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Screening of different wheat varieties against aphids at Pantnagar

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Abstract
Study was carried out in the department of entomology, GBPUA & T, Pantnagar (2015-16). Lowest aphid population were found in PBW-660 (1.9 aphids/plant) and highest aphid population was found in UP-2785 (4.96 aphids/plant) during 30 DAG. In the genotypes UP-2526 (8.86 aphids/plant) and DPW-62150 (26.46 aphids/plant) recorded lowest and highest aphid population at 45DAG respectively. At 60 DAG UP-2785 and UP-2785 genotypes recorded the lowest (1.50 aphids/plant) and highest (4.96 aphids/plant) aphid population was recorded respectively.
The genotype UP-2526 and UP-2869 were comparatively resistant with minimum population of aphids (4.30/plant and 5.83/plant). Whereas, the genotypes DPW-62150 (11.98 aphids/ plant) found susceptible.
As the genotype UP-2869 and UP-2526, has lowest aphid population shows the highest yield of 21.00q/ha. DPW-62150, UP-2425, HD-3059, WH-1105 and UP-2883 with highest aphid population (11.98, 10.93, 10.72, 10.06 and10.02 aphids/plant) shows the lowest yield of 15.50q/ha, 17.50q/ha, 17.50q/ha,17.00q/ha and 16.00 q/ha.

Keywords: Aphid, genotype, screening, resistant, wheat, varieties

1. Introduction
Wheat (*Triticum aestivum* L.) is one of the important cereal, occupies almost 90% of the total wheat area and ranks first among world food crops [8]. Annual global production is over 724 million tones, which decreases 1.4 percent, or 10 million tonnes, from the 2015, 734.1 million tones and Major wheat producing countries are China, India, Russia, USA, France, Canada, Germany and Pakistan [4].
Wheat is the main cereal crop in India and total area under the crop is about 29.8 million hectares in the country [4]. India stands at 2nd position in wheat production in the world and in the year 2013-2014, wheat production crossed the mark of 95 Million Tonnes after China which has production of 126 million metric tons [4].
Amongst various species of insect pests, aphids commonly known as green flies or plant lice belong to the super family Aphidoidea have great importance in the last few years [3]. The wheat crop is infested with aphids during the vegetative and reproductive stages when both the adults and nymphs exploit the cell sap and reduce the vitality of the plants. Honey dew secreted by the aphids is often prolific and sooty molds usually accompany aphid infestation which eventually affects the rate of photosynthesis in plants [3].
In India, as many as 11 species of aphid have been associated with wheat and barley crops [3] out of these 11 aphid species, six species of aphids damaging cereals viz *Rhopalosiphum maidis*, *Rhopalosiphum padi*, *Schizaphus graminum*, *Metopolophium miscanthi*, *Sitobion avenae* and *Diuraphis noxia*, has been included world widely in the list of the important pests of cereals. Out of theses only 3 species viz. *Sitobion avenae*, *Metopolophium miscanthi* and *Rhopalosiphum maidis* did the direct serious damage to wheat crop. The aphid is the main vector of barley yellow dwarf, barley mosaic, and sugarcane mosaic viruses [9]. Reported four aphid species viz., *Sitobion avenae* (F.), *Schizaphis granarium* (Rond.), *Rhopalosiphum rufiabdominalis* (Sasatri) and *Rhopalosiphum maidis* (Fitch.) on wheat [7].
The aphid problem can be tackled with the application of commonly used insecticides but the drawback lies with their haphazard use resulting in problems of health hazards, environmental pollution and development of resistance in insects against insecticides. It is, therefore, advisable to screen wheat cultivars possessing resistance against aphids. Study on varietal resistance of some significance was carried out by [2] who reported that among the test varieties FSD-83 having 10.30\ aphids/tiller proved to be highly susceptible while Pitic-62

(4.98 aphids/tiller) proved to be comparatively resistant and was statistically equal to Punjab-85 (5.01 aphids/tiller). Similarly [10] conducted a screening trial of 38 wheat strains and reported the least infestation in VL-616 and maximum in Hindi-62. Grading of the entries on the basis of mean root aphid population revealed that 5 entries (V1-616, HS-295, WH-629, WH-589 and IWP-762) were found least infested (0-2 aphid/plant), 4 (UP-2378, WH-551, PBW-362) and UP-2379) were intermediate (15.01 to 25.0 aphid/plant) and 2 (Raj- 1777 and Hindi-62) were susceptible (more than 25.0 aphids/plant). The incidence of aphids has been reported to be significantly different on different cultivars of wheat [1, 2, 10].

Keeping in view the above facts, the present study was conducted with the objective to screen various available genotypes of wheat showing resistant and susceptible response to aphids.

2. Materials And Methods

The present field experiments were conducted during Rabi season of 2015-16 in N.E. Borlaug Crop Research Center, G. B. Pant University of Agriculture & Technology Pantnagar, District U.S. Nagar, and Uttarakhand, India. Geographically, Pantnagar is situated at latitude 29^0 N and longitude 79.29^0E and altitude 243.8 m above mean sea level. The soil of experimental field is slightly clay loam.

Experiment was laid out in a Randomized Complete Block Design with three replications. The plot size was kept as 2x $1m^2$. Twenty three genotypes of wheat i.e. UP-2565, UP-2526, UP-2869, UP-2784, UP-2883, UP-2748, UP-2572, UP-2524, UP-2584, UP-2785, UP-2855, UP-2338, UP-2628, UP-2425, HD-2967, HD-3059, PBW-590, PBW-343, PBW-660, WH-1105, WH-1021, DPW-62150 and UL-829 were sown on December 5, 2015.we also identified three aphid spices (*Rhopalosiphum maidis, Rhopalosiphum padi, Schizaphus graminum*). Observation was recorded after appearance of aphid. The counting of aphids was recorded from 10 randomly tagged plants of each variety per replication at 15 days intervals until harvest. Average count of aphid per tiller and grading of varieties will be work out by [12] as given below:

Table 1: Susceptibility rating of wheat cultivars against aphid

Grades	Approx. No. of aphids/shoots	Rating
I	0	Immune
II	1 to 5	Resistant
III	6 to 10	Moderately Resistant
IV	11 to 20	Susceptible
V	21 and above	Highly Susceptible

2.1 Observation on yield

Grain yield was obtained from each plot after harvesting. The grains were sun dried to establish the moisture content. The weight was taken after this period. The total yield per plot including all 3 replication was taken and converted it into q/ha and also observed effect of aphid on grain yield.

2.2 Statistical analysis

The data on insect population was subjected to square root transformation with 0.5 adding factor using programme STPR3.

3. Results and Discussion

3.1 On aphid population

After 30 days of germination lowest aphid population was found in PBW-660 with 1.9 aphids plant followed by UP-2525 (1.9 aphids/plant), UP-2572 (2.3 aphids/plant), UP-2584 (2.33aphids/plant), UP-2565 (2.33aphids/plant), UP-2524 (2.43 aphids/plant), HD-2967 (2.66 aphids/plant), PBW-590 (2.70aphids/plant), UP-2338 (2.8 aphids/plant), UP-2855 (2.83 aphids/plant), UL-829 (2.83aphids/plant), UP-2784 (2.93aphids/plant), UP-2748 (3.23 aphids/plant), HD-3059 (3.26aphids/plant), UP-2883 (3.66 aphids/plant),WH-1021 (3.73aphids/plant), PBW-343 (3.86 aphids/plant), UP-2425 (3.93aphids/plant), UP-2628 (3.96aphids/plant), WH-1105(4.00aphids/plant), DPW-62150 (4.8 aphids/plant) and highest aphid population was found in UP-2785 (4.96 aphids/plant) that showed non-significance difference among these genotypes

Forty five days after germination lowest aphid population was found on UP-2526 (8.86 aphids/plant) followed by UP-2869 (11.86 aphids/plant), UP-2565 (13.93 aphids/plant), UP-2584 (14.30 aphids/plant), UP-2338 (15.50 aphids/plant), PBW-343 (16.56 aphids/plant), UP-2628 (16.76 aphids/plant), UP2572 (17.06 aphids/plant), UP2524 (17.36 aphids/plant), HD-2967 (17.56 aphids/plant), WH-1021 (17.73 aphids/plant), UP-2784 (18.80 aphids/plant), PBW-660 (19.36 aphids/plant), UL-829 (19.70 aphids/plant), UP-2855 (20.73 aphids/plant), UP-2748 (20.76 aphids/plant), UP-2785 (21.20 aphids/plant), UP-2883 (21.56 aphids/plant), WH-1105 (22.86 aphids/plant), PBW-590 (23.20 aphids/plant), HD-3059 (25.00 aphids/plant), UP-2425 (26.03 aphids/plant) and highest aphid population was found in DPW-62150 (26.46 aphids/plant) that showed significant difference among these genotypes.

The observation taken on 60^{th} day after germination showed that lowest aphid population was found in UP-2785 (1.50 aphids/plant), followed by UP-2784 (1.56 aphids/plant), PBW-660 (1.56 aphids/plant), UP-2565 (1.8 aphids/plant), UP-2526 (2.13aphids/plant), UP-2524 (2.26 aphids/plant), UP-2748 (2.46 aphids/plant), UP-2584 (2.46 aphids/plant), HD-2967 (2.53 aphids/plant), PBW-343 (2.73 aphids/plant), UP-2628 (2.73 aphids/plant), UP-2572 (2.76 aphids/plant), UP-2425 (2.83 aphids/plant), UP-2855 (2.86 aphids/plant), UP-2338 (3.13aphids/plant), WH-1105 (3.20 aphids/plant), UP-2869 (3.40 aphids/plant), UL-829 (3.40 aphids/plant), PBW-590 (3.7 aphids/plant), HD-3059 (3.90 aphids/plant), WH-1021 (4.70 aphids/plant), DPW-62150 (4.70 aphids/plant)) and highest aphid population was found in UP-2883 (4.96 aphids/plant) that showed significant difference among these genotypes and. Presented in Table (2).

This study was supported by [13] while testing 557 wheat lines found that out of 200 wheat lines, 15 were resistant and 12 were tolerant at seedling stage to *Schizaphis graminum* and *Rhopalosiphum padi*. Study was supported by [11] on population dynamics of aphids on wheat varieties Bakhtawar, Uqab and Pir Sabaque-85 and their natural enemies at Malakandher Research Farm, Peshawar. This study was supported by [14] studied the population trend of wheat aphids on different varieties/ lines of wheat.

3.2 Susceptibility rating of wheat cultivars against aphid

The overall results regarding mean population of aphids per plant on various genotypes of wheat at different dates of observation reveal highly significant difference among genotypes. The genotype UP-2526 and UP-2869 were comparatively resistant with minimum population of aphids (4.30/plant and 5.83/plant). The genotypes, UP-2565, UP-2869, UP-2883, UP-2748, UP-2572, UP-2524, UP-2584, UP-2785, UP-2855, UP-2338, UP-2628, UP-2425, HD-2967, HD-3059, PBW-590, PBW-343, PBW-660, WH-1105, WH-1021

and UL-829 respectively showed moderately resistant 6.02/plant, 7.76/plant, 10.06/plant, 8.81/plant, 7.37/plant, 7.35/plant, 6.36/plant, 9.22/plant, 8.80/plant, 7.14/plant, 7.81/plant, 10.93/plant, 7.58/plant, 10.72/plant, 9.86/plant, 7.71/plant, 7.60/plant, 10.02/plant, 8.72/plant, 8.64/plant) whereas, the genotypes DPW-62150, with 11.98 aphids per plant, were found as susceptible. The present findings can be compared with those of [5] who reported that resistant lines were the least damaged by aphid feeding than susceptible lines. The present findings are in conformity with those of [6] who reported that resistant cultivars showed lowest population of aphids (0-5.0/tiller) as compared to susceptible lines (16-20/tiller) and presented in Table (3).

3.3 Yield Obtained - As the genotype UP-2869,UP-2565 and UP-2526, has lowest aphid population (4.30 5.83 and 6.02 aphids/plant) shows the highest yield of 21q/ha significantly, vice-verse genotype DPW-62150,UP-2425,HD-3059,WH-1105 and UP-2883 with highest aphid population (11.98, 10.93, 10.72, 10.06 and10.02 aphids/plant) shows the lowest yield of 15.50q/ha, 17.50q/ha, 17.50q/ha,17.00q/ha and 16.00 q/ha. This study was supported by [1] that highest grain yield was obtained with lowest aphid density. Similar results were reported by [2] but with different set of genotypes and presented in Table (4).

Table 2: Screening of wheat cultivars against aphid during *rabi*, 2015-16

Sl. No.	Name of the screening variety	30 DAG	45 DAG	60 DAG	Mean population of aphids
1	UP-2565	2.33 (1.67)	13.93 (3.78)	1.8 (1.51)	6.02
2	UP-2526	1.93 (1.55)	8.86 (3.04)	2.13 (1.61)	4.30
3	UP-2869	2.23 (1.65)	11.86 (3.49)	3.40 (1.96)	5.83
4	UP-2784	2.93 (1.84)	18.80 (4.37)	1.56 (1.43)	7.76
5	UP-2883	3.66 (2.01)	21.56 (4.68)	4.96 (2.33)	10.06
6	UP-2748	3.23 (1.90)	20.76 (4.57)	2.46 (1.71)	8.81
7	UP-2572	2.30 (1.65)	17.06 (4.15)	2.76 (1.80)	7.37
8	UP-2524	2.43 (1.70)	17.36 (4.22)	2.26 (1.66)	7.35
9	UP-2584	2.33 (1.67)	14.30 (3.81)	2.46 (1.70)	6.36
10	UP-2785	4.96 (2.32)	21.20 (4.64)	1.50 (1.38)	9.22
11	UP-2855	2.83 (1.82)	20.73 (4.57)	2.86 (1.82)	8.80
12	UP-2338	2.80 (1.78)	15.50 (3.99)	3.13 (1.90)	7.14
13	UP-2628	3.96 (2.09)	16.76 (4.13)	2.73 (1.79)	7.81
14	UP-2425	3.93 (2.09)	26.03 (5.12)	2.83 (1.82)	10.93
15	HD-2967	2.66 (1.77)	17.56 (4.24)	2.53 (1.69)	7.58
16	HD-3059	3.26 (1.93)	25.00 (5.04)	3.90 (2.09)	10.72
17	PBW-590	2.70 (1.77)	23.20 (4.79)	3.70 (2.03)	9.86
18	PBW-343	3.86 (2.07)	16.56 (4.12)	2.73 (1.78)	7.71
19	PBW-660	1.90 (1.54)	19.36 (4.44)	1.56 (1.43)	7.60
20	WH-1105	4.00 (2.08)	22.86 (4.77)	3.20 (1.91)	10.02
21	WH-1021	3.73 (2.05)	17.73 (4.26)	4.70 (2.25)	8.72
22	DPW-62150	4.80 (2.21)	26.46 (5.14)	4.70 (2.26)	11.98
23	UL-829	2.83 (1.82)	19.70 (4.44)	3.40 (1.97)	8.64
	CV value	14.98	11.6	12.95	
	SE(m)	.162	.292	0.1363	
	CD (0.05%)	.462	.834	0.388	
	Significant *	Ns	**	**	

Table 3: Pest susceptibility rating of wheat cultivars against aphid during *rabi* 2015-16

S. No	Name of the screening variety	Mean population of aphids	Rating
1	UP-2565	6.02	Moderately Resistant
2	UP-2526	4.30	Resistant
3	UP-2869	5.83	Resistant
4	UP-2784	7.76	Moderately Resistant
5	UP-2883	10.06	Moderately Resistant
6	UP-2748	8.81	Moderately Resistant
7	UP-2572	7.37	Moderately Resistant
8	UP-2524	7.35	Moderately Resistant
9	UP-2584	6.36	Moderately Resistant
10	UP-2785	9.22	Moderately Resistant
11	UP-2855	8.80	Moderately Resistant
12	UP-2338	7.14	Moderately Resistant
13	UP-2628	7.81	Moderately Resistant
14	UP-2425	10.93	Moderately Resistant
15	HD-2967	7.58	Moderately Resistant
16	HD-3059	10.72	Moderately Resistant
17	PBW-590	9.86	Moderately Resistant
18	PBW-343	7.71	Moderately Resistant
19	PBW-660	7.60	Moderately Resistant
20	WH-1105	10.02	Moderately Resistant
21	WH-1021	8.72	Moderately Resistant
22	DPW-62150	11.98	Susceptible
23	UL-829	8.64	Moderately Resistant

Table 4: Yield obtained from wheat cultivars against aphid during *rabi* 2015-16

Screening Variety	Kg/plot	q/ha
UP-2565	0.42 (0.95)	21
UP-2526	0.42 (0.95)	21
UP-2869	0.42 (0.95)	21
UP-2784	0.38 (0.93)	19
UP-2883	0.32 (0.90)	16
UP-2748	0.36 (0.92)	18
UP-2572	0.40 (0.94)	20
UP-2524	0.40 (0.94)	20
UP-2584	0.41 (0.95)	20.5
UP-2785	0.32 (0.90)	16
UP-2855	0.37 (0.93)	18.5
UP-2338	0.40 (0.94)	20
UP-2628	0.38 (0.93)	19
UP-2425	0.35 (0.92)	17.5
HD-2967	0.39 (0.94)	19.5
HD-3059	0.35 (0.92)	17.5
PBW-590	0.32 (0.90)	16
PBW-343	0.39 (0.94)	19.5
PBW-660	0.39 (0.94)	19.5
WH-1105	0.34 (0.91)	17
WH-1021	0.38 (0.93)	19
DPW-62150	0.31 (0.89)	15.5
UL-829	0.38 (0.93)	19
CV value	0.575	
SE(m)	0.310	
CD (0.05%)	0.884	
Significant *	**	

4. Conclusion

From the present study results, it can be concluded that the aphids, *Scizaphis graminum*, *Rhopalosiphum maidis*, and *Rhopalosiphum padi* started infesting wheat in the second week of January. Maximum population was found during first and second week of March. Aphid population per ten tillers was lowest on wheat variety UP-2526 and UP-2869 and found resistant against aphids whereas, maximum population of aphid obtained from the DPW-62150 and found susceptible. Based on the number of aphid per ten tillers it is concluded that variety UP-2526 and UP-2869 was most resistant DPW-62150 was most susceptible among the varieties used for tested in the study.

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