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Muhammad Arshad
Department of Entomology,
University College of
Agriculture, University of
Sargodha, 40100, Sargodha,
Pakistan.

Muhammad Irfan Ullah
Department of Entomology,
University College of
Agriculture, University of
Sargodha, 40100, Sargodha,
Pakistan.

Ghulam Murtaza
Department of Entomology,
University College of
Agriculture, University of
Sargodha, 40100, Sargodha,
Pakistan.

Mudassar Javed
Department of Entomology,
University College of
Agriculture, University of
Sargodha, 40100, Sargodha,
Pakistan.

Muhammad Hannan Ahmad
Department of Entomology,
University College of
Agriculture, University of
Sargodha, 40100, Sargodha,
Pakistan.

Correspondence
Muhammad Arshad
Department of Entomology,
University College of
Agriculture, University of
Sargodha, 40100, Sargodha,
Pakistan.

Responses of different wheat genotypes against aphid (*Schizaphis graminum* R.) and its natural enemies

Muhammad Arshad, Muhammad Irfan Ullah, Ghulam Murtaza, Mudassar Javed, Muhammad Hannan Ahmad

Abstract

In the present study, incidence of aphid and its natural enemies was observed among different wheat genotypes. The genotype Mairaj-81 possessed maximum aphid population (6.83/tiller) and was proved the most susceptible as compared to others. The peak population of the aphid was observed on 18 March, 2014 (20.03/tiller) while population of aphid was observed minimum on 08 April, 2014 (0.01/tiller). Coccinellids and *Chrysoperla carnea* population was observed maximum (0.08/tiller, 0.44/tiller) respectively on MILLAT-11. Maximum population of Syrphid fly was observed on Mairaj 2008 (0.11/sweep).

Keywords: Aphid, Wheat genotypes, Coccinellids, *Chrysoperla carnea*

1. Introduction

Wheat (*Triticum aestivum* L.) is a suitable, nutritious and economical cereal crop. Worldwide, 20% of food calories are provided by wheat crop and also food for about 40% of total world's population [1].

In Pakistan, wheat is a major food of Pakistan and grown as a cereal crop, but other plant material like straw, seed, and bran is used as a feed for livestock as well as used in industries. Wheat is the 2nd largest cereal crop and contributes more than 12% value added in agriculture of Pakistan and about 2.6% to GDP [2].

Unfortunately, wheat crop is threatened by number of insect pests like wheat weevil (*Tanymecus indicus*), wheat armyworm (*Mythimna separata*), white ants (*Microtermes obesit*) and aphids (*Schizaphis graminum* R.). Among these insect pests of wheat crop, aphid (*Schizaphis graminum* R.) is an important and destructive pest [3].

Aphids effect deeply within the leaf whorl by direct feeding and also inject a toxic material into plant which ultimately disrupts the chloroplast membrane [4].

To prevent losses caused by aphid, many control measures have been used like cultural, mechanical and chemical control. Biological control has some discrete advantages to many other control techniques due to relatively safe, stable and economical. Present study aimed to investigate the population dynamics of wheat aphids and their natural enemies. The study also focused on the varietal response of wheat against aphid and their biological control agents.

2. Materials and Methods

The study was conducted at National Agriculture Research Center, Islamabad during 2014. Fourteen genotypes of wheat viz. Pakistan 13, Shahkar 13, NARC 2011, AARI 2011, Punjab 2011, AAS-11, MILLAT-11, NARC 2009, BARC 2009, Chakwal-50, Pirsabak-08, Lasani 2008, Faisalabad 2008 and Mairaj 2008 were selected to check the incidence of aphid and its natural enemies. The data regarding population of aphids, Coccinellids (larvae and adults), *Chrysoperla carnea*, and Syrphid fly adults were recorded from tillers of ten plants selected randomly from each plot at weekly interval.

For assessment of aphid and its natural enemies, 10 randomly wheat tillers were selected by carefully examining whole plants.

The data was subjected to statistical analysis (ANOVA) and means were compared using LSD all pairwise comparison test. Correlation was performed to check the relationship of aphid population with its natural enemies. All the statistical analysis was performed using Minitab 16.1 software.

3. Results and Discussion

The results revealed significant variation among different genotypes of wheat regarding the population of Aphids, Coccinellids, *Chrysoperla carnea* and Syrphid fly. Investigations revealed that prominent resistance responses were observed among wheat genotypes for aphids attack and its natural enemies. The genotype Mairaj-81 possessed maximum aphid population (6.83/tiller) and was the most susceptible followed by Faisalabad 2008, (5.81/tiller) and Shahkar 13, (5.62/tiller). Genotypes NARC 2009 proved as resistant with minimum population of aphid (4.29/tiller) followed by BARC 2009, (4.67/tiller) and ASS-11, (4.69/tiller) (Table 1). Overall, the population of natural enemies was very low. Coccinellids were observed maximum (0.08/tiller) on MILLAT-11, while these were minimum (0.01/tiller, 0.01/tiller) on Punjab 2011 and Mairaj 2008 genotype respectively. Maximum population of Syrphid fly was observed on Mairaj 2008 (0.11/sweep) followed by Punjab 2011 (0.09/sweep) and minimum population was observed on Pakistan 13, (0.01/sweep). Similarly, maximum population of *Chrysoperla carnea* was recorded on MILLAT-11 (0.44/tiller), while these were minimum (0.13/tiller) on ARRI 2011 genotype. The peak population of the aphid was observed on 18 March, 2014 (20.03/tiller) while minimum population was recorded on

08 April, 2014 (0.01/tiller). *Coccinellids* were recorded maximum on 4 March, 2014 (0.09/tiller) while their population was recorded minimum on 08 April, 2014 (0.00/tiller). But the population of Syrphid fly was observed maximum on 11 March, 2014. *Chrysoperla carnea* population was recorded maximum on 25 March, 2014 while their population was reduced when crop moved toward the harvesting stages (Table 2). There was highly significant positive correlation between aphid population and its natural enemies (Table 3). The present results conform by the findings of [5, 6].

Screening of different genotypes of wheat to check resistance level against aphids, mainly the three main aphid species, i.e. *S. avenae*, *R. padi* and *S. graminum* were recorded by [7,8]. They conclude that, high yielding varieties were found to be more susceptible to cereal aphids. Additionally, interaction between wheat resistance and *Chrysoperla plorabunda* (Fitch) predation for *Diuraphis noxia* suppression was also reported by Frank and Sorenson, (2001) [9]. Coccinellids are very effective predators due to consumption of many aphids per day for oviposition [10]. On the other hand, Syrphid flies and its immature stages are predaceous on aphids [11]. Furthermore, *Chrysopa* spp (Neuroptera: Chrysopidae) are also observed as a voracious predators of all the lepidopterous pests, aphids and mealy bugs [12].

Table 1: Mean population of aphid and its natural enemies on different genotypes of Wheat

Wheat genotype	Aphid /tiller	<i>Chrysoperla carnea</i> /tiller	Syrphid/sweep	Coccinellids /tiller
Pakistan 13	5.18 ^{bc}	0.28 ^a	0.01 ^a	0.02 ^b
Shahkar 13	5.62 ^{ac}	0.14 ^a	0.07 ^a	0.02 ^b
NARC 2011	5.10 ^{bc}	0.38 ^a	0.06 ^a	0.06 ^{ab}
AARI 2011	5.16 ^{bc}	0.13 ^a	0.04 ^a	0.03 ^{ab}
Punjab 2011	4.88 ^{bc}	0.29 ^a	0.09 ^a	0.01 ^b
AAS-11	4.69 ^{bc}	0.38 ^a	0.04 ^a	0.02 ^b
MILLAT-11	5.60 ^{ac}	0.44 ^a	0.08 ^a	0.08 ^a
NARC 2009	4.29 ^c	0.23 ^a	0.07 ^a	0.04 ^{ab}
BARC 2009	4.67 ^{bc}	0.21 ^a	0.03 ^a	0.03 ^{ab}
Chakwal-50	5.22 ^{bc}	0.28 ^a	0.04 ^a	0.02 ^b
Pirsabak-08	4.91 ^{bc}	0.26 ^a	0.06 ^a	0.02 ^b
Lasani 2008	5.42 ^{bc}	0.30 ^a	0.06 ^a	0.03 ^{ab}
Fsd. 2008	5.81 ^{ab}	0.42 ^a	0.07 ^a	0.02 ^b
Mairaj 2008	6.83 ^a	0.43 ^a	0.11 ^a	0.01 ^b

Means (through LSD test) sharing similar letter (s) are not significantly different

Table 2: Mean population of aphid and predators at different time interval

Date	Aphid /tiller	<i>Chrysoperla</i> /tiller	Syrphid/sweep	Coccinellid /tiller
11-02-2014	3.77 ^{cd}	0.01 ^b	0.00 ^b	0.01 ^c
18-02-2014	2.14 ^{ef}	0.06 ^b	0.05 ^b	0.03 ^{bc}
25-02-2014	2.75 ^{de}	0.07 ^b	0.06 ^b	0.04 ^{ac}
04-03-2014	1.57 ^f	0.06 ^b	0.06 ^b	0.09 ^{bc}
11-03-2014	4.69 ^c	0.04 ^b	0.21 ^b	0.02 ^{bc}
18-03-2014	20.03 ^a	0.25 ^a	0.04 ^a	0.06 ^a
25-03-2014	8.39 ^b	2.15 ^b	0.07 ^b	0.08 ^{ab}
01-04-2014	3.79 ^{cd}	0.05 ^b	0.03 ^b	0.01 ^{bc}
08-04-2014	0.01 ^g	0.00 ^b	0.00 ^b	0.00 ^c

Means (through LSD test) sharing similar letter (s) are not significantly different

Table 3: Correlation between aphid population and its natural enemies on different wheat genotypes

Aphid density	Coccinellid	<i>C. carnea</i>	Syrphid fly
Correlation co-efficient	0.301**	0.795**	0.423**
p-value	0.000	0.000	0.000

** Highly Significant at 1% level of significance.

4. Conclusion

The present study concludes that biological agents played a significant role in controlling the aphids on wheat. Further artificial release of predators may give a satisfactory control of the pest, suggests encouraging biological control.

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