recorded and reached its lowest level with 97.3 aphids per 3 leaves in the 8th standard week. Likewise, during 2016-17 *M. persicae* population first appeared in 5th standard week which ranged from 23.7 to 97.2 aphids per 3 leaves. the population of *M. persicae* in the 8th standard week found highest with 97.0 aphids per 3 leaves (Table 1). Correlation between the population of *M. persicae* and minimum temperature, sunshine was found significantly negative. During 2016-17, the correlation between *M. persicae* and sunshine was found positive while wind velocity exhibited significant negative with the population of *M.* persicae. The regression displayed that the various abiotic factors were found to be most influencing factors which contributed 67 and 68 percent variation in aphid population during 2015-16 and 2016-17 (Table 2).

Third Sown: 3rd November, 2015-16 and 2016-17

The data presented in Table 1 reveal the population of *M. persicae* first appeared in the 3rd standard week with 115.1 aphids per 3 leaves and remained active until 7th standard week with 33.6 aphids per 3 leaves. The highest aphid population (183.5 aphids per 3 leaves) was found which started declining from the 6th standard week onwards and reached its lowest level of population (33.6 aphidsper3 leaves) in the 7th standard week. On the other hand, during 2016-17 *M. persicae* population was first reported during 6th standard week with 20.3 aphids per 3 leaves. Peak population of *M. persicae* was recorded during the 9th standard week and ranged from 20.3 to 74.0 aphids per 3 leaves (Table 1). The population of *M. pesricae* exhibited significant positive correlation with maximum temperature and sunshine. correlation between evening relative humidity and population of *M. persicae* was found positive. During 2016-17, Correlation between *M. persicae* and sunshine was found positive while wind velocity exhibited significant negative correlation with the population of *M.* persicae. The regression between *M. persicae* and weather parameters were found to be r^2= 67 and 70 % during both of the years (Table 2).

Fourth Sown: 18th November, 2015-16 and 2016-17

The Population of *M. persicae* was first noticed in 4th standard week with 68.5 aphids per 3 leaves. Maximum aphid population was observed (98.1 aphids per 3 leaves) in 6th standard week which was gradually decreased thereafter and reached its minimum level with 54.2 aphids per 3 leaves. However, during 2016-17 the population of *M. persicae* first appeared in 2rd standard week and continued till 7th standard week which was ranged from 36.1 to 103.6 aphids per 3 leaves (Table 1).The population of *M. persicae* showed significant negative correlation with only maximum temperature. During 2016-17, Maximum and minimum temperature showed a positive correlation with the population of *M. persicae.* however, *Myzus persicae* exhibited the negative correlation with the evening relative humidity. The regression proclaimed that the various abiotic factors were found to be most influencing factors which contributed 63 and 54 percent variation in aphid population during 2015-16 and 2016-17 (Table 2).

Fifth Sown: 3rd December, 2015-16 and 2016-17

The population of *M. persicae* was recorded in the 5th standard week with 78.3 aphids per 3 leaves and reached its peak population of *M. persicae* with 152.7 aphids per 3 leaves in the 7th standard week while lowest population was found (133.4 aphids per 3 leaves) in the 8th standard week. During 2016-17, the population of *M. periscae* first appeared in 6th standard week with the highest population with 45.3 aphids per 3 leaves. Thereafter, the population starts decreasing in subsequent weeks but it was found increased with 41.1 aphids per 3 leaves in the 10th standard week (Table 1).The population of *M. persicae* exhibited significant negative correlation with morning and evening relative humidity. correlation between *M. persicae* and maximum temperature and sunshine was found positive. During 2016-17, the population of *M. persicae* showed significant negative correlation with maximum temperature whereas positive correlation with wind speed. The regression indicated clearly that the various abiotic factors were found to be most influencing factors which contributed 58 and 63 percent

variation in aphid population during 2015-16 and 2016-17(Table 2).

Discussion

An experiment on population dynamics of sucking insect pests particularly aphids on *Brassica carinata* was conducted. Aphid population was also high on the crop sown on the second and fourth date of sowing during 2015-16 and 2016-17, respectively. These results are in similar with the findings of [1,7] who reported that green peach aphid population was highest in early Rabi and lowest in kharif season. Weather conditions may be high influence on population dynamics of *M. persicae*. Our findings are also in agreement with the findings of [3] who reported that abiotic factors could be responsible for the variation in green peach aphid's population and also stated that environmental factors (temperature, rain fall and humidity) greatly affect the population of *M. persicae*. Weather parameters especially rainfall and high temperature had adverse effects on the population of *M. persicae*. In the experiment, the aphid population increased in further week up to week three, when the highest population was recorded. Thereafter, the population of *M. persicae* declined, perhaps due to hardening of leaf tissues. These results agree with the findings of [4] who reported that with the aging of the host plants become unsuitable for the consumption for aphid.

Since the aphid population was higher in late sown crops as compared to early sown, timely sowing of crops would be one of the important strategies for escaping aphid attack under Tarai region of Uttarakhand. On the basis of the present results, it is concluded that the sucking insect pest namely green peach aphid, *Myzus persicae* attacked crop was in regular manner and predictable pest at the vegetative stage of plants. The time - period from first week of January to last week of February was found favourable for build-up of population of green peach aphid on *Brassica* crop and need consideration for the effective and timely management of the aphid.

Table 1: Incidence of *M. persicae* on *B. carinata* in different dates of sowing during *Rabi* 2015-16 and 2016-17

DOS/ Standard week	*M. persicae* /3 leaves									
	D1(3rdOct)		D2(18th Oct)		D3(3rdNov)		D4(18th Nov)		D5(3rd Dec)	
	2015-16	2016-17	2015-16	2016-17	2015-16	2016-17	2015-16	2016-17	2015-16	2016-17
1	53.2	-	-	-	-	-	-	36.1	-	-
2	110.1	-	-	-	-	-	-	50.2	-	-
3	128.2	21.5	-	-	115.1	-	-	52.8	-	-
4	83.3	40.9	205.37	-	146.5	-	68.5	66.8	-	-
5	-	70.3	132.50	23.7	183.5		92.4	103.6	78.3	-
6	-	107.0	124.03	51.7	83.9	20.3	98.1	88.2	92.5	45.3
7	-	142.7	114.97	83.9	33.6	63.9	74.9	-	152.7	30.1
8	-	47.3	97.33	97.0	-	34.4	54.2	-	133.4	32.4
9	-	76.0	-	58.2	-	74.0	-	-	-	31.1
10	-	-	-	-	-	37.0	-	-	-	41.1
Sem	2.97	8.5	5.4	6.3	5.3	5.2	7.0	2.6	10.1	3.80
F-test	S	s	s	s	S	s	s	s	S	S
C. D. at 5%	10.3	26.3	17.6	20.6	17.2	17.1	22.9	8.3	35.0	12.4
CV	5.5	20.5	6.9	17.4	8.1	19.8	15.7	6.8	15.3	18.3

***** DOS=Date of sowing, D1=3rd October, D2=18th October, D3=3rd November, D4=18th November, D5=3rd December

Table 2: Correlation and regression between the population of *M. persicae* and weather parameters on *Brassica carinata* in different dates of sowing during *Rabi* 2015-16 and 2016-17

DOS	*Rabi* season	Multiple regression equation	R^2	T_{max}	T_{min}	RH1	RH2	RF	SS	WS
D1	2015-16	$Y= -253.74+0.09X_1-12.56X_2+9.9X_3+7.9X_4+20.2X_7$	0.65	-0.85	-0.71	0.80	0.56	0.0	-0.65	0.80
	2016-17	$Y=764.7+18.0X_1+16.4X_2+14.1X_3-23.8X_4-152.4X_6-96.3X_7$	0.62	0.39	0.33	-0.45	-0.38	0.0	0.48	-0.56
D2	2015-16	$Y=-795.9+32.16X_1-63.05X_2-166.55X_3+12.95X_4-218.95X_6+27.87X_7$	0.67	-0.58	-0.68	0.41	0.59	0.0	-0.73	0.06
	2016-17	$Y=-1832.1+23.36X_1-17.27X_2+16.62X_3-4.23X_4-9.67X_7$	0.68	0.76	0.54	-0.23	-0.57	0.0	0.66	0.23
D3	2015-16	$Y= -1018.58-3.05X_1+55.73X_2+10.01X_4+43.92X_7$	0.56	-0.64	-0.01	0.50	0.81	0.0	-0.73	0.14
	2016-17	$Y=390.83+2.20X_1+3.78X_2-2.59X_3-2.83X_4-17.06X_7$	0.70	0.59	0.10	-0.45	-0.48	-0.22	0.67	-0.72
D4	2015-16	$Y=-761.30-19.68X_1+9.65X_2+84.40X_3-5.30X_4+94.45X_6-16.9X_7$	0.54	-0.72	-0.59	0.43	0.34	0.0	-0.55	-0.21
	2016-17	$Y=-33.92-10.50X_1+21.37X_2+6.01X_3-7.04X_4-4.93X_7$	0.64	0.80	0.69	-0.54	-0.63	0.00	0.42	-0.09
D5	2015-16	$Y=73.72+9.76X_1+13.28X_2-31.3X_3-2.38X_4-18.26X_7$	0.58	0.86	0.43	-0.96	-0.61	0.0	0.96	-0.18
	2016-17	$Y=83.78-3.54X_1-6.03X_2-0.59X_3+0.85X_4+5.21X_7$	0.63	-0.71	-0.44	0.06	0.42	0.42	-0.55	0.62

* Tmax =Maximum temperature °C, Tmin =Minimum temperature °C, RH1 =Morning relative humidity %, RH2 =Evening relative humidity, %, RF =Rainfall, mm, SSH =sunshine hours, WS=wind speed, DOS=Date of sowing, D1=3rd October, D2=18th October, D3=3rd November, D4=18th November, D5=3rd December

** bold values indicates the significant correlation

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