Research Article

Antibiosis resistance in various wheat varieties against wheat aphid (*Rhopalosiphum padi* L)

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Abstract

Nine wheat varieties viz., NIAW301, NIAW 917, NIAW 1415, NIAW 34, HD 2189, LOK-1, GW 496, NIDW 295 and A-9-30-1 were screened against wheat aphid **(***Rhopalosiphum padi* L) at Agricultural Research Station, Niphad Dist. Nasik during Rabi 2013-14 and 2014-15. Seedling bulk test and antibiosis test were carried out for the resistant, moderately resistant and susceptible wheat varieties. The result revealed that 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 in seedling bulk test. In case of antibiosis study nine varieties were selected to know the effect of host plants on the fecundity of aphid. Three varieties A-9-30-1, NIDW 295 and GW 496 were found highly preferred for fecundity and variety NIAW 917 was least preferred for fecundity whereas NIAW 301, NIAW 34, NIAW 1415, HD 2189 and LOK-1 were moderately preferred.

Keywords: Wheat (*Triticum astivum*), *Rhopalosiphum padi*, Antibiosis, Resistant, Aphid

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Introduction

Wheat (*Triticum astivum*) is the second most important food crop of India, which contribute nearly one third of total food grain production. It occupies an area of 30.72 million hector with a production and productivity of 97.44 million tons and 3172 kg/ha, respectively [3]. Wheat is one of the important *rabi* crop of Maharashtra. In Maharashtra it is grown on area of 10.73 lakh hector with a production and productivity of 16.72 lakh tons and 15.58 kg/ha, respectively during Rabi 2016-17 [3]. In India, damage by aphids is regular in some part of the country. Direct crop yield reduction may range from 10 to 50% and indirect from 20 to 80% [12], from 19 to 31% at the boot stage and from 14 to 20% during anthesis test of plant growth [6,13], reported cereal aphid infestation in early days of December to mid-January. Among wheat pest, aphids are the most widely distributed and are posing a serious threat to wheat crop throughout the world [15]. The cause direct damage by sucking cell sap of leaves, young shoots, 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 [1, 7, 8, 11]. Different aphid species have causing the damage to wheat crop. Bird cherry oat aphid is one of the most numerous and economically important aphid species on wheat [4,9]. The present studies were therefore undertaken to determine the antibiosis resistance in nine wheat varieties against 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 NIAW301, 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 antibiosis test. Experiment was conducted in completely Block Design with three replications.

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+_ 2^0C and 50 to 70% humidity and 16h:8h day:night photoperiod in the rearing room. Resistance was evaluated by seedling and antibiosis 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.

Antibiosis Test

In antibiosis test two seeds of each variety were sown in soil mixed in 15cm diameter pot. When seedlings attended height of 5 to 6 cm, two seedlings of each variety were thinned to one seedling. One adult was released on each seedling and then each pot was covered with cage along with nylon wire mesh. When theses aphids started reproduction on seedling all the nymphs were removed except one, this nymphs was allowed to grow on test varieties until it was matured and started reproduction parthenogenetically. Number of nymphs produced were counted on 5^{th} and 10^{th} day after reproduction started. The varieties were categorized as least preferred for fecundity (LPF) having least number of nymphs per seedling, moderately preferred for fecundity (MPF) having moderate number of nymphs reproduced per seedling and highly preferred for fecundity (HPF) having higher number of nymphs reproduced per seedling.

Result 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

Antibiosis Test

Results of Antibiosis test showed variable responses of test varieties on fecundity of aphid (**Table 2**). On 5^{th} day of recording the progeny data maximum no. of nymphs was recorded on A9-30-1 with mean population of 3.83 aphids. This showed that variety A9-30-1 was highly preferred for fecundity followed by varieties NIDW 295 (2.83 aphids)

& GW 496 (2.67 aphids) showed moderate preference for fecundity. The variety NIAW 917 with mean population of 1.17 aphids showed least fecundity. The data on 10th day recording the maximum no. of nymphs was recorded on A9-30-1 with mean population of 11.83 aphids. This showed highly preference for fecundity of aphids followed by GW 496 (7.00 aphids) & NIDW 295 (6.33 aphids). The variety NIAW 917 with mean population of 2.50 aphids showed least fecundity.

Table 2 Mean population of aphids in various varieties under Antibiosis test

SN	Variety	No. of aphids after 5 days			No. of aphids after 10 days			No. of aphid of 5th & 10th day			Nature of preference for fecundity		
		14-15	15-16	Pooled	14-15	15-16	Pooled	14-15	15-16	Pooled	14-15	15-16	Pooled
1	NIAW 301	2.00 *(1.73)	2.33 (1.82)	2.17 (1.78)	3.00 (2.00)	3.66 (2.15)	3.33 (2.08)	2.50 (1.87)	2.99 (1.99)	2.75 (1.93)	LPF	MPF	MPF
2	NIAW 917	1.00 (1.41)	1.33 (1.52)	1.17 (1.47)	2.33 (1.82)	2.66 (1.91)	2.50 (1.87)	1.66 (1.63)	1.99 (1.72)	1.83 (1.68)	LPF	LPF	LPF
3	NIAW1415	1.66 (1.63)	2.00 (1.73)	1.83 (1.68)	3.33 (2.08)	4.00 (2.23)	3.67 (2.16)	2.50 (1.87)	3.00 (2.00)	2.75 (1.93)	LPF	MPF	MPF
4	NIAW 34	2.33 (1.82)	2.66 (1.91)	2.50 (1.87)	3.66 (2.15)	4.66 (2.37)	4.16 (2.27)	2.99 (1.99)	3.66 (2.15)	3.33 (2.08)	MPF	HPF	MPF
5	NIDW 295	2.66 (1.91)	3.00 (2.00)	2.83 (1.95)	7.66 (2.94)	5.00 (2.44)	6.33 (2.70)	5.16 (2.48)	4.00 (2.23)	4.58 (2.36)	HPF	HPF	HPF
6	HD 2189	1.66 (1.63)	2.33 (1.82)	2.00 (1.73)	3.66 (2.15)	4.66 (2.37)	4.16 (2.27)	2.66 (1.91)	3.49 (1.86)	3.08 (2.01)	MPF	MPF	MPF
7	LOK-1	2.00 (1.73)	2.33 (1.82)	2.17 (1.78)	3.66 (2.15)	4.33 (2.30)	4.00 (2.23)	2.83 (1.95)	3.33 (2.08)	3.08 (2.01)	MPF	MPF	MPF
8	GW 496	2.33 (1.82)	3.00 (2.00)	2.67 (1.91)	6.66 (2.76)	7.33 (2.88)	7.00 (2.82)	4.50 (2.34)	5.16 (2.48)	4.83 (2.41)	HPF	HPF	HPF
9	A9-30-1	3.66 (2.15)	4.00 (2.23)	3.83 (2.19)	11.66 (3.55)	12.00 (3.60)	11.83 (3.58)	7.66 (2.94)	8.00 (3.00)	7.83 (2.97)	HPF	HPF	HPF
SE ±		0.08	0.07	0.08	0.08	0.07	0.08	-	-	-	-	-	-
CD at 5%		0.23	0.21	0.22	0.25	0.21	0.23	-	-	-	-	-	-

* Figures in parentheses are √ n+1 transformed values
LPF= Least Preferred; MPF=Moderately Preferred; HPF=Highly Preferred

Similarly from recording the data (fifth day) to the end (tenth day) there was variation and difference in fecundity noted on the test varieties. Therefore, to asses the fecundity level and antibiosis effect of the varieties, averages of mean populations developed were taken (Table 2). Comparatively higher number of aphid nymphs were recorded on variety A-9-30-1 (7.83) and was highly preferred for fecundity (HPF) means most susceptible followed by GW 496 (4.83) and NIDW 295 (4.58) and varieties NIAW 301 (2.75), NIAW 1415 (2.75), NIAW 34 (3.33), HD 2189 (3.08) and LOK-1 (3.08) were moderately preferred for fecundity (LPF) means tolerant/resistant variety.

Results of [2] indicated that two rainfed wheat varieties V-4 and 95022 were found resistant to aphid (*Rhopalosiphum padi*). The results of the present study are compatible with [5] who evaluated wheat varieties in similar way as highly resistant, moderately resistant and least resistant wheat varieties against wheat aphids. Similarly, [2] evaluated 16 wheat varieties for antibiosis mechanism of resistance and found three varieties as least preferred for fecundity, nine varieties moderately preferred for fecundity and four as highly preferred for fecundity. To overcome the economic caused by aphid attack, use of resistant germplasm is most economical and environmental friendly method for sustainable production. The use of resistant varieties is an effective and efficient tool for the control of wheat aphids [1,10,14]. Results of these studies if incorporated in varietal breeding programme, the crop in the field will suffer comparatively less losses.

Conclusion

From the results it is concluded that the variety NIAW 917 was least preferred for fecundity to aphid and recognized as resistant source to aphid for incorporation of these in aphid resistance breeding programme.

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