

Research Article

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

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Abstract

Study on varietal resistance in wheat varieties was conducted at Agricultural Research Station, Niphad Dist. Nasik during 2012-13 to 2014-15. 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 tested under field condition in protected and unprotected condition. The data revealed significant differences among various wheat varieties for population of aphids and yield. The pooled data of cumulative average number of aphids per plant revealed that the variety NIAW 917 recorded minimum number of aphids per shoot per plant of 41.71 as against susceptible variety A-9-30-1 (209.15). The variety NIAW 917 was identified as tolerant / resistance source for wheat aphid breeding programme as it recorded minimum per cent reduction in spike length (4.16), number of grains/spike (6.85), 1000 grain weight (4.30), earhead biomass (15.46) and yield (24.38) against susceptible variety A-9-30-1 was recorded 35.82, 33.63, 6.00, 45.69 and 59.76 per cent, respectively.

Keywords: Wheat (*Triticum astivum*), *Rhopalosiphum padi*, earhead biomass, spikelength

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Introduction

Wheat (*Triticum astivum*) is one of the most important cereal crop and staple food throughout the world. It is extensively grown both in irrigated and rainfed areas in India. It occupies an area of 30.72 million hectare with a production and productivity of 97.44 million tonnes and 3172 kg/ha, respectively [1]. 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 [1]. A lot of efforts have been made by several agencies to develop high yielding dwarf varieties. These varieties have been replaced by traditional varieties. Due to introduction of new varieties which have high yield potential and response to fertilizer, several species of aphid became serious pests in some areas. Among these, wheat aphid (*Macrosiphum miscanthi*), bird cherry aphid (*Rhopalosiphum padi*) and English grain aphid (*Sitobion avenae*) are more common. The aphid initiates feeding at the base of the leaves near top of the plant. As the colony develops the leaf edges begin to roll inward enclosing aphid seen tubular protective structure. This protection makes the aphid inaccessible to natural enemies and insecticidal spray. As a result of salivary toxin injected by aphid, plant became purplish and develops longitudinal and whitish streaks on leaves. The damage is particularly severe in cold and cloudy weather during winter. They mostly appear from December to January. [2] reported that the aphid cause 10 to 50% reduction in crop yield directly and 20 to 80% indirectly. [3] screened ten wheat varieties in the field against aphid. The late sown varieties Marquis, Ceres, Thatcher, Ribal and Mida were found resistant to attack of aphids. The present investigation is carried out with an object to evaluate the performance of various wheat varieties against aphid and to identify the promising the wheat varieties resistant to aphid.

Material and Methods

The study regarding to identify the resistant varieties was carried out under field condition during 2012-13 to 2014-15 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 growing these varieties under protected and unprotected

condition in Randomized Block Design in three replications. The seeds were sown on 1st November in the plot measuring 6x1.20m² with 20cm spacing under irrigated condition and other recommended agronomical practices. Observations on number of aphids/plant were recorded on five randomly selected shoot of five plants. The observations of aphids were recorded at 40,50,60,70 and 80 days after sowing on selected shoots. Observations of various morphological plant characters *viz.*, plant height, no. of tiller/plant, leaf area, days to heading, spike length, no. of grains/spike, earhead biomass and 1000 grain weight were recorded. Finally, yield per plot was recorded and converted into q/ha and per cent reduction in yield was also determined. The data were subjected to statistical analysis.

Results and Discussion

Wheat aphids

Pooled data for the year 2012-13 to 2014-15 are presented in **Table 1-3**, revealed that differences among various nine varieties were significant for aphid population per plant, grain yield (in both protected and unprotected plots). At 40 DAS, the variety A-9-30-1 showed the maximum survived aphids/plant (60.20 and 66.78) in protected and unprotected plots, respectively. This indicates importance of genotypic resistance even with adoption of adequate plant protection measures. A-9-30-1 was followed by GW-496 (24.18 & 29.31) and NIDW 295 (15.44 & 18.52) in protected and unprotected plots, respectively. At 50 DAS, the similar trend was noticed. In case of protected condition, the control in population of aphid was observed because of recommended control measures were adopted after ETL of the pest. The population of survived aphids were not recorded at 70 and 80 DAS in protected plots, as it was totally controlled at that stage.

Table 1 Reaction of different wheat varieties against foliage wheat aphid at 40 and 50 days after sowing

SN	Treatment	No. of aphids/plant at							
		40 DAS Protected				40 DAS Unprotected			
		12-13	13-14	14-15	Pooled	12-13	13-14	14-15	Pooled
1	Trimbak (NIAW 301)	3.9*(2.21)	19.90(4.57)	1.20(1.48)	8.33(3.05)	8.9(3.15)	21.30(4.72)	1.73(1.65)	10.64(3.41)
2	Tapovan (NIAW 917)	4.4(2.32)	14.70(3.96)	0.60(1.26)	6.57(2.75)	7.1(2.85)	15.70(4.09)	0.93(1.39)	7.91(2.98)
3	Netravati (NIAW 1415)	4.9(2.43)	21.90(4.79)	1.20(1.48)	9.33(3.21)	9.2(3.19)	22.30(4.83)	1.20(1.48)	10.90(3.45)
4	NIAW 34	6.8(2.79)	30.50(5.61)	1.06(1.44)	12.79(3.71)	9.5(3.24)	29.10(5.49)	1.47(1.57)	13.36(3.79)
5	Godavari (NIDW 295)	7.7(2.97)	35.90(6.07)	2.73(1.93)	15.44(4.05)	19.8(4.56)	32.70(5.81)	3.07(2.02)	18.52(4.42)
6	HD 2189	6.9(2.81)	20.90(4.68)	2.60(1.90)	10.13(3.34)	7.5(2.92)	18.70(4.44)	2.00(1.73)	9.40(3.22)
7	Lok-1	6.7(2.77)	21.80(4.77)	2.33(1.82)	10.28(3.36)	5.2(2.49)	20.90(4.68)	2.47(1.86)	9.52(3.24)
8	GW-496	11.7(3.56)	56.70(7.60)	4.13(2.26)	24.18(5.02)	26.6(5.25)	55.20(7.50)	6.13(2.67)	29.31(5.51)
9	A9-30-1	15.1(4.01)	158.90(12.65)	6.60(2.76)	60.20(7.82)	33.5(5.87)	159.90(12.68)	6.93(2.82)	66.78(8.23)
	SE ±	0.09	0.14	0.04	0.07	0.15	0.13	0.07	0.07
	CD at 5%	0.27	0.41	0.13	0.21	0.46	0.39	0.22	0.20

SN	Treatment	50 DAS Protected				50 DAS Unprotected			
		12-13	13-14	14-15	Pooled	12-13	13-14	14-15	Pooled
		1	Trimbak (NIAW 301)	0.00(1.00)	0.00(1.00)	23.26(4.93)	7.75(2.96)	17.93(4.35)	38.80(6.31)
2	Tapovan (NIAW 917)	0.00(1.00)	0.00(1.00)	9.33(3.21)	3.11(2.03)	5.80(2.61)	29.40(5.51)	9.20(3.19)	14.80(3.97)
3	Netravati (NIAW 1415)	0.00(1.00)	0.00(1.00)	23.66(4.97)	7.89(2.98)	9.60(3.26)	42.90(6.63)	21.07(4.70)	24.52(5.05)
4	NIAW 34	0.00(1.00)	0.00(1.00)	13.93(3.86)	4.64(2.37)	17.27(4.27)	45.30(6.80)	12.73(3.71)	25.10(5.11)
5	Godavari (NIDW 295)	0.00(1.00)	0.00(1.00)	39.53(6.37)	13.18(3.77)	41.20(6.50)	88.70(9.47)	39.73(6.38)	56.54(7.59)
6	HD 2189	0.00(1.00)	0.00(1.00)	14.73(3.97)	4.91(2.43)	18.00(4.36)	40.10(6.41)	11.80(3.58)	23.30(4.93)
7	Lok-1	0.00(1.00)	0.00(1.00)	12.46(3.67)	4.15(2.27)	24.07(5.01)	56.50(7.58)	14.13(3.89)	31.57(5.71)
8	GW-496	0.00(1.00)	0.00(1.00)	38.20(6.26)	12.73(3.71)	50.80(7.20)	188.90(13.78)	39.00(6.32)	92.90(9.69)
9	A9-30-1	0.00(1.00)	0.00(1.00)	58.20(7.69)	19.40(4.52)	67.67(8.29)	190.60(13.84)	56.13(7.56)	104.80(10.29)
	SE ±	-	-	0.06	0.12	0.12	0.08	0.06	0.05
	CD at 5%	-	-	0.19	0.36	0.37	0.24	0.19	0.14

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

Table 2 Reaction of different wheat varieties against foliage wheat aphid at 60 and 70 days after sowing

SN	Treatment	No. of aphids/plant at							
		60 DAS Protected				60 DAS Unprotected			
		12-13	13-14	14-15	Pooled	12-13	13-14	14-15	Pooled
1	Trimbak (NIAW 301)	0.00*(1.00)	0.00(1.00)	6.20(2.68)	2.07(1.75)	32.8(5.81)	223.00(14.97)	37.13(6.17)	97.64(9.93)
2	Tapovan (NIAW 917)	0.00(1.00)	0.00(1.00)	7.53(2.92)	2.51(1.87)	11.6(3.55)	124.70(11.21)	23.53(4.95)	53.28(7.37)
3	Netravati (NIAW 1415)	0.00(1.00)	0.00(1.00)	10.13(3.34)	3.38(2.09)	16.9(4.23)	138.70(11.82)	74.73(8.70)	76.78(8.82)
4	NIAW 34	0.00(1.00)	0.00(1.00)	10.80(3.44)	3.60(2.14)	29.1(5.49)	247.30(15.76)	36.00(6.08)	104.13(10.25)
5	Godavari (NIDW 295)	0.00(1.00)	0.00(1.00)	12.86(3.72)	4.29(2.30)	72.0(8.54)	315.10(17.78)	137.33(11.76)	174.81(13.26)
6	HD 2189	0.00(1.00)	0.00(1.00)	9.07(3.17)	3.02(2.00)	36.1(6.09)	268.50(16.42)	38.40(6.28)	114.33(10.74)
7	Lok-1	0.00(1.00)	0.00(1.00)	8.80(3.13)	2.93(1.98)	39.6(6.37)	206.80(14.42)	43.66(6.68)	96.69(9.88)
8	GW-496	0.00(1.00)	0.00(1.00)	12.33(3.65)	4.11(2.26)	77.5(8.86)	423.50(20.60)	95.53(9.82)	198.84(14.14)
9	A9-30-1	0.00(1.00)	0.00(1.00)	18.60(4.43)	6.20(2.68)	116.5(10.83)	489.30(22.14)	175.86(13.30)	260.55(16.17)
	SE ±	-	-	0.06	0.04	0.19	0.07	0.06	0.45
	CD at 5%	-	-	0.18	0.12	0.58	0.22	0.19	1.36

SN	Treatment	70 DAS Protected				70 DAS Unprotected			
		12-13	13-14	14-15	Pooled	12-13	13-14	14-15	Pooled
		1	Trimbak (NIAW 301)	0.00(1.00)	0.00(1.00)	0.00(1.00)	0.00(1.00)	43.4(6.66)	335.80(18.35)
2	Tapovan (NIAW 917)	0.00(1.00)	0.00(1.00)	0.00(1.00)	0.00(1.00)	23.8(4.98)	214.70(14.69)	65.47(8.15)	101.32(10.12)
3	Netravati (NIAW 1415)	0.00(1.00)	0.00(1.00)	0.00(1.00)	0.00(1.00)	52.9(7.34)	326.70(18.10)	112.93(10.67)	164.18(12.85)
4	NIAW 34	0.00(1.00)	0.00(1.00)	0.00(1.00)	0.00(1.00)	43.5(6.67)	340.30(18.47)	73.80(8.65)	152.53(12.39)
5	Godavari (NIDW 295)	0.00(1.00)	0.00(1.00)	0.00(1.00)	0.00(1.00)	90.7(9.58)	434.30(20.86)	228.87(15.16)	251.29(15.88)
6	HD 2189	0.00(1.00)	0.00(1.00)	0.00(1.00)	0.00(1.00)	43.5(6.67)	318.30(17.87)	106.47(10.37)	156.09(12.53)
7	Lok-1	0.00(1.00)	0.00(1.00)	0.00(1.00)	0.00(1.00)	29.9(5.56)	306.50(17.54)	105.40(10.31)	147.27(12.18)
8	GW-496	0.00(1.00)	0.00(1.00)	0.00(1.00)	0.00(1.00)	142.9(12.0)	520.20(22.83)	196.40(14.05)	286.50(16.96)
9	A9-30-1	0.00(1.00)	0.00(1.00)	0.00(1.00)	0.00(1.00)	185.6(13.66)	624.10(25.00)	435.27(20.89)	414.99(20.40)
	SE ±	-	-	-	-	0.14	0.07	0.17	0.04
	CD at 5%	-	-	-	-	0.52	0.20	0.51	0.13

* Figures in parentheses are $\sqrt{n+1}$ transformed values**Table 3** Reaction of different wheat varieties against foliage wheat aphid at 80 days after sowing & average population of aphid

SN	Treatment	No. of aphids/plant at							
		80 DAS Protected				80 DAS Unprotected			
		12-13	13-14	14-15	Pooled	12-13	13-14	14-15	Pooled
1	Trimbak (NIAW 301)	0.00*(1.00)	0.00(1.00)	0.00(1.00)	0.00(1.00)	21.93(4.79)	34.50(5.96)	100.33(10.07)	52.25(7.30)
2	Tapovan (NIAW 917)	0.00(1.00)	0.00(1.00)	0.00(1.00)	0.00(1.00)	11.90(3.59)	18.50(4.42)	63.26(8.02)	31.22(5.68)
3	Netravati (NIAW 1415)	0.00(1.00)	0.00(1.00)	0.00(1.00)	0.00(1.00)	26.33(5.23)	37.20(6.18)	121.20(11.05)	61.58(7.91)
4	NIAW 34	0.00(1.00)	0.00(1.00)	0.00(1.00)	0.00(1.00)	20.13(4.60)	27.00(5.29)	88.20(9.44)	45.11(6.79)
5	Godavari (NIDW 295)	0.00(1.00)	0.00(1.00)	0.00(1.00)	0.00(1.00)	66.33(8.21)	63.50(8.03)	308.53(17.59)	146.12(12.13)
6	HD 2189	0.00(1.00)	0.00(1.00)	0.00(1.00)	0.00(1.00)	22.13(4.81)	27.90(5.38)	118.67(10.94)	56.23(7.57)
7	Lok-1	0.00(1.00)	0.00(1.00)	0.00(1.00)	0.00(1.00)	17.07(4.25)	28.70(5.45)	104.53(10.27)	50.10(7.15)
8	GW-496	0.00(1.00)	0.00(1.00)	0.00(1.00)	0.00(1.00)	118.67(10.93)	47.70(6.98)	218.53(14.82)	128.30(11.37)
9	A9-30-1	0.00(1.00)	0.00(1.00)	0.00(1.00)	0.00(1.00)	122.67(11.12)	52.50(7.31)	420.80(20.54)	198.66(14.13)
	SE +	-	-	-	-	0.13	0.09	0.05	0.08
	CD at 5%	-	-	-	-	0.38	0.27	0.15	0.25

SN	Treatment	Cumulative av. no. of aphids/plant							
		DAS Protected				DAS Unprotected			
		12-13	13-14	14-15	Pooled	12-13	13-14	14-15	Pooled
1	Trimbak (NIAW 301)	0.78(1.33)	3.98(2.23)	6.13(2.67)	3.63(2.15)	24.99(5.10)	130.68(11.48)	47.21(6.94)	67.63(8.28)
2	Tapovan (NIAW 917)	0.88(1.37)	2.94(1.98)	3.49(2.12)	2.42(1.85)	12.04(3.61)	80.60(9.03)	32.48(5.79)	41.71(6.54)
3	Netravati (NIAW 1415)	0.98(1.41)	4.38(2.32)	7.00(2.83)	4.12(2.26)	22.99(4.90)	113.56(10.70)	66.23(8.20)	67.59(8.28)
4	NIAW 34	1.36(1.54)	6.10(2.66)	5.16(2.48)	4.21(2.28)	23.90(4.99)	137.80(11.78)	42.44(6.59)	68.05(8.31)
5	Godavari (NIDW 295)	1.54(1.59)	7.18(2.86)	11.02(3.47)	6.58(2.75)	58.07(7.69)	186.86(13.71)	143.51(11.98)	129.48(11.42)
6	HD 2189	1.38(1.54)	4.18(2.28)	5.28(2.51)	3.61(2.15)	25.45(5.14)	134.70(11.65)	55.47(7.51)	71.87(8.54)
7	Lok-1	1.34(1.53)	4.36(2.32)	4.72(2.39)	3.47(2.11)	23.17(4.92)	123.88(11.17)	54.04(7.42)	67.03(8.25)
8	GW-496	2.34(1.83)	11.34(3.51)	10.93(3.45)	8.20(3.03)	83.29(9.18)	247.10(15.75)	111.12(10.59)	147.17(12.17)
9	A9-30-1	3.02(2.00)	31.78(5.73)	16.68(4.20)	17.16(4.26)	105.19(10.30)	303.28(17.44)	218.99(14.83)	209.15(14.50)
	SE ±	0.02	0.03	0.03	0.03	0.15	0.09	0.08	0.11
	CD at 5%	0.05	0.08	0.10	0.08	0.46	0.27	0.25	0.32

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

Table 4 Effect of different wheat varieties on 1000 grain weight, yield and % reduction in yield due to the population of wheat aphid

S N	Treatments	1000 grain weight (g)								Yield q/ha								(%) Reduction in yield			
		Protected				Unprotected				Protected				Unprotected				12-13	13-14	14-15	Poo led
		12-13	13-14	14-15	Poo led	12-13	13-14	14-15	Poo led	12-13	13-14	14-15	Poo led	12-13	13-14	14-15	Poo led				
1	Trimbak (NIAW 301)	42.08	44.43	43.33	43.28	40.58	43.71	42.17	42.15	48.47	67.78	58.44	58.23	41.94	38.92	44.83	41.90	13.47	42.58	23.28	26.44
2	Tapovan (NIAW 917)	39.40	41.72	40.77	40.63	37.68	39.02	39.95	38.88	51.95	66.81	65.38	61.38	44.44	42.81	50.48	45.91	14.46	35.92	22.78	24.38
3	Netravati (NIAW 1415)	39.30	41.11	40.40	40.27	37.30	37.71	38.20	37.74	43.70	65.49	68.72	59.30	36.85	35.58	44.53	38.99	15.68	45.67	35.20	32.18
4	NIAW 34	40.43	42.33	42.91	41.89	38.17	39.16	40.89	39.41	51.29	57.22	60.36	56.29	45.18	35.05	46.40	42.21	11.91	38.75	23.12	24.62
5	Godavari(N IDW 295)	50.80	52.61	50.10	51.17	45.37	44.20	42.10	43.89	52.68	61.23	64.18	59.36	41.71	24.57	27.93	31.40	20.82	59.87	56.48	45.72
6	HD 2189	41.33	43.12	41.10	41.85	39.20	40.71	37.92	39.28	48.89	60.47	59.99	56.45	35.32	41.35	45.31	40.66	27.76	31.62	24.47	27.95
7	Lok-1	48.37	50.21	47.05	48.54	46.37	49.24	46.65	47.42	51.86	66.56	65.40	61.61	43.46	53.53	51.91	30.95	20.95	43.69	28.19	30.94
8	GW-496	40.07	42.50	41.80	41.46	37.97	40.07	40.28	39.44	43.57	57.28	52.93	51.26	34.54	14.96	26.98	25.49	20.73	73.88	49.02	47.88
9	A9-30-1	43.07	46.52	44.26	44.62	41.10	43.24	41.49	41.94	38.89	41.44	54.46	44.92	30.37	7.31	13.60	17.09	21.91	82.36	75.02	59.76
	SE ±	0.24	0.72	0.02	0.21	1.17	0.30	0.00	0.39	2.75	5.32	2.82	2.32	2.52	2.13	3.01	1.4-	-	-	-	-
	CD at 5%	0.72	2.15	0.19	0.62	3.50	0.90	0.07	1.17	8.19	15.99	8.45	7.09	7.78	6.42	9.09	4.42	-	-	-	-

In case of unprotected condition, the variety, Tapovan (NIAW-917) recorded minimum (7.91, 14.80, 53.28, 101.32 and 31.22) number of aphids/plant at 40, 50, 60, 70 & 80 days after sowing, respectively. NIAW-917 was followed by HD 2189 (9.40 & 23.30) at 40 and 50 DAS and Netravati (NIAW-1415) (76.78 & 101.32) at 60 & 70 DAS, respectively. The variety A-9-30-1 showed highest population of 66.78, 104.80, 260.55, 414.99 and 198.66 aphids/plant at 40, 50, 60, 70 & 80 DAS under unprotected block followed by the second highest GW-496 which recorded 29.31, 92.90, 198.84, 286.50 and 128.30 number of aphids/plant at 40, 50, 60, 70 and 80 DAS, respectively. On the basis of cumulative number of aphid/plant the variety NIAW 917(Tapovan) recorded minimum (41.71) aphids/plant whereas the susceptible check A-9-30-1 recorded maximum (209.15) aphids/plant under unprotected condition.

Morphological characters

The data presented in **Table 5** revealed that the variations among the data regarding various morphological characters viz. Plant height, No. of tillers/plant, Leaf area, Days to heading, Spike length, No. of grains/spike and 1000 grain weight under the crop sown at protected and unprotected condition recorded. The maximum (106cm, 6.25, 46.21sq cm, 69.33, 11.64cm, 76.67 and 51.17g) plant height, no. of tillers, leaf area, days to heading, spike length, no. of grains/spike and 1000 grain weight were recorded in variety A-9-30-1, HD 2189, HD 2189, HD 2189, HD 2189, NIAW 1415 and NIDW 295, respectively, under protected block. In case of unprotected block loss in plant height (1.13 to 12.10 cm), leaf area (0.54 to 15.99 sq cm), spike length (0.08 to 3.07cm), no. of grains/spike (3.70 to 17.67) and 1000 grain weight (1.13 to 7.28g) were recorded. The minimum (0.83, 6.85 and 2.61) per cent reduction in spike length, no. of grains/spike and 1000 grain weight were recorded in variety NIAW 301, NIAW 917 and NIAW 301, respectively.

Table 5 Physical plant characters (Morphological characters) in various varieties

SN	Variety	Plant height		No. of tiller/plant		Leaf area (cm ²)		Days to heading		Spike length (cm)		% Red ⁿ in spike length	No. of grains/spike		% Red ⁿ in grain/spike	1000 grain weight (g)		% Red ⁿ in 1000 gr.wt.	Earhead/Head biomass (g)		% Red ⁿ in Bio mass
		P	U	P	U	P	U	P	U	P	U		P	U		P	U				
1	Trimbak (NIAW 301)	83.23	81.57	5.03	3.90	40.06	38.03	60.33	64.33	9.57	9.49	0.83	52.87	45.00	14.88	43.28	42.15	2.61	4.76	3.77	20.80
2	Tapovan (NIAW 917)	81.43	80.30	5.14	3.87	39.91	34.32	64.33	62.00	9.60	9.20	4.16	54.00	50.30	6.85	40.63	38.88	4.30	4.85	4.10	15.46
3	Netravati (NIAW 1415)	89.50	82.17	5.02	3.80	42.81	40.21	69.00	70.00	10.57	9.54	9.74	76.67	59.00	23.04	40.27	37.74	6.28	6.00	4.42	26.33
4	NIAW 34	86.83	81.87	4.30	3.53	41.55	41.01	59.70	60.30	9.37	8.65	7.68	58.53	49.67	15.13	41.89	39.41	5.92	4.58	3.82	16.59
5	Godavari (NIDW 295)	88.77	76.67	4.20	3.40	29.91	26.38	68.30	69.67	7.73	5.74	25.74	50.07	39.07	21.96	51.17	43.89	14.22	5.60	3.40	39.28
6	HD 2189	102.5	96.20	6.25	4.27	46.21	38.75	69.33	70.00	11.64	9.83	15.54	56.00	46.10	17.67	41.85	39.28	6.14	6.05	4.96	18.02
7	Lok-1	90.43	84.03	5.13	3.90	40.12	33.90	56.67	56.67	8.44	8.21	2.72	44.87	35.07	21.84	48.54	47.42	2.30	4.53	3.68	18.76
8	GW-496	90.20	81.80	5.17	2.67	42.65	33.65	58.67	60.00	9.77	8.30	15.04	55.93	37.87	32.29	41.46	39.44	4.87	4.15	2.82	32.05
9	A9-30-1	106.0	102.57	5.04	2.33	39.86	23.87	68.33	70.70	8.57	5.50	35.82	37.67	25.00	33.63	44.62	41.94	6.00	6.04	3.28	45.69
	Coefficient value with aphid	0.502		-0.912**		-0.790*		0.362		-0.814**		-0.782*		0.150				-0.658			

*Correlation is significant at the 0.05 level; **Correlation is significant at the 0.01 level

Correlation with physical plant factors versus population of aphids

Effect of physical plant factors on the population of the aphids was determined by the data into simple correlation (Table 5). The results revealed that total No. of tillers/plant, Leaf area (cm²), Spike length and No. of grains/spike showed a significant negative correlation with the population of the aphid and earhead/head biomass showed negative correlation at considerable level. All the other physical plant factors like Plant height, Days to heading and 1000 grain weight showed a non-significant correlation with the population of the aphid.

1000 grain weight

The data presented in **Table 4** revealed that the genotypes Godavari (NIDW 295) showed the maximum 1000 grain weight (51.17g). In case of unprotected block, loss in 1000 grain weight among various varieties from 3.75 to 13.43g was recorded. The variety LOK-1 (47.42g) registered maximum 1000 grain weight.

Yield

The data presented in **Table 4** revealed that in unprotected plots the highest yield of 45.91 q/ha was recorded in cv. Tapovan (NIAW-917). It was at par with NIAW 34 (42.21 q/ha) and Trimbak (NIAW 301) (41.90 q/ha). In case of protected block also Tapovan (NIAW-917) recorded highest yield of 61.38 q/ha and it was at par with Godavari (NIDW-295) (59.36 q/ha), Netravati (NIAW-1415) (59.30 q/ha), Trimbak (NIAW 301) (58.23 q/ha) and HD 2189 (56.45 q/ha).

Reduction in yield (%)

The data presented in **Table 4** revealed that the losses due to aphids were recorded in the range 24.38 to 59.76 per cent. The results revealed that maximum avoidable grain yield losses per cent were displayed by the variety A9-30-1 (59.76%) with a highest number of aphids causing these losses followed by GW-496 (47.88%) and Godavari (NIDW-295) (45.72%). This suggested that these varieties were highly susceptible to aphids.

The current results revealed that there was significant difference in number of aphids among various wheat varieties. Thus, A-9-30-1, NIDW 295 and GW 496 seem to be more susceptible and NIAW 917 and NIAW 34 were more tolerant and resistant. Variations in the aphid population among the various varieties have been reported by several researchers like [4-12]. [13] tested Denton, Wichita, Chinese and Russian varieties in Southern plain areas of Oklahoma. Denton was found less preferred by the aphids and less susceptible to the attack of the aphid as compare to other varieties. [14] evaluated in field trials the relative susceptibility of 15 cultivars of Spelmar (*Triticum durum*), 16 cultivar of Einkorn (*Triticum monococcum*) and 13 cultivar of Khapli (*Triticum dicoccum*) against wheat aphids in United States. Minimum aphid infestation was reported in Einkorn and maximum in Spelmar. These findings are similar to results of present study.

Conclusion

From the results it is concluded that the variety NIAW 917 is identified as resistant to aphid due to minimum reduction in grain yield, spike length, no. of grains/spike, 1000 grain weight and earhead biomass.

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Publication History

Received 06th Feb 2018
Revised 20th Feb 2018
Accepted 04th Mar 2018
Online 30th Mar 2018