Academic Journal of Entomology 6 (3): 116-120, 2013
ISSN 1995-8994
© IDOSI Publications, 2013
DOI: 10.5829/idosi.aje.2013.6.3.1111

Resistance Pattern Against Aphid (*Diuraphis noxia*) in Different Wheat Varieties /Lines at District Layyah

[1]*Wali Muhammad,* [1]*Muhammad Nasir,* [2]*Saqi Kosar Abbas,* [1]*Muhammad Irshad,*
[2]*Muhammad Wasim Abbas,* [1]*Ahmad Nawaz and* [1]*Atta-ur-Rehman*

[1]Pest Warning and Quality Control of Pesticide, Agriculture Department, Punjab, Pakistan
[2]Department of Agri-Entomology, University of Agriculture, Faisalabad, Pakistan

Abstract: The study was conducted on the population dynamics of wheat aphid (*Diuraphis noxia*) at Arid Zone Research Institute Bhakkar during 2009. The population of aphid was studied on sixteen varieties/lines of wheat (*Triticum aestivum* L.) viz., Tw69001, Tw69002, Tw69003, Tw69004, Tw69005, Tw69006, Tw69007, Tw69008, Tw69009, Tw69010, Tw69011, Tw69012, Tw69013, Bhakkar-2002, Saher-2006 and Inqlab-91. Aphid population appeared on all varieties/lines on 12 February and increased gradually up to 5th March, 2009. Thereafter the aphid population increased exponentially and reached its peak on 12th March, 2009 on all the varieties / lines. A sudden decline in the aphid population was recorded after 26th March, 2009. Mean aphid population/ tiller of a wheat plant during the whole season was lower on Tw 69002 & 69003 (3.83) followed in ascending order by Tw 69009 (3.94 aphids), Tw 69004 (4.37 aphids), Saher (5.55 aphids), Tw 69013 (10.37 aphids), Tw 69001 (11.25 aphids), Inqlab-91 (11.57 aphids), Tw 69005 (13.33 aphids), Tw 69006 (13.43 aphids), Bk-2002 (13.75 aphids), Tw 69008 (13.93), Tw 69010 (14.43 aphids) and Tw 69011 (14.88 aphids), Tw 69007 (16.45), Tw 69012 (19.18). Tw 69002 & Tw 69003 was the most resistant and Tw69012 was the most susceptible varieties/lines among sixteen tested varieties/lines.

Key words: *Triticum aestivum* · Aphid population · Varieties/lines · Temperature

INTRODUCTION

Bread wheat (*Triticum aestivum* L.) is the main crop with the largest area under cultivation in Pakistan [1]. Wheat is a nutritious, useful, cost-effective source and a source of the basic dietary product-breads which is consumed by more than 70% of the human population. Wheat is a major cereal crop of Pakistan that help in increasing of GDP to the country's economy [2]. It is a staple food in Pakistan. It was grown on 8414 million hectares producing 21749 million tons of grain with a yield of 2585 kg ha^{-1} [3]. It contributes 13.7% to the value added in agriculture and 3.0% to GDP [4]. The wheat crop suffers from a number of biotic and abiotic stresses from sowing to harvesting, including heat, drought, disease and insects.

Wheat aphid is a serious pest having a wide host range of at least 60 plant species including wheat, barley, sorghum and corn [5]. Aphids (Aphididae: Homoptera), also called green flies and plant lice have a large host range. They secrete honey dew which facilitates growth of sooty mould which ultimately hinders photosynthetic process of attacked plants [6]. As a sucking pest, aphids significantly affect various vegetables, fruits and field crops, [7]. The aphids are important sucking pests of various field crops, fruits and vegetables and are commonly called as plant lice. Their population has been increasing for last few years and had attained the status of a regular pest in Pakistan [7]. Aheer *et al*. [8] reported that aphids are too much dangerous even one aphid can cause 2.20% loss in grain yield while according to [9] losses occur in range of 30-40% at 15 aphids per plant. The investigation of aphid population dynamics on wheat is complex and depends on the number of immigrant aphids and the length of time required for the population growth [10]. The growth rate and migration are

Corresponding Author: Muhammad Wasim Abbas, Department of Agri-Entomology, University of Agriculture, Faisalabad, Pakistan.

affected by host plant variety and crop vigor, microclimate and natural enemies [11]. Due to extensive use of chemical insecticides, aphids have developed resistance to various groups of pesticides [12]. Host plant resistance is one of the most important methods for control of the wheat aphids [13-16]. Host plant resistance is the relative amount of heritable qualities of a plant that reduces the degree of damage by pests [17]. Among different types of the host plant resistance, antibiosis is a heritable quality possessed by a plant that adversely affects the life history or biology of the insect pests [18]. The incidence of *Schizaphis graminum* has been reported to be significantly different on different wheat cultivars [19, 20]. The host plant variety can affect the reproductive periods and fecundity of aphids [21]. The type and level of resistance in wheat cultivars to the pest aphids have been studied using different assays [22-25] including the effects of barley cultivars on life table parameters [26-28].

To overcome the economic losses caused by aphid attack, use of host plant resistance is more economical and environment sound method then using insecticide for the control of aphids. The use of resistant varieties is an effective and efficient tool for the control of cereal aphids [29]. The objective of present study was conducted to determine the population dynamics of aphid on wheat and to find out best resistant wheat varieties/lines against aphids.

MATERIALS AND METHODS

The studies were conducted during 2009 and were located at Arid Zone Research Institute Bhakkar. Sixteen genotypes of wheat were screened against aphid named, Tw69001, Tw69002, Tw69003, Tw69004, Tw69005, Tw69006, Tw69007, Tw69008, Tw69009, Tw69010, Tw69011, Tw69012, Tw69013, Bhakkar-2002, Saher-2006 and Inqlab-91. The experimental plot was prepared by ploughing and planking, after this these lines/strains were sown in three replications followed by Randomized Complete Block Design (RCBD). The plot size of each replication was 4×1.8m. Non experimental area was of 2ft. Row to row distance was 6 cm. The experiment was planted on 15th November 2008. All cultural and agronomic practices were kept constant. Nitrogen @ 160 kg ha^{-1} and phosphorous @ 115 kg ha^{-1} P_2O_5 were applied. The crop was irrigated five times during season.

The entries were kept unsprayed to check the aphid population on them under natural condition. The data of aphid population on these lines/strains were recorded from 2nd week of February to end of March. The observations were taken after 7 days interval. The aphid population on each line/strain was recorded by randomly selecting plant in one meter square, three times in each replication. In all lines/strains data were recorded according to this method, after this aphid population per tiller was calculated for each replication. Total number of tiller of selected one meter square and aphid population on them were counted. The aphid population was then divided with number of tillers to get number of aphid per tiller. The data were subjected to analysis of variance (ANOVA) and DMR test at 5% level of significance was applied.

RESULTS AND DISCUSSION

Data regarding the aphid population recorded during 12th February, 2009 showed that maximum aphid population (6.47) was recorded in line TW69007 followed by 1.73, 1.77, 1.86, 2.11, 2.21, 3.16, 3.33, 3.48, 3.86, 4.48, 4.51 and 4.59 aphid/tiller, was recorded in TW69009, TW69003, TW69002, TW69013, TW69004, TW69010, TW69012, TW69006, TW69011 and TW69008, TW69005 respectively as compared to selected wheat varieties. The maximum aphid population was recorded in Inqalab-91 (3.49) followed by 3.29, 2.28, was reported in BK-2002 and Saher-06 respectively. The maximum population of aphid reached at 12th March, 2009 that may be due to the favorable temperature for aphid reproduction as these finding are similar to [30]. Temperature ranges from approximately 10 to 33°C during the experiment was seem to be encouraging for pest population development. These findings are also similar with [31] that cold weather support aphid breeding behavior. Temperature ranging from 7.7 to 25.2 °C is favourable for aphid growth [32], while the optimum temperature for aphid growth is 23.44 °C [33].

Data was recorded after every seven days intervals. Maximum aphid population recorded in lines during 12th March, 2009 was 29.37 in TW69012, while minimum population was recorded in line TW69002 (5.75), while in selected varieties maximum population was reported in BK-2002 22.74 followed by 18.89 and 9.76 was in Inqalab-91 and Sehar 2006 respectively (Table 1).

Last data was recorded at 26th March, 2009 in which maximum aphid population was 23.38 noted in line TW69012, while lowest aphid population was recorded in TW69009 was 4.35. To compare the varieties BK-2002 was most susceptible having aphid population of 18.71/tiller while the variety Sehar-06 show the resistance

Table 1: Mean population of aphids.

Variety/line	12/02/09	19/2/09	26/2/09	5/03/09	12/03/09	19/3/09	26/3/09	Mean
Tw69001	3.86bcd	4.96f	7.85f	11.19e	18.66f	17.55b	14.69d	11.25f
Tw69002	1.86cd	2.05i	3.35g	4.11f	5.75h	5.34c	4.38e	3.83i
Tw69003	1.77cd	2.02i	3.13g	4.16f	5.64h	5.28c	4.89e	3.83i
Tw69004	2.21bcd	2.97h	3.84g	4.72f	6.11h	5.84c	4.96e	4.37i
Tw69005	4.59ab	6.72c	9.92de	14.94bcd	20.83e	19.02b	17.31c	13.33e
Tw69006	3.48bcd	5.63e	8.69ef	15.63bc	22.57de	20.85ab	17.21c	13.43e
Tw69007	6.47a	9.28a	14.15b	17.63b	25.21bc	23.22a	19.26b	16.45b
Tw69008	4.51abc	6.16d	9.85de	14.92bcd	22.46bc	21.45ab	18.36bc	13.93de
Tw69009	1.73d	2.12i	3.16g	4.13f	6.15h	6.02c	4.35e	3.94i
Tw69010	3.16bcd	5.76de	10.71cd	16.52b	24.63c	21.62ab	18.65bc	14.43cd
Tw69011	4.48abcd	6.59c	11.76c	17.65b	26.37b	22.35ab	18.34bc	14.88c
Tw69012	3.33bcd	7.62b	19.77a	23.49a	29.37a	27.34a	23.38a	19.18a
Tw69013	2.11bcd	3.98g	7.31f	11.74e	18.71f	16.26b	14.22d	10.37g
Bk-2002	3.29bcd	5.49e	9.86de	15.42bcd	22.74d	20.75ab	18.71bc	13.75e
Saher-06	2.28bcd	3.82g	4.51g	6.21f	9.76g	7.84c	4.48e	5.55h
Inqlab-91	3.49bcd	5.64e	8.72ef	12.85cde	18.89f	17.85b	13.64d	11.57f

against aphid population by 4.48/tiller as shown in the (Table 1). These findings are similar to the [34] which describes the peak population of aphid was during the mid-January, mid-February and starts of March due to cold weather condition. The present findings are similar with the results of [35] who reported that resistant cultivars showed lowest population of aphids (0-5.0/tiller) as compared to susceptible lines (16-20/tiller).

Rios De Saluso and Conde [36] reported that at milking stage the aphid tends to increase in population i.e. during the third week of March. Aphid reproduces rapidly at heading and earing stage [37-40]. This rapid growth in aphid population on all wheat varieties / lines could be due to availability of good quality and surplus quantity of food (sap) present in the ears. Another factor responsible for rapid increase in the aphid population is temperature [41]. It has been reported [42] that gross and net reproductive rates of aphids were greatest at low temperature regimes and declined with increase in temperature. Abou-Elhagag and Abdel-Hafez [30] found that average daily temperature, natural enemies and relative humidity play most important role in controlling aphid population in wheat field. Host plant resistance is an important part of IPM of aphids. In Pakistan, there are several commercial wheat varieties available which need screening for resistance to aphids [43]. 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 resistant lines [44].

Based on number of aphid per tiller these lines found to be resistant against aphid. Means followed by same letter (s) within each row (denoted by lower-case letters) are not significantly different by DMRT test at P = 0.05.Means having different letter(s) (denoted by lower-case) show statistically significant results by DMRT test at P= 0.05.

CONCLUSIONS

The results concluded that peak aphid population was recorded during the beginning of the Second week of March in the years 2009. Aphid dynamics were largely dependent on temperature and relative humidity. The most resistant varieties/lines reported in this study were Tw69002, Tw69003 and Tw69012 was more susceptible, but in varieties Sehar-06 is more resistant while Bk-2002 was more susceptible.

REFERENCES

1. Anwar, J., M.A. Ali, M. Hussain, W. Sabir, M.A. Khan, M. Zulkiffal and M. Abdullah, 2009. Assessment of yield criteria in bread wheat through correlation and path analysis. J. Animal and Plant. Sci., 19: 185-188.
2. Chowdhry, M.A., A. Maqbool, N. Mahmood and I. Khaliq, 1998. Performance of pure and mixed stands for bio-mass and grain yield in hexaploid wheat. Pak. J. Sci., 1: 145- 147.

3. MINFAL, 2008-2009. Statist. Govt. of Pakistan, Ministry of Food, Agric. & Livest. Economic Wing, Islamabad, pp: 273.
4. Anonymous, 2008. Population, labour force and employment. Economic Survey, Government of Pakistan, pp: 195.
5. Bowling, R.W., G.E. Wlide and D. Margolies, 1998. Relative fitness of greenbug (Homoptera: Aphididae) biotypes E and I on Sorghum, Wheat, Rye and Barley. J. Econ. Entomol., 91: 1219-1223.
6. Zia A., S.A. Hassan, A. Shehzad and F. Naz, 2010. Diversity of Aphidoidea in Rawalpindi Division (Punjab) Pakistan, with a list of host plant studied. Halteres, 1: 40-46.
7. Aheer, G.M., A. Ali and M. Munir, 2008. Abiotic factors effect on population fluctuation of alate aphids in wheat. J. Agric. Res., 46: 367-371.
8. Aheer, G.M., K.J. Ahmad and A. Ali, 1994. Role of weather in fluctuating aphid density in wheat crop. J. Agric. Res., 32: 295-30.
9. Kieckhefer, R.W. and N.C. Elliott, 1989. Effect of fluctuating temperatures on development of immature Russian wheat aphid and demographic statistics. J. Econ. Entomol, 82: 119-122.
10. Jarosik, V., A. Honek and A. Tichopad, 2003. Comparison of field population growths of three cereal aphid species on winter wheat. Plant Protection Sci., 39: 61-64.
11. Dixon, A.F.G., 1987. Cereal aphids as an applied problem. Agric. Zool. Rev., 2: 1-57.
12. Wilde, G.E., R.A. Shufran, S.D. Kindler, H.L. Brooks, and P.E. Sloderbeck, 2001. Distribution and abundance of insecticide resistant greenbugs (Homoptera: Aphididae) and validation of a bioassay to assess resistance. J. Econ. Entomol., 94: 547-551.
13. Dogramaci, A., Z.B. Mayo, R. Wright and J. Reese, 2007. Categories of resistance, antibiosis and tolerance, to biotype I greenbug (Schizaphis graminum (Rondani) Homoptera: Aphididae) in four sorghum (Sorghum bicolor (L.) Moench., Poales: Gramineae) hybrids. J. Kansas Entomol. Soci., 80: 183-191.
14. Messina, F.J. and A.J. Bloxham, 2004. Plant resistance to the Russian wheat aphid: effects on a non-target aphid and the role of induction. Can. Entomol., 136: 129-137.
15. Burd, J.D. and G.J. Puterka, 2009. Plant resistance management strategies for greenbug (Schizaphis graminum (Rondani) (Homoptera: Aphididae) in wheat-sorghum cropping systems. Redia J. Zool., 92: 227-229.
16. Berzonsky, W.A., H.J. Ding, S.D. Haley, M.O. Harris, R.J. Lamb, R.I.H. McKenzie, H.W. Ohm, F.L. Patterson, F.B. Peairs, D.R. Porter, R.H. Ratcliffe and T.G. Shanower, 2003. Breeding wheat for resistance to insects. Plant Breeding. Rev., 22: 221-296.
17. Painter, R.H., 1951. Insect Resistance in Crop Plants. The Macmillan Co., New York, pp: 520.
18. Panda, N. and S.G. Khush, 1995. Host Plant Resistance to Insects. CABI, Wallingford, UK.
19. Ciepiela, A.P., 1993. The harmful effect of cereal aphid on winter wheat crop. Ochrona Roslin, 37: 9-10.
20. Ahmad, F. and S. Nasir, 2001. Varietal resistance of wheat germplasm against wheat aphid (Sitobion avenae F.). Pak. Entomol., 23: 5-7.
21. Saikia, A.K. and V. Muniyappa, 1989. Epidemiology and control of tomato leaf curl virus in Southern India. Tropical Agric., 66: 350-354.
22. Webster, J.A. and D.R. Porter, 2000. Plant resistance components of two greenbug (Homoptera: Aphididae) resistant wheat. J. Econ. Entomol., 93: 1000-1004.
23. Radchenko, E.E., 2000. Identification of genes for resistance to greenbug in sorghum. Genetika, 36: 510-519.
24. Castro, A.M., A. Vasicek, S. Ramos, A. Martin, L.M. Martin and A.F.G. Dixon, 1998. Resistance against greenbug, Rond. and Russian wheat aphid, Diuraphis noxia Mordvilko, in Tritordeum amphiploids. Plant Breed., 117: 515-522.
25. Akhtar, N., and M.Y. Mujahid, 2006. Patterns of resistance against Schizaphis graminum (Rondani) in rainfed wheat varieties. Pak. J. Zool., 38: 153-157.
26. Elek, H., P. Werner, L. Smart, R. Gordon-Weeks, M. Nadasy and J. Pickett, 2009. Aphid resistance in wheat varieties. Commun. Agric. Appl. Biol. Sci., 74: 233-41.
27. Tofangsazi, N., K. Kheradmand, S. Shahrokhi, and A.A. Talebi, 2011. Demography of greenbug, Schizaphis graminum (Rondani) (Hemiptera: Aphididae) on six barley cultivars. Archive of Phytopathol. and Plant Protec., 44: 484-492.
28. Vasicek, A., F. Rossa, A. la-Paglioni and M.C. Lopez, 2010. Biological and demographical statistics of Diuraphis noxia (Mordv.), Metopolophium dirhodum (Wlk.), Rhopalosiphum padi (L.), Schizaphis graminum (Rond.) and Sipha maydis (Pass.) (Hemiptera: Aphididae) on different cultivars of *Avena sativa* L. under controlled conditions. Boletin de la Sociedad Entomologica Aragonesa, 46: 591-596.

29. Akhtar, N., Ehsan-ul-Haq and M. Asif, 2006b. Categories of resistance in National Uniform Wheat Yield Trials (NUWYT) N against Aphid, Schizaphis germanium (Rondani), (Homoptera: Aphididae). Pak. J. Zool., 38: 167-171.
30. Abou-Elhagag, H.G., and A.N. Abdel-Hafez, 1998. Cereal aphids (Homoptera: Aphididae); Factors affecting their population on wheat in Upper Egypt. Assiut. J. Agric. Sci., 29: 241-252.
31. Bhambhro, S.A., 2002. Schizaphis graminum Threat of aphids to wheat crop. DAWN – Business , T he Internet Edition , March 18, 2002 .http://www .DA WN.com.
32. Chander, S., 1996. Aphid infestation of wheat in relation to climatic factors and predators. J. Annals of Plant. Protect. Sci., 4: 148-150.
33. Miller, R.M. and A.W. Smith, 1998. The Greenbug Aphid and Its Control. Fact sheet extension horticulture and crop sciences. Ohio State Univ. Ext. Fact Sheet. 2021, Coffey Rd., Columbus, Ohio, pp: 43210-1086.
34. Manna, S.H., 2002. Cereal aphids on wheat in new valley , natural enemies, seasonal activity of alate forms and susceptibility of certain varieties to natural infestation. Assiut J. Agric. Sci., 31: 287-297.
35. Formusoh, E.S., Wildo, G.E., J.H. Hatchett and R.D. Collins, 1994. Resistance to the Russian wheat aphid (Homoptera: Aphididae) in wheat and wheat related hybrids. J. Econ. Entomol., 81: 241-244.
36. Rios De Saluso, M.L.A. and A.A. Conde, 1986. Evaluation of the damage caused to wheat by the grain aphid, Sitobion avenae. Serie Tecnica, Estacion Experimental Agropecuaria, Prana, Argentine, 53: 15.
37. Dyadechko, N.P. and M.B. Ruban, 1975. The harmfulness of cereal aphids. Zash Rash, 12: 17-8.
38. Kieckhefer, R.W., N.C. Elliott, W.E. Riedell and B.W. Fuller, 1994. Yield of spring wheat in relation to level of infestation by greenbug (Homoptera: Aphididae). Canadian Entomol., 126: 61-6.
39. Kieckhefer, R.W. and J.L. Gellner, 1992. Yield losses in winter wheat caused by low–density cereal aphid populations. Agron. J., 84: 180-183.
40. Rustamani, M.A., S.A. Sheikh, N. Memon, M.H. Laghari, and M.H. Dhaunroo, 1999. Impact of wheat plant phenology on the development of greenbug, Schizaphis graminum R. Pak. J. Zool., 31: 245-8.
41. Trdan, S. and L. Mileroj, 1999. The cereal aphid (Sitobion avenae T.) wheat pest. Sodobno–Kmetijstvo, 32: 119-128.
42. Kieckhefer, R.W. and J.L. Gellner, 1989. Influence of plant growth stages on cereal aphid reproduction. Crop Sci., 28: 688-90.
43. Webster, J.A., C.A. Baker, and D.R. Poter, 1991. Detection and mechanism of Russian wheat aphid (Homoptera: Aphididae) resistance in barley. J. Econ. Entomol., 84: 669-673.
44. Saxena, R.C. and Z.R. Khan, 1989. Factors affecting resistance of rice varieties to plant hopper and leafhopper pests. Agric. Zool. Rev., 3: 97-132.