NATURAL ENEMIES OF CEREAL APHIDS IN NORTH WEST FRONTIER PROVINCE (NWFP) OF PAKISTAN

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Abstract
Parasitoids and predators of the cereal aphids were investigated at five different sites of North West Frontier Province (NWFP) of Pakistan. The most dominant species of parasitoids were *Aphidius ervi* and *Aphidius colemani* while *Dieretella rapae* and *Aphidius martricarae* were very low. It was observed that the parasitoids got active after mid February when the aphids’ population had reached the peak level in wheat fields. Among the predators *Coccinella septumpunctata* was the predominant species among the four-major Coccinellid. The peak population of *C. septumpunctata* was recorded in the middle of March. The numbers then declined and came to an abrupt end by the last week of April. *Menochilus sexmaculatus* was the next dominant species, which followed the same populations’ trends as that of *C. septumpunctata*. *Hippodamia variegata* and *Bromoidis suturalis* were present but at a low level. The peak populations of coccinellids were recorded a week later as compared to the other species.

INTRODUCTION
Parasitoids and predators have played a vital role in the biological control of many obnoxious pest species. Despite the fact that the cereal aphids do not cross the economic threshold level (Nawaz 2000), the recommendation for insecticide application against the cereal aphids in Pakistan (Ihasanul haq 1985, and Karimullah & Khawaja 1989) has created concern over the loss of biodiversity in the wheat agro ecosystem. The importance of the natural enemies associated with the cereal aphids has been acknowledged by Chambers and Sunderland (1983). Rautapaa (1976), Ba-Angood (1985) and Feng et al (1992) have also contributed to the studies of cereal aphids and their natural enemies.

Work in Pakistan on this aspect of cereal aphids’ control is at best sketchy. Most of it is done in the North West Frontier Province (NWFP) where Inayatullah and Karimullah (1997) identified five genera of the Braconid wasps. The earliest work of Gilani (1976), Mohyuddin (1981), and Shah (1985), on the presence of lady beetle; *Coccinella septumpunctata* in a large number of vegetation including *Hibiscus esculantus*, *Solanum melongena* and *Glycine max* paved the ways for more studies in this part of the world.

The present studies were initiated with the objectives to document the parasitoids and coccinellid predators associated with the cereal aphids, to study their population trends and to determine percent parasitism of the cereal aphids in Peshawar valley.

MATERIALS AND METHODS
Exhaustive surveys were conducted at five different locations of Peshawar valley during 2002-2003. The sampling sites included; Agricultural research farm malakandher (Site I), Ring Road Peshawar (Site II), Tarnab Agriculture Research Farm (Site III), Cereal crop research institute Pirsaab (CCRI) (Site IV), and Charsadda sugar mill (Site-V). Sampling was initiated in the mid February in all the aforementioned sites. Samples were collected at weekly intervals. Data on aphids, *Rhopalosiphum padi Schizaphis graminum* and *Sitobian avenae* and their parasitoids was recorded in one square meter of the wheat crop. Wheat fields were randomly selected and three samples were randomly taken from each field and means were calculated. In each field, all aphids irrespective of the species, were counted including the mummified ones. The mummies were kept in a transparent gelatinous capsule and brought to the laboratory for proper identification. The adults of the parasitoids were identified using the existing collection at the department of Plant Protection, NWFP Agriculture University Peshawar and using the modified key of Olsen et al (1993).

Among the predators, only adult of macro species of ladybird beetles were considered. Depending on size of the wheat field, two to three samples were taken, using a sweep net. The collected adults of coccinellid were identified and then released back into the field. Some of the specimens were brought to the laboratory for confirmation and record. After species confirmation, the data were analyzed using M-STAT-C package and using LSD test for means separation.

RESULTS
The results of parasitoids, are presented in (Fig-1), revealed that early in the beginning of season, there was no parasitism at any site despite a substantial
presence of aphids. The increase in parasitism was slow and gradual and seemed to be independent of aphids’ population. This trend continued till 9\textsuperscript{th} March, when greatest numbers of aphids were observed. At this time 9.62\% parasitism was recorded. From this time onward the parasitoids activities were on the rise and reached a peak level of 93.33\% on the 20\textsuperscript{th} day of April.

Among the five sites, highest percent of parasitism (40.23\%) was recorded at Charsadda sugar mill (site-V), followed by CCRI-Pirsabak, site-IV (35.69\%), ARI-Tarnab, site-III (30.11\%), Ring Road Peshawar site-II (30.38\%) and Malakander Research Farm, site-I (27.49\%). The lowest percent parasitism recorded at site-I (Malakander Research Farm) is obviously the effects of various kinds of pesticides used during the last four to five decades, which also include chlorinated hydrocarbons. In contrast, a very high percentage of parasitism (40.23) of the cereal aphid was recorded at site-V (Charsadda Sugar Mill). As most of the samples were collected from wheat grown in the Persimmon fruit orchards, where no chemical pesticides were used (personal observations), therefore this high level of parasitism could be attributed to the absence of pesticides. The most dominant species of parasitoids were *Aphidius colemani*, and *Aphidius ervi*. Parasitism by *Diaeretilla rapae* and *Aphidius morticaiae* was very low. Two unknown species of *Ephedrus* and *Praon* were also collected. The cereal aphids were evenly distributed throughout the Peshawar valley and so did the parasitoids.

The results of the four major coccinellids found during the wheat growing season are presented in Fig.2. *C. septumpunctata* was the predominant species. Its highest population was recorded on 16\textsuperscript{th} March where highest average number of *C. septumpunctata*, *M. sexmaculata*, *H. variegata* and *B. suturalis* was 99.55, 90.250, 35.500 and 16.250, respectively. The number declined gradually and reached the lowest ebb at the end of April, *M. sexmaculata* was the other dominant species while *H. variegata* and *B. suturalis* were present at a low level. Their peak populations were recorded a week later as compared to the other two major species.

**DISCUSSION**

Our findings are, to a greater extent, in conformity with other workers who reported 64\% parasitism of *R. padi* and 53.75\% of *S. graminum* (Abdul Rehman, et al 2000) from Southern Egypt. Sigsgaard (1997) reported 60\% parasitism in Barley and 30\% in wheat. In general, we observed moderate to high level of parasitism (27.49 \% and 40.23 \%). We believe that there exists a rich fauna of parasitoids and predators in Peshawar valley. The threshold for the cereal aphid is a very dynamic phenomenon and is influenced by varietals differences, growth stage, climatic conditions and prevalence of the natural enemies. Banangood and Stewart (1980) suggested control threshold of 8-16 aphid/tiller for Quebec, Canada while a control threshold of 25-30 aphid/tiller were proposed for California by Stern (1967). However Khan et al, 2006 reported 6 aphids/tiller. At this stage, it is recommended not to use insecticides against the cereal aphids as their enemies keep their number below the economic threshold.

We believe that the predators and parasitoids are showing signs of recovery after years of indiscriminate aerial and ground sprays. In Peshawar valley, parasitoids in the wheat crop become active after 15\textsuperscript{th} of February and their density is correlated with the peak population of aphid infestation. The most dominant species of the parasitoids are *Aphidius colemani* and *Aphidius ervi*. Diaretilla rapae and *Aphidius metricarae* are present in small number. Our results are in conformity with those of Inayatullah and Karimullah (1997) who reported almost the same hymenopterous parasitoids from the cereal aphid in Peshawar.

The predators, *Coccinella septumpunctata* is undoubtedly the predominant species of coccinellid throughout the Peshawar valley followed by *M. sexmaculata*. The other two species, though, less in number, are important simply due to their presence in the wheat ecosystem. Our studies indicate that there exist a rich fauna of parasitoids and predators in Peshawar valley. The discontinuation of aerial spray in the area has played a positive role in re-establishment of natural enemies. There is a great potential of using *C. septumpunctata* and *A. colemani* against the cereal aphids in Peshawar valley.
Fig. 1. Percent parasitism of cereal aphids during growing season (2002-03) of wheat crop at various sites in Peshawar valley.
Fig. 2. Average number of predatory coccinellids during growing season (2002-03) of wheat crop at various sites in Peshawar valley.
REFERENCES


Khan S.A; F.Ullah; and N.Hussain 2006. Screening of wheat genotypes against cereal aphids in wheat growing areas of NWFP. S.J.A.Vol.22.651-655.


Nawaz 2000 Insect pests of wheat and effect of fertilizer (NPK) on aphids population M.Sc Thesis presented to the department of Entomology Agricultural University Peshawar.

Ostman, O; Ekborn B. and Bengtsson J 2003. Yield increase attributable to aphid predation by ground-living polyphagous natural enemies in spring barley in Sweden, Ecological Economics 45,149-158.


