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Full Length Research Paper

Effect of wheat cultivars on aphids and their predator populations

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The current study was conducted to determine the influence of wheat cultivars on aphids and their coccinellid predator populations. Five cultivars of wheat (99T007, BK-2002, TW0135, INQLAB and CHAKWAL-97) were sown at Arid Zone Research Institute, Bhakkar during 2006. The INQLAB-91 appeared to be the most resistant cultivar, whereas 99T007 appeared to be the most susceptible one for aphid infestations. The 4th week of February was found to be very favourable for aphids in wheat fields in the study area. The highest and lowest populations of coccinellid predators (all species) were recorded on TW0135 and 99T007 cultivars, respectively. The highest population of coccinellid predators was recorded during the 3rd week of February. We observed a significant synchronization between aphids and coccinellids populations. It is concluded from the study that as INQLAB-91 is resistant to the attack of aphid's population, this cultivar should be promoted in the areas of high aphid infestation. The populations of coccinellids follow the aphid's population and coccinellids can be important biological control agents of aphids and can be imported tool for IPM programme in the study area.

Key words: Aphids, wheat, coccinellids, wheat cultivars.

INTRODUCTION

Wheat (*Triticum aestivum* L.) is a major crop which plays a significant role in economic stability of Pakistan (Anwar et al., 2009). Although many insect pests attack wheat plantations in Pakistan, the highest damage is caused by aphids. Aphids cause yield losses either directly (35 to 40%) by sucking the sap of the plants or indirectly (20 to 80%) by transmitting viral and fungal diseases (Aslam et al., 2005). The aphid infestations significant affect wheat cultivars (Ahmad and Nasir, 2001) and other abiotic factors (Aheer et al., 2007, 2008; Wains et al., 2008). However, for integrated pest management, evaluation of more wheat cultivars would lead to selection of the most tolerant cultivar for aphid infestations under various situations.

Aphids can be managed in several ways like, cultural, physical, mechanical, biological, chemical and host plant resistance controls. Biological control is the major component of any integrated pest management strategy (Schöller et al., 1997). Hover fly grubs, ground beetle, Coccinellid beetle, *Chrysoperla*, Syrphid fly sp. and earwigs are important natural enemies of aphid. Coccinellid beetles are important predators of aphids in agricultural crops, and have been used as biological control agents against a number of pest aphids due to their ability to feed on a wide range of prey, to be very voracious, and to have a rapid numeric response (Hodek and Honěk, 1996). Use of selective insecticides which have the least harmful effect on parasite and predator could be the best option (Gair et al., 1987). However, most of the synthetic insecticides seriously affect the populations of target and other non-target organisms. It is therefore, advisable to use wheat cultivars which are

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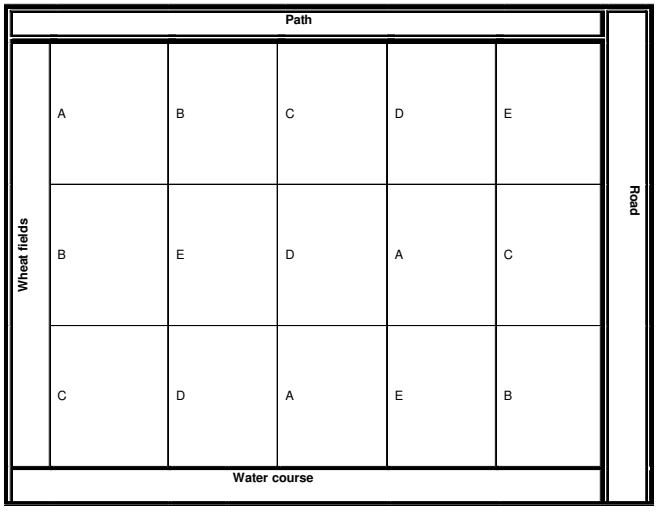

Figure 1. Experimental design for the different wheat cultivars sown in the study area. A, 99T-007; B, BK-2002; C, TW-0135; D, INQLAB-91; E, CHAKWAL-97.

Table 1. Statistical differences between the different wheat cultivars in the mean number of aphids/tiller (Tukey's tests α 0.05).

Wheat cultivar	Mean number of aphids/tiller
INQLAB-91	0.35 ± 0.011^{c}
BK-2002	0.37 ± 0.010^{c}
TW0135	0.53 ± 0.014^{b}
CHAKWAL-97	0.58 ± 0.008^{b}
99T007	0.95 ± 0.020^{a}

Values in the column having different letters are significantly different at 0.05 probability level.

resistant to the attack of aphids.

The resistance of crop is an index of the balance that exists between the preference of the pest for a crop and its antibiosis against it. Nature also keeps check on these insect pests in the form of biological agents and environmental factors. In the present study, we investigated the attractiveness of aphids and coccinellid predators towards the tested wheat cultivars to select the most resistant cultivar against aphid infestations.

MATERIALS AND METHODS

The present study was conducted at Arid Zone Research Institute Bhakkar during 2006 to study the influence of wheat cultivars on aphid populations. The data of aphids and its predator (*Coccinellid* species all combined) was recorded during the whole experimental period (from February to March 2006). Five wheat cultivars were used in this study (BK-2002, INQLAB-91, CHAKWAL-97, 99T007 and TW0135). The BK-2002, INQLAB-91 and CHAKWAL-97 were obtained from Punjab Seed Corporation, Bhakkar while 99T007 and TW0135 were obtained from Arid Zone Research Institute, Bhakkar. All cultivars were sown on the 30th of November, 2005 and the plant samples were collected weekly from 06-02-2006 to 20-03-2006. Each cultivar was grown in three plots (replicates). Each plot was 40 m^2 in space. The experimental design is given in Figure 1. During each sampling date, 25 wheat plants from each plot were randomly selected and the number of aphids per tiller of each plant was counted. Predators were also collected by using sweep net.

ANOVA was used to test the significant effect of wheat cultivars on aphid and predators populations followed by using Tukey's test at 0.05 probability level to compare the significant differences in the mean number of aphids and predators between the five wheat cultivars. Correlation analysis (Pearson's) was used to assess the relationship between aphid and predator populations. Minitab 13.3 was used for statistical analyses.

RESULTS

The mean number of aphids/tiller significantly differed among the five wheat cultivars (df = 4, 10; F = 305.47; P < 0.001). The highest number of aphids per tiller (0.95 ± 0.02) was recorded on 99T007 cultivar, whereas the lowest one (0.35 ± 0.01) was recorded on INQLAB-91 cultivar (Table 1). The highest number of aphids per tiller

Table 2. Statistical differences between the different wheat cultivars in the mean number of coccinellid predators/sweep.

Wheat cultivar	Mean number of *Coccinellids*/sweep
INQLAB-91	0.74 ± 0.030[c]
BK-2002	0.75 ± 0.030[c]
TW0135	1.84 ± 0.010[a]
CHAKWAL-97	0.928 ± 0.050[b]
99T007	0.70 ± 0.015[c]

Values in the column having different letters are significantly different at 0.05 probability level.

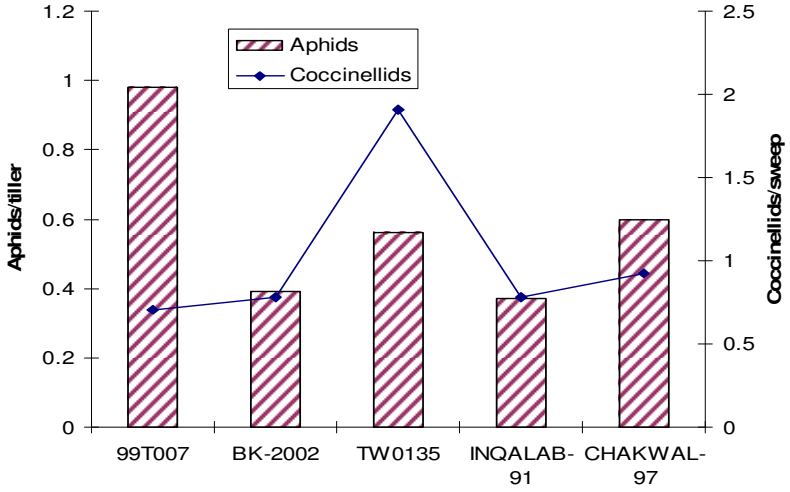

Figure 2. Mean number of aphids and coccinellid predators on different wheat cultivars.

was recorded during the last sample (28-02-2006).

The mean number of *Coccinellids* (all species combined) significantly differed among the five wheat cultivars (df = 4, 10; F = 218.80; P < 0.001). The highest number of *Coccinellids* per sweep per each strike (1.84 ± 0.01) was gotten from TW0135 cultivar (Table 2). Mean numbers of aphids and *Coccinellids* recorded from different wheat cultivar are given in Figure 2. Two peaks of coccinellid predators were recorded. The first peak (the highest one) was recorded at the end of February and the second one in mid March (Figure 3). There was significant synchronization between aphid and coccinellid populations (Pearson's correlation = 0.30; Figure 3).

DISCUSSION

The current results reveal that there were significant differences in the number of aphids and their associated predators among the wheat cultivars. Number of aphids per tiller was high in 99T007 cultivar and low in INQLAB-91 cultivar. Thus, 99T007 seems to be more susceptible and INQLAB-91 more resistant. Variations in the aphid populations among the different cultivars has been reported by several researchers like Zhang et al. (1989), Kindler et al. (1992), Aheer et al. (1993), Havlickova (1993), Zia et al. (1999), Bosque and Schotzko (2000) Ahmed and Nasir (2001), Aslam et al. (2005) and Aheer et al. (2007).

The fourth week of February was found to be the most favourable time for aphid reproductions as highest aphid population was recorded in this month. Our results are in conformity with those of Bhambhro (2002) and Aslam et al. (2005), they reported that aphids breed with fast rate during the cold weather and reach the highest population at the end of February and early March when ears start repining. Aheer et al. (2007) and Wains et al. (2008) found that the highest peak of aphids was in March. Decline in aphid populations after mid March may be due to the increase in temperature, repining of crop and the attack of coccinellid beetles (Nasir et al., 2001; Aslam et al., 2005; Aheer et al., 2007, 2008).

Population of coccinellid predators synchronized with aphid population with the highest synchronization during the end of February. This implies that aphid population increased or decreased the coccinellid predators and

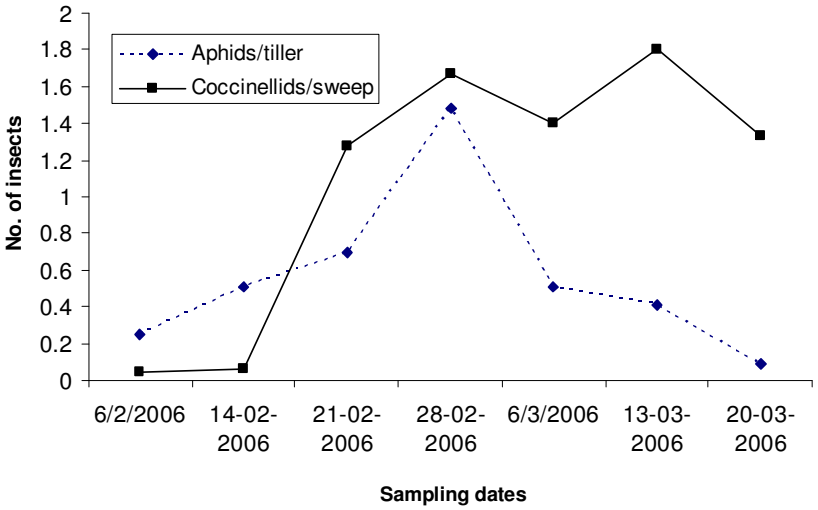

Figure 3. Synchronization between prey (aphid species) and coccinellid predator populations during the period of study.

fluctuated with the same trend. This is an important attribute in the natural enemies which could regulate the pest population. The wheat cultivar 99T007 should be considered in IPM program to minimize the infestation with aphids.

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