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Survey of Entomophagous Insects in Cotton Belt of Punjab, Pakistan

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Abstract: A survey was conducted in cotton belt of different areas of Punjab to know the present situation of the entomophagous insects through out the year. The following selective localities of Punjab were: Vehari, Multan, Melsi, Rahim Yar Khan, Bahawalpur and Sahiwal. Maximum average population in Vehari *Geocoris* was recorded followed by *Orius* and Spiders. In Multan *Orius* was recorded followed by Spiders, *Geocoris*, ants, predatory mite and *Chrysopa* sp. In Melsi Spiders was recorded followed by *Orius*, *Geocoris*, Ants, Predatory mite, *Chrysopa* sp. In Rahim Yar Khan *Orius* was recorded followed by Spiders, *Geocoris*, Ants, Predatory mite, *Trichogramma* sp. In Bahawalpur *Geocoris* was recorded followed by *Orius*, Ants, Spiders, *Chrysopa* sp., Predatory mite. In Sahiwal *Geocoris* was recorded followed by Spiders, *Orius*, Ants, Predatory mite, *Trichogramma* sp.

Key words: Survey, cotton, entomophagous insects

INTRODUCTION

Cotton (*Gossypium hirsutum* L.), a member of Malvaceae family, is the world most important fiber crop accounting for 48% of the yield trade in natural and synthetic fiber. Cotton fabrics dating back to 3000 BC were found in the Indus valley in Pakistan.

Pakistan is an important cotton and yarn producing country with potential to become a key force in the global cotton and textile market place. Cotton and cotton products contribute about 10% to GDP and 62.3% percent to the foreign exchange earnings of the country (Anonymous, 2003). It provides raw material to domestic cotton industry comprising 503 textile mills, 12139 ginning factories and 5000 oil expelling units. It has 85% share in total vegetable oil produced in the country. Cotton seed cake, an important by-product of cotton, is a valuable source of protein for ruminant cattle. In addition, 40% labour force of the country is employed in cotton fields and cotton processing mills (Mahmood, 1999). Keeping in view the above facts, cotton can rightly be considered as internationally trade crop and plays pivotal role in agriculture based economy of Pakistan.

Production of cotton is provisionally estimated at 10211 thousand bales for 2002-2003 which is 3.8% lower than last year. Cotton was cultivated on the area of 2796 thousand hectares (Anonymous, 2003). It is an ironic fact that despite notable increase in the production of cotton over the years, the quality of cotton has been declining. Certain factors like improper picking methods, adulteration of cotton with water and insect pests, mixed grades and seed varieties have all played their part. Coupled with improper packaging, storage and transportation (farm to market) means, the situation has resulted in an estimated loss of $350 million annually for the country. Average yield is 621 kg ha^{-1} which is lower than other cotton producing countries due to many reasons (Pakistan Central Cotton Committee, 2003).

Cotton with its green, succulent leaves, larger open flowers, nectarines on every leaf and flower, abundance of fruits attract and support a great variety of insect pests. The core of the problem facing the country's cotton industry has been absence of proper protection measures against insect pests. About 1362 insect species are known to occur on cotton crop in the world. In Pakistan also, nearly 148 insect species have been recorded on this crop. Out of which only 17 species of the insects recorded on cotton can be considered as major pests of cotton crop (Abbas, 2001).

They cause heavy qualitative and quantitative losses varying from 70.64% have been reported in Pakistan under various combinations and conditions (Ali and Mumtaz, 1997). According to an estimate in 1970, annual crop losses exceeding Rs. 6,000 crore are infected by pests of which insects cause 20% (Paroda, 1993).

In Pakistan, plant protection mainly revolving around the greater use of insecticides, however, it has played a major role in achieving high cotton production targets.

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The exhaustative and injudicious use of insecticides besides creating problem of health hazards and environmental pollution, has also resulted in the development of resistance in large number of insect pests (Mohyuddin *et al*., 1997; Soerjani, 1998). Indiscriminate use of pesticides kills the natural enemies resulting in flare up of pest population (Hamburg and Guest, 1997; Yousaf, 1996).

The huge amount of foreign exchange is spent on the import of pesticides every year. The import of pesticides were increased from 20678 matric tonns having 7721 million rupees in 2001 to 27103 metric tons having 6790 million rupees in 2002 (Anonymous, 2003).

Integrated pest management, a greener alternative to the conventional use of chemicals, is an attempt to promote natural, economic and sociological farming methods through the most effective combination of forming techniques and judicious and limited use of pesticides. The review of IPM demonstrated that, globally, researchers are seeking to develop and refine approaches that incorporate the three major principles of integrated pest management, productivity, profitability and ecological soundness into cotton production system. The sole reliance on pesticides create a lot of problems such as pesticide resistance in pests, pest resurgence, secondary pest out break, increasing cast of pesticides, pesticide residues in food, ill effect on non target organisms and environmental pollution, etc. These maladies of injudicious use of pesticides have forced workers to turn toward biological control as an environmental friendly method of pest control. Biological control now forms an integral part of pest management and alternative for chemical control (Vaishshali and Sathe, 2003).

Rahman and Munir (1989) worked on the development of integrated pest management, pesticide treatments and their effects on cotton crops and the potential of natural enemies of insect pests. The biological control has been economically successful and ecologically sound in modern progressive and intensive agriculture. According to Romeis and Shanower (1996) and Ahmed *et al.* (1998) *Trichogramma* sp. has been the great potential to control bollworms in cotton IPM. Under IPM, biological control of insect pests through their predators and parasites are internationally recognized approaches. In the same way, the biological control, the most compatible technique is an internationally recognized approach of IPM. For this purpose, effective parasites and predators of the pests are available in nature, which can play an important role for the suppression of pests, if properly utilized.

Twenty three species of predators from cotton fields in Multan area consisting of four arachnids, ten Coccinellids, Chrysopids, lygaeid, anthocorid and three formicids (Cheema *et al*., 1980).

The predators being a major segment of biological control, scattered in about 167 families of 14 orders of class insecta (Sathe and Bhosle, 2001).

Mohyuddin (1981) reported different species of predators and parasites from Pakistan. These predators and parasites control different pests of cotton like pink bollworm, spotted bollworm, leaf roller, american bollworm and cotton whitefly. Some of these entomophagous insects are *Apenteles* sp., *Bracon gelechaie*, *B. greeni*, *B. hebetor*, *Chrysopa carnea*, *Geocoris tricolor*; *Rhynocoris fuscipes*. Mohyuddin and Habib (1977) showed that during the investigation, 15 species of the parasites and 57 of the predators and 2 of pathogens were recorded to attack pink bollworm. The natural fauna of entomophagous insects of pink bollworm in Pakistan is deficient in egg and egg larval parasites. Habib and Muhyuddin (1981) had reported 27 species of parasites in Pakistan. The important parasites reported include *Elasmus johnstoni* Ferr. (Elasmidae); *Bracon greeni* Ash., *Rogas restaceus* Spinola (Braconidae) and *Gorryphus nursci* Cam. (Ichneumonodae). Khuhro *et al*. (2002) surveyed cotton and alfalfa fields at the experimental field of Integrated Pest Management (IPM), Agriculture Research Institute (ARI) Tandojam, during June to September 2000. They recorded that twelve predators were recorded *Campylomma nicolasi*, *Brumus suturalis*, *Staphylinid hutchinsoni*, *Paederus fuscipes*, *Coccinella undecimpunctata*, *Orius laevigatus*, *Chrysoperla carnea*, *Geocoris tricolor*, *Formicomus antiqumus*, *Laius malleifer*, *Delta* sp. and Spider. Keeping in view the endeavor of aforementioned researchers, this project was planed to explore the entomophagous insects in cotton belt.

MATERIALS AND METHODS

The collection of Entomophagous insects had been done from cotton belt of Punjab.

Study area: The study was conducted in the cropping regions of cotton through out the year 2004-05.The following selective localities of Punjab were: Vehari, Multan, Melsi, Rahim Yar Khan, Bahawalpur and Sahiwal.

In each locality, a plot of 10 acres was selected. For comprehensive survey, the data was recorded randomly from 2 acres in each locality on fortnightly basis and the data was recorded. The meteorological data was recorded for each collection day in each locality.

Study materials: The Entomophagous insects of cotton belonging to various orders were collected for survey in each locality.

Collection: Different collection techniques were used to collect the entomophagous insects of cotton. These entomophagous insects include immature stages and their adults from different habitat. The collection was made randomly by aspirator, sweep netting, hand picking, leaf beating and light trapping.

A light trap with electric bulb emitting white light at a height of four feet from the ground level was put up once a fortnight in an open place near cotton fields. The light trap was operated from dusk to dawn. All the collected entomophagous insects were killed next morning.

Net sweeping with hand nets was done for entomophagous insects present in the canopy of the crop for an hour time from each area to collect the data. It was done randomly throughout the experimental sites without dividing the area or selecting the sub-area.

Aspirator with small 16 volts battery was used to collect the small and minute parasitoids from different parts of cotton crop.

Preservation: Collection was done on fortnightly basis in each locality. The specimens for each and every collection day were treated separately. The collected mature specimen were killed in a cyanide killing bottle, pinned, set, labeled and mounted in collection boxes for the safety of the collected specimen. The collected immature specimen and soft-bodied specimens were put into vials containing 70% alcohol for count. Each collection made on fortnight intervals was labeled accordingly containing date of collection, locality name, common name, technical name of the specimen.

Identification: Collected specimens were identified in the laboratory side by side with the help of available material. For identification, microscope with high magnification and different taxonomic keys were used.

RESULTS AND DISCUSSION

Data regarding the average population density of different predators and parasitoids in the agro ecosystem of Vehari, Multan, Melsi, Rahim Yar Khan, Bahawalpur and Sahiwal is collected from five localities each SP_1, SP_2, SP_3, SP_4 and SP_5 from the months of August to October is given in Table 1. Maximum average population of *Geocoris* (7.2 collected/25 plants) was recorded from Vehari followed by *Orius* (7.0 collected/25 plants), Spiders (7 collected/25 plants), Ants (6.6 collected/25 plants), Predatory mite (5.6 collected/25 plants), *Chrysopa* sp. (4.4 collected/25 plants), whereas from Multan, maximum average population of *Orius* (8.4 collected/25 plants) was recorded followed by Spiders (8.0 collected/25 plants), *Geocoris* (7.4 collected/25 plants), Ants (7.4 collected/25 plants), Predatory mite (6.6 collected/25 plants), *Chrysopa* sp. (5.4 collected/25 plants), while in Melsi maximum average population of Spiders (7.8 collected/25 plants) was recorded followed by *Orius* (8.0 collected/25 plants), *Geocoris* (7.8 collected/25 plants), Ants (7.8 collected/25 plants), Predatory mite (6.6 collected/25 plants),

Table 1: Data regarding the average climatic factors and average population of Entomophagous insects recorded from cotton belt during the period of 3 months i.e., August, September and October

		Vehari	Multan	Melsi	Rahim Yar Khan	Bahawalpur	Sahiwal
	August	41.83	38.36	43.166	42.06	40.10	43.16
	September	77.00	69.60	75.33	75.80	74.46	75.00
	October	26.66	28.86	30.00	01.60	24.00	12.60
Lady bird beetle		4.2	4.6	4.4	4.6	4.8	3.8
Orius		7.0	8.4	8.0	8.6	7.4	6.6
Geocoris		7.2	7.4	7.8	8.4	7.6	7.0
Chrysopa sp.		4.4	5.4	5.6	5.4	5.2	4.0
Dragonfly		2.6	3.6	3.2	3.2	3.6	3.0
Damselfly		3.6	2.4	2.6	3.4	3.0	2.2
Syrphid fly		2.2	1.6	2.4	2.4	2.4	1.6
Campyloma		3.6	4.0	3.6	3.6	3.6	3.6
Damsel bug		0.6	0.6	0.6	0.8	0.6	0.8
Assassin bug		3.2	3.4	3.6	3.4	3.6	4.4
Trichogramma sp.		4.2	5.0	5.2	5.6	4.2	5.0
Encarsia sp.		2.0	2.4	2.6	3.2	2.4	2.4
Eretemocerus sp.		1.8	2.2	2.2	2.6	2.2	1.8
Bracon sp.		3.8	5.2	5.6	5.4	4.4	3.6
Apenteles sp.		0.6	0.6	0.6	0.8	0.6	0.8
Predatory mite		5.6	6.6	6.6	6.8	5.2	5.6
Spider		7.0	8.0	8.4	8.6	6.2	7.0
Ant		6.6	7.4	7.8	7.4	6.6	6.6
Yellow wasp		2.2	2.0	2.8	2.6	2.4	2.2
Red wasp		1.2	1.4	1.6	1.4	1.4	1.0

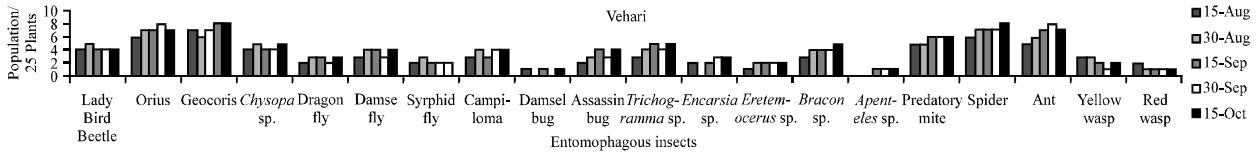

Fig. 1: Relation of population fluctuation trend of different entomophagous insects in Vehari with different observation dates

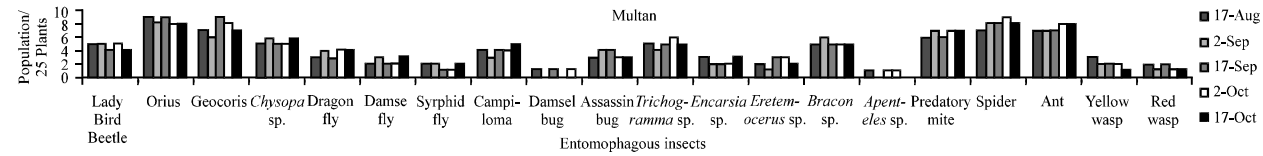

Fig. 2: Relation of population fluctuation trend of different entomophagous insects in Multan with different observation dates

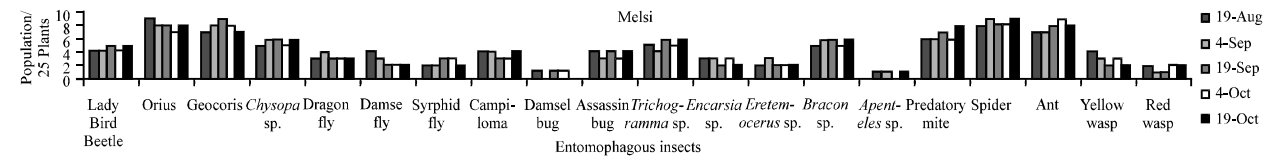

Fig. 3: Relation of population fluctuation trend of different entomophagous insects in Melsi with different observation dates

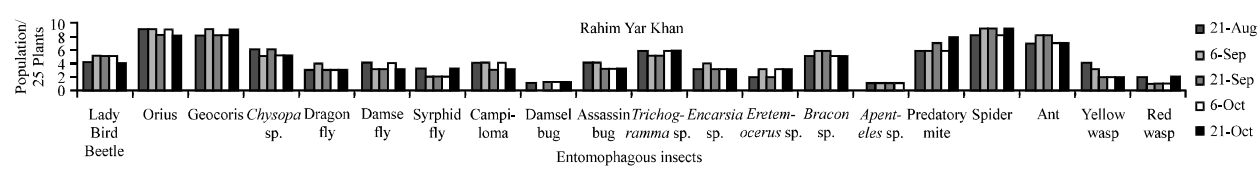

Fig. 4: Relation of population fluctuation trend of different entomophagous insects in Rahim Yar Khan with different observation dates

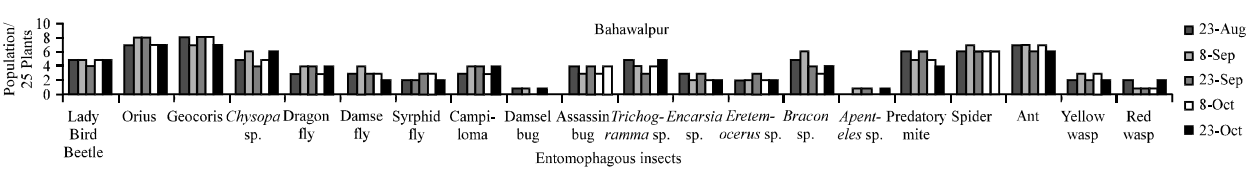

Fig. 5: Relation of population fluctuation trend of different entomophagous insects in Bahawalpur with different observation dates

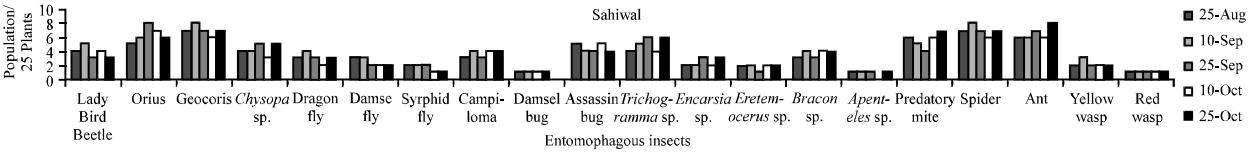

Fig. 6: Relation of population fluctuation trend of different entomophagous insects in Sahiwal with different observation dates

Chrysopa sp. (5.6 collected/25 plants), whereas in Rahim Yar Khan maximum average population of *Orius* (8.6 collected/25 plants) was recorded followed by Spiders (8.6 collected/25 plants), *Geocoris* (8.4 collected/25 plants), Ants (7.4 collected/25 plants), Predatory mite (6.8 collected/25 plants), *Trichogramma* sp. (5.6 collected/25 plants) while in Bahawalpur maximum average population of *Geocoris* (7.6 collected/25 plants)

was recorded followed by *Orius* (7.4 collected/25 plants), Ants (6.6 collected/25 plants), Spiders (6.2 collected/25 plants), *Chrysopa* sp. (5.2 collected/25 plants), Predatory mite (5.2 collected/25 plants) and while in Sahiwal maximum average population of *Geocoris* (7 collected/25 plants) was recorded followed by Spiders (7.0 collected/25 plants), *Orius* (6.6 collected/25 plants), Ants (6.6 collected/25 plants), Predatory mite (5.6 collected/25 plants), *Trichogramma* sp. (5.0 collected/25 plants) in descending order, respectively (Table 1).

The results of these data showed that predators are more dominant as compared to parasitoids.

The finding of these studies is at par with Mohyuddin and Habib (1977), Irshad (2003), Khuhro *et al.* (2002), Mohyuddin (1981) and Attique *et al.* (2001). Among all these entomophagous arthropods *Orius* bug, *Geocoris* bug, Spiders and Ants were found to be more active in the growing season of cotton. This showed the high adoptability to the agro-climatic conditions and the farming system so these can be collected, mass reared and used in IPM program of cotton to reduce the number of the sprays in the cotton crop. The low population density of other entomophagous arthropods may be attributed to the high susceptibility towards chemicals being sprayed blindly on cotton crop, to unability to get adopted and climatic conditions prevailed in cotton belt. Area wise variation in population densities of these entomophagous arthropods may be due to different cropping patterns (Dhaliwal and Arora, 2003, Mohyuddin, 1994, Pillai *et al.*, 1993). Figure 1-6 showed the trend of population build up of almost all the entomophagous arthropods in all localities are the same during the observation period ranging from August to October.

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