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Resistance to Foliage Feeding Aphid in Wheat

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Abstract: Experimental trials were conducted at Integrated Pest Management Programme, National Agriculture Research Centre Islamabad, to evaluate the resistance of host plants (cereals) against *Rhopalosiphum padi* (L.). For evaluation of susceptibility, twenty varieties/-advanced lines of National Uniform Wheat Yield Trails (NUWYT) Normal (N) of year 2004-2005 were used. In seedling bulk tests varieties/advanced lines were grouped into three categories resistant, moderately resistant and susceptible. Data from seedling bulk tests showed that DN-47 and PR 87 lines of wheat were resistant to aphid as compared to the other varieties/-advanced lines. In antixenosis tests varieties/-advanced lines were grouped into three categories, least preferred, moderately preferred, highly preferred. Lines V-01180, DN-47 and PR-84 were least preferred, sixteen varieties/-advanced lines were moderately preferred and only one variety V-9021 was found to be highly preferred.

Key words: Varietal resistance, susceptibility, wheat, *Rhopalosiphum padi* (L.), seedling bulk test, antixenosis test

INTRODUCTION

Aphids are pests of economic importance throughout the world, causing direct and indirect damage to a wide variety of different crops, vegetables, fruits and ornamental plants. They cause direct damage by sucking cell sap of leaves, young shoot, causing distortion, stunting, leaf curling, wilting, twisting and some time premature leaves falls. They are directly involved in transmission of plant viruses and indirectly by depositing honey dew that reduce photosynthetic activity and induce sooty mould production and premature leaf senescence (Naeem, 1996; Karimullah and Ahmad, 1998; Akhtar and Khaliq, 2003; Akhtar and Mujahid, 2006).

Rhopalosiphum padi L. Bird Cherry Oat is heteroecious, migrating between its primary host to secondary host and exhibits holocyclic life cycle between them (Naeem, 1996). It is one of the most numerous and economically important aphids on wheat and spring wheat, *Triticum aestivum* L. (Schotzko and Perez, 2000). This pest damages the host by direct feeding and by transmitting barley yellow dwarf virus (BYDW) (Stern, 1967). Aphid's nymphs and adult both reduce the yield by infesting leaves and stems of the crop plants (Sekhar *et al*., 2001). To overcome the economic losses caused by aphid's attack, economical and environmentally sound method for control of aphids is the use of resistant wheat cultivars in pest management programmes (Dong *et al*., 1994; Webster and Inayatullah, 1984; Tyler *et al*., 1987). The present studies discuss the status of host-plant resistance in wheat varieties/-advanced lines against *R. padi.*

MATERIALS AND METHODS

To find out the resistant varieties of wheat two experiments, Seedling Bulk Test and Antixenosis Test were conducted in the Host Plant Resistance laboratories, Insect Pest Management Program, at National Agriculture Research Centre, Islamabad during 2006. Varieties/-advanced lines were evaluated against bird cherry oat aphid (*R. padi* L.). Twenty varieties/advanced lines of National Uniform Wheat Yield Trails (NUWYT) Normal (N) of year 2004-05 were used in Seedling Bulk Test and Antixenosis Test. Three wheat varieties were Wafaq-2001, Diamond and Chakwal-97. Seventeen advanced wheat lines were V-01078, 99B4012, RWM-9313, V-00125, PR-84, TW 0135, V-00055, 99B2278, KT-7, V-01180, DN-47, V-9021, CT-00062, 7-03, PR-86, V-02192 and V-002493. Experiments were performed under controlled environmental conditions of temperature 27+2°C, humidity 45-70% and Photoperiod of 16:8 h.

Mass rearing of aphid (*R. padi* L.): Bird cherry oat aphid (*R. padi* L.) are collected from cereals and wheat fields of NARC, Islamabad and their culture was maintained in specially made iron racks measuring 112×50×62 cm, enlightened with five florescent (20 W) tubes lights.

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Twenty seeds of susceptible wheat variety (Chakwal-97) were sown in a plastic pot 11.5 cm diameter. Experiments were performed under controlled environmental conditions of temperature 27+2°C, humidity 45-70% and Photoperiod of 16:8 h.

Evaluation by seedling bulk test: Seedling bulk test was performed in metal trays measuring 51×35×9 cm. Trays were filled with soil mix and eight rows of 1 cm depth were made with the help of wooden mould. There were 20 seedlings of every test entry sown in furrow of each row. When the seedlings attained the height of 5-6 cm, *R. padi* were released on them with the average of 10 aphids per seedling. Damage Rating (DR) data of each variety were evaluated on visual damage rating scale of 0-9 where 0 stands for healthy and 9 stands for dead (Inayatullah *et al*., 1993). The data was categorized as Resistant (R), Moderately Resistant (MR) and Moderately Susceptible (MS) varieties/lines.

Antixenosis test: Antixenosis experiment with five replications of twenty wheat varieties/lines of NUWYT (N) was conducted to find out the results of non-preference. Seeds of varieties/lines were sown in a circular pattern about 3 cm from the edge of 30 cm diameter plastic pot. When seedlings were of 5.8 cm height, 100 adult wingless *R. padi* were released in the center of the pot on circular paper of 3 cm diameter. Pots were covered with plastic cages with cloth-covered top and two ventilation holes. After 24 h *R. padi* settled on each seedling were counted. There were three categories for preference, Least Preferred (LP) having least number of aphids, Moderately Preferred (MP) having moderate number of aphids and Highly Preferred (HP) having highest number of aphids (Akhtar and Mujahid, 2006).

RESULTS AND DISCUSSION

Seedling bulk tests: Out of 20 varieties following five lines V-01078, V-00055 K9-7, V-01180 and DN-47 were resistant with damage ratings of 2-3 (Table 1). Ten lines 99B4012, 99B2278, V-9021, V-002493, PR-84, TW0135, CT-00062, 7-03, PR-86, V-02192 and two varieties Wafaq-2001 and Chakwal-97 were moderately resistant (MR) with damage ratings of 4-5. Two lines RWM-9313, V-00125 and one variety Diamond were found to be moderately susceptible (MS) with damage ratings of 6. No variety/line was found to be susceptible. Hesler *et al*. (2002) like present studies evaluated resistance by Antixenosis to *R. padi* (L.) among eight wheat accessions and concluded that even low levels of resistance could be important in limiting aphid infestations.

Table 1: Nature of resistance in wheat NUWYT (N) against *R. padi* by seedling bulk test

Wheat varieties NUWYT (N)	Damage rating	Nature of resistance against *R. padi*
V-01078	2	Resistant (R)
99B4012	4	Moderately Resistant (MR)
Wafaq-2001	5	Moderately Resistant (MR)
RWM-9313	6	Moderately Susceptible (MS)
V-00125	6	Moderately Susceptible (MS)
Diamond	6	Moderately Susceptible (MS)
PR-84	5	Moderately Resistant (MR)
TW 0135	5	Moderately Resistant (MR)
V-00055	3	Resistant (R)
99B2278	4	Moderately Resistant (MR)
KT-7	3	Resistant (R)
V-01180	3	Resistant (R)
DN-47	3	Resistant (R)
V-9021	4	Moderately Resistant (MR)
CT-00062	5	Moderately Resistant (MR)
7-03	5	Moderately Resistant (MR)
PR-86	5	Moderately Resistant (MR)
V-02192	5	Moderately Resistant (MR)
V-002493	4	Moderately Resistant (MR)
Chakwal-97	5	Moderately Resistant (MR)

Antixenosis test: Results of Antixenosis tests of data taken after 24 h showed that out of 20 varieties/lines only three lines were found to be Least Preferred (LP) by *R. padi* with their respective names and mean aphids preference a V-01180 (7.0), DN-47 (7.6) and PR-84 (9.0) (Table 2). Thirteen lines and three varieties were moderately preferred (MP) with their respective names and mean aphids preference as V-002493 (10.2), TW0135 (10.4), V-01078 (11.8), CT-00062 (12.0), PR-86 (12.4), KT-7 (12.5), 99B4012 (14.8), V-00055 (13.8), 7-03 (14.2), 99B2278 (15.2), V-02192 (15.2), RWM-9313 (16.2) Chakwal-97 (17.6), Wafaq-2001 (18.2) and Diamond (18.8) and V-00125 (19.0). Only one line was Highly Preferred (HP) with respective mean aphids preference was V-9021 (21.6). Tiwari and Sharma (2002) screened wheat lines for resistance against aphid and five lines were graded as highly resistant while one variety was graded as susceptible in Seedling Bulk Test. They also estimated least aphid population as (<5.0) and maximum aphid populations as (>30.0) in Antixenosis Test in wheat.

Data taken after 48 h of aphid release in our Antixenosis test on NUWYT (N) wheat varieties/lines (Table 2) showed that two wheat lines least preferred by *R. padi* were with their respective mean aphids preference PR-84 (9.8) and V-01180 (11.8). Fourteen lines and three varieties were moderately preferred with their respective names and mean aphids preference were TW 0135 (13.8), V-002493, (14.0), DN-47 (14.6), V-01078 (17.0), CT-00062 (17.2), 99B2278 (17.8), 99B4012 (19.2), PR-86 (19.4) RWM-9313 (20.5), V-00055 (22.6), Chakwal-97 (22.6), 7-03 (22.8), Wafaq-2001 (23.2), KT-7 (23.7), Diamond (24.2), V-02192 (24.2) and 00125 (24.7). There was only one highly preferred line V-9021 with mean aphids preference of 29.8.

Table 2: Number of bird cherry oat aphid attracted to different wheat vanities/lines under antixenosis test

NUWYT(N) wheat cultivars	Av. aphids after 24 h	Nature of preference	Av. aphids after 48 h	Nature of preference	Av. aphids after 24 and 48 h	Over all nature of preference
V-01078	11.8bc	MP	17.0bc	MP	14.4	MP
99B4012	14.8abc	MP	19.2abc	MP	17.0	MP
Wafaq-2001	18.2ab	MP	23.2ab	MP	20.7	MP
RWM-9313	16.2ab	MP	20.5abc	MP	18.3	MP
V-00125	19.0ab	MP	24.7ab	MP	21.8	MP
Diamond	18.8ab	MP	24.2ab	MP	21.5	MP
PR-84	9.0c	LP*	11.8c	LP*	10.4	LP*
TW 0135	10.4bc	MP	13.8bc	MP	12.1	MP
V-00055	13.8abc	MP	22.6ab	MP	18.2	MP
99B2278	15.2abc	MP	17.8abc	MP	16.5	MP
KT-7	12.5bc	MP	23.7ab	MP	18.1	MP
V-01180	7.6c	LP*	9.8c	LP*	8.7	LP*
DN-47	7.0c	LP*	14.6c	MP	10.8	LP*
V-9021	21.6a	HP	29.8a	HP	25.7	HP
CT-00062	12.0bc	MP	17.2abc	MP	14.6	MP
7-03	14.2abc	MP	22.8ab	MP	18.5	MP
PR-86	12.4bc	MP	19.4ab	MP	15.9	MP
V-02192	15.2abc	MP	24.2ab	MP	19.7	MP
V-002493	10.2bc	MP	14.0bc	MP	12.1	MP
Chakwal-97	17.6ab	MP	22.6abc	MP	20.1	MP

Av. No. of Aphids after 24 h. LP = Least preferred; MP = Moderately preferred; HP = Highly preferred; LSD = 0.6099 at 0.050 (Means with same letter(s) do not show significant difference). Av. No. of Aphids after 48 h. *LP = Least preferred; MP = Moderately preferred; HP = Highly preferred; LSD = 0.8119 at 0.050; (Means with same letters do not show significant difference)

Results of Akhtar (2001) indicated that two rainfed wheat varieties V-4 and 95022 were found to be resistant *R. padi.*

Combined results of Antixenosis tests, recorded after 24 h and after 48 h indicated that in both tests three lines found to be LP by *R. padi* with their respective names and mean aphids preference as V-01180 (8.7), PR 84 (10.4) and DN-47(10.8). Sixteen lines and three varieties were MP with their respective names and mean aphids preference as V-002493 (12.1), TW 0135 (12.1), V-01078 (14.4), CT-00062 (14.6), PR-86 (15.9), 99B2278 (16.5), 99B4012 (17.0), KT-7 (18.1), V-00055 (18.2), RWM-9313 (18.3), 7-03 (18.5), V-02192 (19.7), Chakwal-97 (20.1), Wafaq-2001 (20.7), Diamond (21.5) and V-00125 (21.8), respectively. Only one line V-9021 was found to be HP with its respective average aphids preference as 25.7. Li *et al.* (2001) evaluated wheat varieties like this research as highly resistant, moderately resistant and least resistant wheat varieties against wheat aphids.

In present study most suitable lines against *R. padi* were V-01180, PR 84 and DN-47. A proper understanding of mechanism of host plant resistance will lead to breeding for long-term resistance. These are important studies and if the derived results are incorporated in varietal breeding programmes, the wheat crop in the field will suffer comparatively less loss.

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