

Research Article

Susceptibility in wheat varieties to infestation of wheat aphid (*Rhopalosiphum padi* L) (Homoptera : Aphididae)

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Abstract

Nine wheat varieties viz., NIAW 301, NIAW 917, NIAW 1415, NIAW 34, HD 2189, LOK-1, GW 496, NIDW 295 and A-9-30-1 were studied against wheat aphid (*Rhopalosiphum padi* L) for their susceptibility at Agricultural Research Station, Niphad Dist. Nasik during *Rabi* 2013-14 and 2014-15. Data from seedling bulk test showed that six wheat varieties namely NIAW 917, NIAW 301, NIAW 34, NIAW 1415, HD 2189 and LOK-1 were found moderately resistant with damage rating 4 to 7 and three varieties namely A-9-30-1, NIDW 295 and GW 496 were found susceptible to wheat aphid with damage rating 8 to 9. Result of antixenosis test after 24 hours showed that out of nine wheat varieties viz., NIAW 301, NIAW 917, NIAW 1415, NIAW 34, HD 2189 and LOK-1 were least preferred and three varieties viz., A-9-30-1, NIDW 295 and GW 496 were highly preferred for fecundity.

Results of antixenosis test for 48 hours showed that four varieties viz., NIAW 917, NIAW 301, NIAW 34 and NIAW 1415 were least preferred and two varieties namely LOK-1 and HD 2189 were moderately preferred and three varieties namely A-9-30-1, NIDW 295 and GW 496 were highly preferred for fecundity.

Keywords: Wheat (*Triticum aestivum*), *Rhopalosiphum padi*, antixenosis, aphid, resistance

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Introduction

Among the cereals wheat (*Triticum aestivum*) is the most important food crop of India and staple food through the world. It is extensively grown in irrigated and rainfed condition in the world. It occupies an area of 30.72 million hectare with a production and productivity of 97.44 million tonnes and 3172 kg/ha, respectively [4]. Wheat is one of the important *rabi* crop of Maharashtra. In Maharashtra it is grown on area of 10.73 lakh hectare with a production and productivity of 16.72 lakh tonnes and 1558 kg/ha, respectively during *rabi* 2016-17 [4]. In India damage by aphids is regular in some part of the country. The reduction in wheat yield may be due to the effect of biotic and abiotic factors. Various aphid species are established pests of agricultural and horticultural crop across the world. Among these wheat aphid (*Microsiphum miscanthi*), Bird cherry oat aphid (*Rhopalosiphum padi*) and English grain aphid (*Sitobion avenae*) are more common. *Rhopalosiphum padi* L. is one of the most numerous and economically important aphid in wheat.

They are known for their direct and indirect damage. Direct damage in respect by sucking cell sap of the leaves, young shoot, causing distortion, stunting, leaf curling, wilting, twisting and transmitting plant viruses. They cause indirect damage by depositing honey dew that reduce photosynthetic activity and induce sooty mould production and pre mature leaf senescence [3, 9]. The damage is particularly severe in cold and cloudy weather during winter. They mostly appear from December to January. [11] reported that aphid caused 10 to 50% reduction in crop yield directly and 20 to 80% indirectly. To overcome to economical losses caused by aphids attack, the most eco-friendly and sound method for the control of aphids is the use of resistant wheat variety in pest management strategy [6, 12]. The use of resistant varieties is an effective and efficient tool for the control of aphids. [10, 1]. Identification of the factors that confer resistance or susceptibility and study of their inheritance in cereals would improve breeding strategy to identify the resistant variety. In this way, for recognising the mechanism of host plant resistance will lead to breeding for long term resistance. The present study was undertaken with an object to identify the resistant varieties for aphids by determining the influence of infestation on growth of wheat and ability of varieties to resist stunting caused by infestation of aphid.

Material and Methods

To find out the resistant wheat varieties experiment was carried out under laboratory condition during 2014-15 and 2015-16 at Agricultural Research Station, Niphad, Dist. Nashik. Nine wheat varieties were evaluated against aphid. These nine wheat varieties tested were NIAW 301, NIAW 917, NIAW 1415, NIAW 34, HD 2189, LOK-1, GW 496, NIDW 295 and A-9-30-1. Evaluation of resistance was done by seedling bulk test and antixenosis test. Experiment was conducted in completely Block Design with three replications. The experiment was carried out under control environmental condition.

Mass rearing of aphid

Aphids were collected from wheat field of Agricultural Research Station, Niphad, Dist. Nashik and their culture was maintained in iron racks measuring 120x60x60cm lightened with florescent light (40w) bulb. About twenty seeds of susceptible wheat variety were sown in plastic pot of 12cm diameter. Seedlings were obtained for mass rearing from twenty wheat seeds sown per plot. Culture of aphids was maintained under control condition of 28+₋ 2⁰C and 50 to 70% humidity and 16h:8h day:night photoperiod in the rearing room. Resistance was evaluated by seedling and antixenosis test.

Seedling Bulk/ Flat Test

The test was performed in three plastic trays measuring 36cmx28cmx8cm. Trays were filled with soil and four rows on one cm depth. There were 20 seedlings of every test entry sown in furrows of each row. When the seedlings attained the height of 5 to 8cm, aphids was released on them with the average of 10 aphids per seedling. Damage rating (DR) scale of 0-9, where 0 stands for healthy and 9 stands for dead. After 10-15 days of infestation, when lodging and chlorosis started, plants was observe and data was categorized as highly resistant lines/ varieties having DR=2, resistant lines/varieties having DR=3, moderately resistant (MR) lines/varieties having DR=4-6 and susceptible lines/varieties were having DR=7-9.

Antixenosis Test

In randomized complete block design tests of wheat varieties in three replications was conducted to find out the results of non-preference. Seeds of test varieties were sown in a circular pattern about 3cm from the edge of 30cm diameter plastic pot. When seedling was attained 5 to 8cm height, 100 adult wingless aphids were released on the circular paper of 3cm diameter in the centre of the pot and then pots were covered by cage. After 24 hours aphids was settled on each seedling and was counted. There was three categories for preference, least preference (LP) having least number of aphids, moderately preferred (MP) having moderate number of aphids and highly preferred (HP) having highest number of aphids.

Results and Discussion

Seedling Bulk Test

Data presented in **Table 1** revealed that out of 9 wheat varieties six namely NIAW 34, NIAW 301, NIAW 917, NIAW 1415, HD 2189 and LOK-1 were found moderately resistant with damage rating of 4 to 7 whereas three (GW 496, NIDW 295 and A9-30-1) were found susceptible to wheat aphid with damage rating 8 to 9.

Table 1 Varietal reaction of wheat against aphid

S.N.	Name of varieties	Damage rating			Category		
		2014-15	2015-16	Pooled	2014-15	2015-16	Pooled
1	NIAW 301	4	4	4	MR	MR	MR
2	NIAW 917	4	4	4	MR	MR	MR
3	NIAW 1415	6	6	6	MR	MR	MR
4	NIAW 34	5	5	5	MR	MR	MR
5	NIDW 295	8	8	8	S	S	S
6	HD 2189	5	5	5	MR	MR	MR
7	LOK-1	7	7	7	MR	MR	MR
8	GW 496	8	8	8	S	S	S
9	A9-30-1	8	8	8	S	S	S

R=Resistant; MR=Moderately Resistant; MS= Moderately Susceptible; S= Susceptible

Antixenosis Test

Results of Antixenosis test for 24 hours data showed in **Table 2** revealed that, out of nine wheat varieties six were least preferred by aphids with their respective preference rating of 1.17 (NIAW 34), 0.84 (NIAW 301), 0.33 (NIAW 917), 1.17 (NIAW 1415), 1.00 (LOK-1) and 2.17 (HD 2189) while three varieties were highly preferred namely A-9-30-1, NIDW 295 & GW 496.

Table 2 Number of aphids attracted to different wheat varieties/ genotypes under Antixenosis test

S. N	Variety	Av. No. of aphids after 24 hrs			Av. No. of aphids after 48 hrs			Av. No. of aphid of 24 & 48 hrs			Preference category		
		14-15	15-16	Pooled	14-15	15-16	Pooled	14-15	15-16	Pooled	14-15	15-16	Pooled
1	NIAW 301	0.67 *(1.29)	1.00 (1.41)	0.84 (1.35)	0.67 (1.29)	1.33 (1.52)	1.00 (1.41)	0.67 (1.29)	1.17 (1.47)	0.92 (1.38)	LP	LP	LP
2	NIAW 917	0.33 (1.15)	0.33 (1.15)	0.33 (1.15)	0.67 (1.29)	0.67 (1.29)	0.67 (1.29)	0.50 (1.22)	0.50 (1.22)	0.50 (1.22)	LP	LP	LP
3	NIAW 1415	1.00 (1.41)	1.33 (1.52)	1.17 (1.47)	1.33 (1.52)	2.33 (1.82)	1.83 (1.68)	1.17 (1.68)	1.83 (1.68)	1.50 (1.58)	LP	LP	LP
4	NIAW 34	1.00 (1.41)	1.33 (1.52)	1.17 (1.47)	1.00 (1.41)	2.33 (1.82)	2.17 (1.78)	1.00 (1.41)	1.83 (1.68)	1.42 (1.55)	LP	LP	LP
5	NIDW 295	4.67 (2.38)	6.00 (2.64)	5.34 (2.51)	8.67 (3.10)	9.00 (3.16)	8.84 (3.13)	6.67 (2.76)	7.50 (2.91)	7.09 (2.84)	HP	HP	HP
6	HD 2189	2.00 (1.73)	2.33 (1.82)	2.17 (1.78)	3.33 (2.08)	3.33 (2.08)	3.33 (2.08)	2.67 (1.91)	2.83 (1.95)	2.75 (1.93)	MP	MP	MP
7	LOK-1	0.67 (1.29)	1.33 (1.52)	1.00 (1.41)	3.67 (2.16)	4.00 (2.23)	3.84 (2.20)	2.17 (1.78)	2.67 (1.91)	2.42 (1.84)	LP	MP	LP
8	GW 496	5.33 (2.51)	7.33 (2.88)	6.33 (2.70)	10.33 (3.36)	11.67 (3.55)	11.00 (3.46)	7.83 (2.97)	9.50 (3.24)	8.67 (3.10)	HP	HP	HP
9	A9-30-1	8.00 (3.00)	9.33 (3.21)	8.67 (3.10)	11.67 (3.55)	14.67 (3.95)	13.17 (3.76)	9.83 (3.29)	12.00 (3.60)	10.92 (3.45)	HP	HP	HP
	SE ±	0.09	0.09	0.08	0.12	0.07	0.09	-	-	-	-	-	-
	CD at 5%	0.28	0.27	0.25	0.36	0.20	0.28	-	-	-	-	-	-

* Figures in parentheses are $\sqrt{n+1}$ transformed values.

LP= Least Preferred; MP=Moderately Preferred; HP=Highly Preferred

Results of antixenosis test for 48 hours showed that only four varieties NIAW 34, NIAW 301, NIAW 1415 and NIAW 917 were least preferred. Two wheat varieties namely LOK-1 (3.84) & HD 2189 (3.33) were moderately preferred. There were three wheat varieties A9-30-1 (13.17), NIDW 295 (8.84) & GW 496 (11.00) were highly preferred. Combined results of data recorded after 24 and 48 hours indicated that in antixenosis test, least preferred wheat varieties with their respective mean preference rating were NIAW 917 (0.50), NIAW 301 (0.92), NIAW 34 (1.42), NIAW 1415 (1.50) and LOK-1 (2.42) (Table 2). Three wheat varieties A-9-30-1 (10.92), GW 496 (8.67) and NIDW 295 (7.09) were highly preferred while only one variety HD 2189 was moderately preferred by aphids.

The present investigation is in close agreement with [7] who evaluated the wheat varieties in similar way as highly resistant, moderately resistant and least resistant wheat varieties against aphid. [2] indicated that two rainfed wheat varieties V-4 and 95022 were resistant to aphid. [5] reported that the wheat variety Inqulab-91 was the most resistant to aphid and PND+ was the most susceptible among the various tested wheat variety. [8] reported that three wheat lines V-01180, PR 84 and DN 47 were least preferred by aphids as these findings are in corroboration with the present finding of the research.

Conclusion

From the results it is concluded that the variety NIAW 917 is identified as resistant to aphid by seedling bulk test method which recorded lowest damage of aphid and least preferred by aphid under antixenotic test while the variety A-9-30-1 emerged as susceptible to aphid.

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