Pakistan J. Zool., vol. 39(3), pp. 191-194, 2007.

Resistance of Different Wheat Lines to *Rhopalosiphum padi* (L.) (Aphididae: Homoptera) in Pakistan

NAHEED AKHTAR, RAO TANVER HASHMAT, GHULAM JILANI, SAJJAD UR REHMAN CHUGHTAI, EHSAN-UL-HAQ, M. IRSHAD, ATA-UL-MOHSIN AND SHAHEENA YASMIN

Insect Pest Management Programme, National Agricultural Research Centre, Islamabad (NA, GJ, SURC, EUH, AUM, SY) and Gomal University, D. I. Khan (RTH), United Nations Development Program (MI)

Abstract.- The nature of resistance in eleven NUWYT Rain Fed (RF) wheat advanced lines and in one variety of year 2004-05 were determined against *Rhopalosiphum padi* L. (Bird Cherry Oat Aphid). Results of Seedling Bulk Tests of wheat lines showed that three lines namely PR-87, NR-234 and NR-241 were resistant, while the one variety namely Chakwal-97 and one line V–002467 were susceptible to aphid attack whereas seven lines were moderately resistant. Most suitable wheat lines were resistant and moderately resistant lines with damage rating of 4. Another set of experiments was conducted for Antixenosis (Non-preference) Tests to find out the least preferred line in same rain fed wheat lines. In the Antixenosis test, two lines DN-44 after 24 hrs. and NRL-2017 after 48 hrs. were highly preferred in Seedling Bulk Test three lines namely PR-87, NR-234 and NR-241 were resistant, while V-00BT004 line was least preferred, after 24 hrs and 48 hrs of release of aphids in antixenosis Tests, so it was the most suitable line regarding Free Choice test against this insect pest.

Key words: Aphids, rainfed wheat lines, pest resistance, antixenosis, varietal resistance.

INTRODUCTION

Aphids are the most widely distributed and serious threat to cereal crops (Yadev, 2003). *Rhopalosiphum padi* (L.), is one of the most economically important aphids on wheat. Other aphids which are serious include *Sitobion avenae* (Fab.), *Sitobion miscanthi* (Takahashi), *Rhopalosiphum maidis* (Fitch), *Metopolophium dirhodum* (Walker), and *Schizaphis graminum* (Rondani) (Dixon, 1987; Schotzko and Perez, 2000; Akhtar *et al.*, 1991). The S. *graminum, R. padi,* R *maidias* and *Diurapis noxia* (Mordvilko) commonly attack wheat throughout the world including Pakistan causing severe damage to wheat crop (Hamid, 1983; Inayatullah *et al.*, 1993). Population of aphids has been increasing for the last few years on cereal crops and attaining the status of pest in Pakistan (Zia *et al.,* 1999). It has not been possible to develop varieties that combine satisfactory aphid resistance with good agronomic properties and yielding capacity (Ahmad *et al.,* 2000). Several crop management practices that increase the impact of natural enemies, and unsprayed lands, have been suggested and have gained some acceptance by farmers in northwest Europe (Ninkovic *et al.,* 2001).

Susceptibility/resistance of plants is the result of a series of interactions between plants and insects, which influence the ultimate degree of establishment of insect populations on plants. Unfavorable biophysical or biochemical plant characters interrupt one or more of insect responses, may inhabit the establishment of insect populations on a plant and render it resistant to infestation and injury (Akhtar *et al.*, 2006a).

The present research was conducted to discuss the status of host plant resistance in wheat advanced lines against aphid species *R. padi* by determining the influence of infestation on their growth and their ability to resist stunting caused by infestation of bird cherry oat aphid.

MATERIALS AND METHODS

Eleven rainfed wheat advanced lines PR-87, NR-241, SN-128, V00BT004, V-00055, V-5, NRL-2017, NR-234, V-002467, DN-44, PR-83 and one variety Chakwal-97 were tested of NUWYT (RF) of year 2004-2005 were tested for determination of resistance. Resistance categories were determined

0030-9923/2007/0003-0191 $ 8.00/0

by Seedling Bulk Test and Antixenosis Test. *R. padi* was collected from wild grasses and wheat fields of NARC, Islamabad. The culture was maintained under controlled environmental conditions of temperature, 27±2°C and relative humidity, 55-60% with a photo phase of 16:8 hrs of day: night in rearing room in specially made iron racks measuring 112 x 50 x 62 cm, enlightened with five florescent tube lights (20 W). Susceptible wheat variety Chakwal-97 was used for mass rearing of aphids. About twenty seeds of Chakwal-97 were sown in a plastic pot of 11.5 cm dia. to obtain seedling for mass rearing of this aphid.

Seedling bulk test

For this test metal trays measuring 51x35x9 cm were used. Trays were filled with soil mix; there were eight rows of 1cm depth in each metal tray, and 20 seeds of every test line were sown in each furrow. When the seedlings attained the height of 5.8 cm, *R. padi* were released with 10 aphids per seedling. Damage rating (DR) was noted on damage rating scale of 0-9 where 0 stand for healthy and 9 stands for dead. After 10-15 days of infestation when lodging and yellowing started, data were recorded. Resistant lines were having damage rating DR. of 2-3. Moderately resistant (MR) lines were having DR 4-6 and susceptible lines were with DR! 7-9 (Inayatullah *et al.*, 1993).

Antixenosis test

The randomized complete block design in five replications was conducted to find out the results of non-preference. Two seeds of each line were sown in a circular pattern about 3 cm from the edge of 30 cm diameter plastic pot and when seedlings emerged, they were thinned to one, When seedlings were of 5.8 cm height, 100 wingless *R. padi* adults were released in the center of pot on the white circular paper of 3 cm diameter and pots were covered with plastic cages. After 24 hours, when aphids settled on seedlings of their choice, were counted. There were" three categories of preference, least preferred (LP) having least number of aphids, moderately preferred (MP) having moderate average number of aphids and highly preferred (HP) having highest number of aphids (Akhtar *et al.*, 2006b).

RESULTS AND DISCUSSION

Seedling bulk tests

Results of seedling bulk tests showed that three lines PR-87, NR-234 and NR 241 were resistant (R) with damage rating of 2-3 (Table I). Three lines SN-128, V-5 and NRL-20l7 were found to be moderately resistant (MR) with damage ratings of 4, while lines V–00BT004, V -00055, PR-83 and DN-44 were also moderately resistant (MR) with damage ratings of 5-6. One variety Chakwal-97 and on line V-002467 were found to be susceptible (S) with damage rating 7-9.

Table I.- Response of different rainfed wheat lines to *R. padi*

Wheat cultivars NUWYT (RF)	Damage rating (DR)	Remarks about nature of Resistance
PR–87	2	Resistant (R)
NR–24 1	3	Resistant (R)
SN–128	4	Moderately Resistant (MR)
V–00BT004	5	Moderately Resistant (MR)
V–00055	5	Moderately Resistant (MR)
V–5	4	Moderately Resistant (MR)
NRL–20l7	4	Moderately Resistant (MR)
NR–234	3	Resistant (R)
V–002467	8	Susceptible (S)
DN–44	6	Moderately Resistant (MR)
PR–83	5	Moderately Resistant (MR)
Chakwal- 97	7	Susceptible (S)

Two lines were susceptible three were resistant while seven lines were found to be moderately resistant

Antixenosis tests

Results of Antixenosis test indicated that line V00BT004 was least preferred (LP) after 24-hrs. of release of aphids with mean preference rating of 2.6 (Table II). Moderately Preferred (MP) lines were PR-87, SN-128, PR-83 and V-00055 with a mean preference rating of 3.0, 3.2, 3.4 and 3.6, respectively. Moderately preferred (MP_1) variety was Chakwal-97 and lines were NR-24l and NR-234 with mean preference ratings of 4.0, 4.5, and 5.0, respectively. Moderately preferred (MP_2) lines were V-5, NRL-20l7 and V-002467 with a mean preference rating of 5.2, 5.5 and 5.6, respectively. Of all the lines/variety highly preferred (HP) line was DN-22 with an average preference rating of 7.2,

whereas line V00BT004 was least preferred.

Table II.- Antixenosis test for non-preference of bird cherry oat aphid to *Triticum aestivum* L.

NUWYT (RF) wheat cultivars	Av. No. of aphids after 24 hrs.	Nature of preference	Av. No. of aphids after 48 hours	Nature of preference	Mean avg. No. of aphids after 24 & 48 hrs	Nature of overall preference
PR-87	3.0 abc	MP	3.7 bc	MP	3.3	MP
NR-241	4.0 abc	MP_1	3.6 bc	MP	3.8	MP
SN-128	3.2 abc	MP	3.4 bc	MP	3.3	MP
V00BT004	2.6 c	LP	1.6 c	LP	2.1	LP
V-00055	3.6 abc	MP	3.4 bc	MP	3.5	MP
V-5	5.2 ab	MP_2	4.8 abc	MP_1	5.0	MP_1
NRL-2017	5.6 ab	MP_2	8.5 a	HP	7.0	HP
NR-234	5.0 ab	MP_1	4.5 abc	MP_1	4.7	MP_1
V-002467	5.6 ab	MP_2	5.0 abc	MP_1	5.3	MP_2
DN-44	7.2 a	HP	6.4 ab	MP_2	6.9	HP
PR-83	3.4 abc	MP	5.3 abc	MP_1	4.3	MP_1
Chakwa1-97	4.5 abc	MP_1	6.4 ab	MP_2	5.9	MP_2

LP Least preferred (2.6) *LP= Least preferred (1.6)

MP= Moderately preferred (3.4-3.6)
MP_1= Moderately preferred (4.5-5.3)
MP_2 = Moderately preferred (5.2-5.6)
HP = highly preferred (7.2)
*LSD=0.5233 at 0.050
(Means with same letters do not show significant difference).

MP Moderately preferred (3.0 - 3.6)
MP_1 = Moderately preferred (4.0 - 5.0)
MP_2 = Moderately preferred (6.4)
HP = highly preferred (8.5)
*LSD= 0.6187 at 0.050
(Means with same letters do not show significant difference).

The results of Antixenosis Test after 48 hrs for same wheat lines indicated that line V-00BT004 was least preferred with mean preference rating of 1.6. MP lines were SN-128, V-00055, NR-241 and PR-87 with mean preference rating of (3.4, 3.4, 3.6 and 3.7), respectively. MP_1 lines were NR-234, V-5, V-002467 and PR-83 with mean preference ratings of 4.5, 4.8, 5.0 and 5.3 respectively. MP_2 variety was Chakwal-97 and line was DN-22 with mean preference rating of 6.4 and 6.4, respectively. Highly preferred (HP) was one line NRL-2017 with an average preference rating of 8.5 (Table II).

The results of Antixenosis Tests both after 24 hrs. and after 48 hrs. indicated that in both studies line V-00BT004 was least preferred with a mean preference rating of 2.1. Four lines SN-128, PR-87, V-00055 and NR-241, were found to be moderately preferred with a mean preference rating of 3.3, 3.3, 3.5 and 3.8 respectively. Three lines PR-83, NR-234 and V-5 were found to be MP1 with a mean preference rating of 4.3, 4.7 and 5.0 respectively. One variety Chakwal-97 and one line V-002467 were found to be MP_2 with a mean preference rating of 5.3 and 5.9 and two lines NRL-2017 and DN-44 were HP by aphids with an average preference rating of 6.9 and 7.0. Lines NRL-2017 and DN-44 were most vulnerable varieties against this pest. Most suitable line was V-00BT004 and according to these studies it is recommended that this promising line must be incorporated in breeding programmes.

Similar research have been reported by Akhtar *et al.* (2006a) who found out that in Antixenosis Test of rainfed wheat lines DN-18, MAW-1 and variety Faisalabad-85 were least preferred. Eight lines/variety PR-77, Wafaq-2001, NR 192, NR 206, KT 2000, SN-7, 2KC050, 97B2333 were moderately preferred while five lines V-6, NRL-9912, Bars1, V00146 and 98C0170 were highly preferred. Young wheat plants appear to lack any meaningful Antixenosis toward *D. noxia*, even though the aphids appear to perceive, and sometimes respond to, certain differences in cultivars suitability (Qureshi *et al.*, 2005). Akhtar *et al.* (2006b) reported that in Antixenosis experiments conducted, (N) on National Uniform Wheat Yield Trails (NUWYT) showed that line/variety V-5,

Wafaq-2001 (L. Check), MAW-I, and 99B2460 were least preferred. Lines CT-00231, V-99022 and PR-74 were highly preferred and twelve lines were moderately preferred.

The use of resistant lines will remain the most logical and economical way of reducing insect pest damage in cereals. Identification of the factors that confer resistance on susceptibility and the study of their inheritance in cereal plants would greatly improve breeding strategies for resistance lines (Saxena and Khan, 1989). A proper understanding of mechanism of host plant resistance will also lead to breeding for long term resistance. Increased understanding of resistance factors will pave the way of manipulation of insects' behaviors for use in pest management programmes. These are important studies and if the derived results are incorporated in varietal breeding programme, the wheat crop in the field will suffer comparatively less loss. Thus there will be reduced use of chemicals with much economic benefits.

REFERENCES

AHMAD, I., TUVESSON, S. AND JOHANSON, M., 2000. Indole alkaloids confer resistance in barley to aphid *Rhopalosiphum padi. J. chem. Ecol.*, **26**: 233-255.

AKHTAR, N. AND YAQOOB, M., 2006a. Patterns of Resistance to *Schizaphis. graminum* (Rondani) among rain fed national uniform wheat varieties. *Pakistan J. Zool.*, **38**: 153-157.

AKHTAR, N., EHSAN-UL-HAQ AND ASIF, M., 2006b. Categories of resistance in National Uniform Wheat Yield Trials (NUWYT) N against Aphid, *Schizaphis germanium* (Rondani), (Homoptera: Aphididae). *Pakistan J. Zool*., **38**: 167-171.

AKHTAR, N., LNAYATULLAH, C. AND CHAUDHARY, M.F., 1991. Resistance in pearl millet germplasm to the green bug, *Schizaphis graminum* (Rondani). *Proc. Pakistan Congr. Zool*., **11**: 137-140.

DIXON, A.F.G., 1987. Cereal aphids as an applied problem. *J agric. Zool.*, **2**: 1-57.,

HAMID, S.; 1983. Natural balance of graminicolous aphids in Pakistan, Survey of population. *J. Agron.*, **3**: 665-673.

INAYATULLAH, C., NAHEED, M., EHSAN-UL-HAQ AND CHAUDHAR, M.F., 1993. Incidence of greenbug, *Schizaphis graminum* (Rondani) (Homoptera: Aphididae) in Pakistan and resistance in wheat against it. *Insect Sci. Applic*., **14**: 247-254.

NINKOVIC, V, ABASSI, S.A. AND PETTERSSON, J., 2001. The influence of aphid-induced plant volatiles from barley on the *b* searching behavior of the seven spot ladybird, *Coccinella septempunctata. J. biol. Contr*., **21**: 191-195.

QURESHI, J.A.., JYOTI, J.L. AND MICHAUD, J.P., 2005. Differential colonization of wheat cultivars by two biotypes of Russian wheat aphid (Homoptera: Aphididae). *J. Ins. Sci.*, **12**: 41-349.

SAXENA, R. C. AND KHAN, Z.R., 1989. Factors affecting resistance of rice varieties to plant hopper and leafhopper pests. *Agric. Zool. Rev.*, **3**: 97-132.

SCHOTZKO, D.J. AND BOSQUE-PEREZ, N.A., 2000. Seasonal dynamics of cereal aphids on Russian wheat aphid (Homoptera: Aphididae) susceptible and resistant wheat's. *J. econ. Ent.*, **93**: 975-981.

YADEV, R., 2003. A combined source of resistance against com leaf aphid and yellow rust in barley. *Int. J. Pest Managem*., **49**: 293-296.

ZIA, M.A., AHEER, G.M., MUMTAZ, M.K. AND AHMAD, K.J., 1999. Field screening of sixteen advanced lines of wheat for resistance to aphids (Homoptera; Aphididae). *Pak. Ent.*, **21**: 95-97.

(Received 25 September 2006, revised 29 November 2006)