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## Survey and monitoring of pests, parasites and predators of pulse crops in central and eastern Uttar Pradesh

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### A B S T R A C T

A survey was conducted in chickpea, pigeonpea and lentil crops in different districts of Uttar Pradesh. A total of 22 districts were surveyed to record gram pod borer *Helicoverpa armigera*, Bihar hairy caterpillar, *Spilarctia obliqua*, plant hopper of *Pentatomorpha* group, termite *Odontotermes* spp, and cut worm *Agrotis ipsilon* in chickpea whereas *Campoplex chloridis* was recorded as natural enemy feeding on *H. armigera* larvae. In pigeonpea crop, mainly *H. armigera*, leaf webber *Grapholita* (*Cydia*) *critica*, *Mylokeres* spp, spotted pod borer *Maruca testulalis*, plume moth *Exelastis atomosa*, tur pod bug *Clavigralla gibbosa*, jassid *Amrasca bigutula*, termite *Odontotermes* spp, green bug *Nezara viridula*, tur podfly *Melanogromyza obtusa*, blue butterfly *Lampides boeticus*, cow bug *Tricentrus bicolor* and *Pentatomorpha* bug were recorded while on lentil crop, black aphid, *Aphis craccivora* was recorded as major pest and *H. armigera* and cut worm *Agrotis ipsilon* as minor pests. 20 insect pests and a total number of 16 parasites and predators were observed in these crops during the period of study. The bio-agents recorded belonged to Order Dictyoptera, Neuroptera, Hemiptera, Hymenoptera, Diptera and Coleoptera.

**Keywords:** Chick pea, pigeon pea, lentil, *Helicoverpa armigera*, parasite, predator, pests

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### Introduction

Diverse array of pests, parasites and predators in the pulse ecosystem have long been investigated in India. The pests play an important role in the legume production of the country. *Helicoverpa armigera* Hubner causes major damage to pigeonpea in South and Central India but has been found causing extensive damage in North India (Gowda & Sharma 2005). The changing climate, use of artificial means of propagation, high doses of fertilizers and pesticides have all created an atmosphere which may enable other insects to turn pests. Resistance to a variety of insecticides, crop infestation, all round availability of food and introduction of new crops have added their ability to cause significant yield reduction in several pulse

crops. 80 per cent damage in chickpea has been reported from India and Pakistan (Ahmed *et al.* 1990). Conservation of natural enemies play an important role in Integrated Pest Management Programme of pulses, as use of natural enemies is one of the alternatives of pest management strategies.

### Materials and Methods

An extensive survey was conducted in 107 villages of 22 districts of Uttar Pradesh during December 2008 till May 2009, to observe the insect pest infestation in chickpea, lentil and pigeonpea fields in the major pulse growing areas. The insects were collected from four different fields in each location by sweeping, for minute insects and handpicking method for

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larger lepidopteran adults and immature stages (Paulraj and Ignacimuthu 2008). The observations were recorded in the morning. In some cases sampling was done by randomly selecting 10 plants/ plot and eggs and larval stages of moths were collected and reared on their natural host in the laboratory until the adult emergence. The field collected insects were brought to the laboratory for identification and preservation. The pest larvae were collected from the field to look for the parasitisation in the laboratory conditions. The I- IV instar larvae were collected randomly from unsprayed pulse fields at weekly intervals from December 2008 to May 2009. Larvae collected from field were reared individually in specimen tubes and fresh leaves and pods were provided daily to the larvae till the pupation or mortality due to parasitisation occurred. The parasitized larvae were examined for the emergence of parasitoids.

The pests, parasites and predators thus collected were identified at University level; those unidentified were sent for identification to Indian Agricultural Research Institute, New Delhi.

## Results

A total number of 20 insect pests and 16 natural enemies were recorded during December 2008 to May 2009, but after March 2009, the population declined (Table 1). It is evident that in chickpea mainly *H. armigera* was recorded in all the districts surveyed but in the eastern U.P. districts like Azamgarh and Gazipur, Pentatomorpha bug was recorded while cut worm *Agrotis ipsilon* was found on chickpea crop in Mirzapur and Sonbhadra districts. The

incidence of insect pests of pigeonpea showed a great variation in different districts. Major pests recorded were, gram pod borer *H. armigera*, pod fly *M. obtusa*, blue butterfly *Lampides boeticus* and plant sucking bug *Clavigralla gibbosa*. Termite *Odontotermes* spp. were recorded from 9 districts under survey while leaf webber, *G. critica* was recorded in 7 districts of eastern Uttar Pradesh. Lentil was surveyed for insect pests in 18 districts as the crop was absent in 4 districts. The major pest in this crop was found to be black aphid *A. craccivora*. The collection of pests indicates that pod borer complex and termites were major pests at all locations in chickpea and pigeonpea growing areas. However, semilooper *Autographa nigrisigna* and black aphid *Aphis craccivora* were recorded in lentil crop.

As regards natural enemies, *C. chloridae* was found parasitising *H. armigera* under chickpea cultivation. In pigeonpea, however, *Apanteles* spp, such as, *A. glomeratus*, *T. chilonis* and coccinellid beetles were found parasitizing and predating different pests. Five species of coccinellids, mantids and *Lycosa* and *Paradosa* spiders were found associated with pigeonpea pests. Table 2 shows the pests and natural enemies recorded during the period of investigation. Maximum numbers of pests were recorded in the month of January-February 2009, while the peak period of activity of parasites and predator was recorded in March 2009.

## Discussion

During December 2008 to May 2009, a total twenty pest insects were recorded on chickpea,

pigeonpea and lentil crops, in 22 districts of Uttar Pradesh. These findings endorse the reports by Sachan and Lal (1997), who reported pests belonging to Lepidoptera, Coleoptera, Diptera and Hemiptera in chickpea and pigeonpea crops.

The survey of parasitoids revealed that larvae of *Helicoverpa armigera* and other lepidopterous pests were parasitized by *C. chloridae*, Brachonids, Syrphids and Tachinids. Singh *et al.* (1991) reported two ichneumonids emerging out from larvae of *H. armigera* which caused up to 63.33 per cent parasitisation in Bengal gram. Vast variety of braconids are typical parasitoid of larval stages of Lepidoptera, Coleoptera, Diptera and Hemiptera (Yusuf & Ray 2009). The Tachinid fly parasitisation recorded from pupae of *H. armigera* in the present study coincides with reports of 20% reduction in *H. armigera* due to Tachinid fly (Bisen & Deotale 2008).

As the crop matured, the pest population declined after March due to the fact that the predators were in abundance. Among the natural enemies, parasitoid *Campoletis chloridae*, *Apanteles glomeratus*, *Trichogramma chilonis*, tachinid fly, *Syrphus* spp. and braconid wasps (unidentified) were recorded at different stages of pests while species of coccinellids and mantids were noticed predating upon aphids and other pests. In the present study, *Campoletis chloridae* was the most important parasitoid, the activity of which was the highest from January to March 2009. Other parasitoids were very low in activity parasitising only a few number of host

larvae during their peak population. This observation was supported by Devi *et al.* (2002) who reported peak activity of larval parasitoid on field collected larvae of March while pupal parasitoid was recorded on January collected pupae. The parasitisation of *C. chloridae* was density dependent which was endorsed by Gupta & Raj (2003). These parasitoids play an important role in the effective management of several pulse crops. The contribution of native parasitoids is often ignored. Taxonomic studies of such parasitoids, their host record and distribution of recorded species is very important.

It is apparent from the data that peak period for pest larval activity in field preceded the activity of parasites and predators. The activity of pests peaked in the month of January when the crop was at flowering and podding stage and later it declined as the crop matured. Therefore it is imperative to suggest chemical control of early instars of pests mainly of *H. armigera*, during December, with least or no adverse effects on parasitoid complex and predator activity. The present study on the pest complex of pulses would help in better conservation of natural enemies of pests and developing the ecologically sound pest management.

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**Table 1**

Insect-pests and natural enemies on chick pea, pigeon pea and lentil recorded in different districts of U.P. during 2008-2009

Districts	Insect-Pests			Natural enemies		
	Chick pea	Pigeon pea	Lentil	Chick pea	Pigeon pea	Lentil
Kaushambi	<i>Helicoverpa armigera</i>	<i>Helicoverpa armigera</i> , <i>Melanagromyza obtusa</i> , <i>Lampides boeticus</i>	<i>Helicoverpa armigera</i> <i>Aphis craccivora</i>	<i>Campoletis chloridae</i>	Coccinellid <i>Cheilomenis sexmaculata</i> , Spider, <i>Apanteles</i> sp., <i>Trichogramma chilonis</i>	Nil
Allahabad	<i>H. armigera</i>	<i>Odontotermes</i> spp.	<i>H. armigera</i>	Coccinellidae beetle	<i>Coccinella septempunctata</i> , <i>Apanteles</i> sp., Spider	Nil
Mirzapur	<i>H. armigera</i> , <i>Agrotis ipsilon</i> , <i>Odontotermes</i>	<i>Lampides boeticus</i>	<i>H. armigera</i> <i>Aphis craccivora</i>	<i>Campoletis chloridae</i>	-	Nil
Sonbhadra	<i>H. armigera</i> , <i>Agrotis ipsilon</i>	<i>M. obtusa</i> , <i>H. armigera</i>	<i>Agrotis ipsilon</i>	<i>Campoletis chloridae</i>	Spider, Coccinellids, <i>Apanteles</i> spp.	Nil
Varanasi	<i>H. armigera</i>	<i>M. obtusa</i> , Pentatomurpha bug/	<i>H. armigera</i>	-	Coccinellids, <i>Apanteles</i> spp.	Nil

Districts	Insect-Pests			Natural enemies		
	Chick pea	Pigeon pea	Lentil	Chick pea	Pigeon pea	Lentil
Azamgarh	Plant hopper, <i>Pentatomarpha</i> bug	Plant sucking bug, <i>Clavigralla</i> spp, plant hopper, <i>Pentatomarpha</i> bug <i>Odontotermes</i> spp.	Nil	-	<i>C. septempunctata</i> , Spider	Nil
Ghazipur	<i>H. armigera</i> , <i>Pentatomarpha</i> bug	<i>Pentatomarpha</i> bug <i>Clavigralla gibbosa</i>	Nil	<i>Campoletis chloridae</i>	-	Nil
Jaunpur	<i>H. armigera</i>	<i>M. obtusa</i> , <i>Odontotermes</i> spp.	Nil	-	<i>Apanteles</i> spp., Coccinellids	Nil
Bhadohi	-	<i>H. armigera</i> , <i>Odontotermes</i> spp. <i>M. obtusa</i>	Nil	-	Spider Coccinellids, <i>Apanteles</i> spp.,	Nil
Kanpur Nagar	<i>H. armigera</i> , <i>Odontotermes</i> spp.	<i>Lampides boeticus</i> , <i>Nezara viridula</i> ,  <i>Ferrisiana virgato</i> , <i>M. obtusa</i> , <i>H. armigera</i> , <i>Amrasca biguttula</i> , <i>Henosepilachna vigintioctopunctata</i>	<i>Aphis craccivora</i>	Coccinellids, <i>C. chloridae</i> , Tachinid fly <i>Mantis religeosa</i>	<i>C. septempunctata</i> , <i>Anegleis cardoni</i> , <i>C. transversalis</i> , <i>Chilomenes sexmaculata</i> , Spider	<i>Campoletis chloridae</i>
Fatehpur	Bihar hairy caterpillar <i>Spilarctia obliqua</i> , <i>H. armigera</i>	<i>Amrasca biguttula</i> , <i>Lampides boeticus</i> , thrips, <i>Pentatomorpha</i> bug, <i>Aphis craccivora</i> , <i>Melanagromyza obtusa</i>	Crop absent	<i>C. chloridae</i>	<i>Coccinella septempunctata</i> , <i>Eocanthecona furcellata</i> , spider	-
Unnao	<i>H. armigera</i>	<i>Melanagromyza obtusa</i> , <i>H. armigera</i> , <i>Amrasca biguttula</i> , <i>Lampides boeticus</i> , <i>Odontotermes</i> spp. Long horned grasshopper <i>Attractomorpha crenulata</i> , Gujhia weevil	<i>Aphis craccivora</i> , <i>Odontotermes</i> sp., <i>H. armigera</i>	<i>C. chloridae</i> , Tachinid fly	Spider, <i>Apanteles flavipus</i>	<i>Campoletis chloridae</i>
Auraiya	<i>H. armigera</i>	<i>Tricentrus bicolor</i> , <i>Lampides boeticus</i> , <i>M. obtusa</i> , <i>H. armigera</i> , <i>Nezara viridula</i> <i>Odontotermes</i> spp. <i>Amrasca biguttula</i>	Crop absent	<i>C. chloridae</i>	<i>Mantis religeosa</i> , <i>C. transversalis</i>	Nil
Etawah	<i>H. armigera</i>	<i>M. obtusa</i> , <i>Amrasca biguttula</i> <i>Tricentrus bicolor</i>	Crop absent	<i>C. chloridae</i>	<i>Chilomenes sexmaculata</i>	Nil

Districts	Insect-Pests			Natural enemies		
	Chick pea	Pigeon pea	Lentil	Chick pea	Pigeon pea	Lentil
Kanpur Dehat	<i>H. armigera</i> Termite ( <i>Odontotermes</i> spp.)	<i>Melanagromyza obtusa</i> , <i>Amersca biguttula</i> , <i>Lampides boeticus</i>	Crop absent	<i>C. chloridae</i>	-	Nil
Barabanki	<i>H. armigera</i>	Leaf webber <i>Grapholita critica</i> , <i>Tricentrus bicolor</i> , <i>Nezara viridula</i> , <i>M.</i> <i>obtusa</i> , <i>H. armigera</i>	<i>Aphis</i> <i>craccivora</i>	<i>C. chloridae</i>	<i>C.</i> <i>septempunctata</i> , <i>C. transversalis</i>	Nil
Sultanpur	<i>H. armigera</i>	<i>Grapholita critica</i> , <i>Lampides boeticus</i> , <i>Tricentrus bicolor</i> , <i>Nezara viridula</i> , <i>M.</i> <i>obtusa</i> , tree hopper, <i>H. armigera</i>	<i>Aphis</i> <i>craccivora</i>	<i>C. chloridae</i>	Spiders, <i>Mentispa</i> <i>indica</i> , <i>Apanteles</i> , <i>Coccinella</i> spp., Braconids	Nil
Gonda	<i>H. armigera</i>	<i>Grapholita critica</i> , <i>Odontotermes</i> spp., <i>Lampides boeticus</i> , <i>Tricentrus bicolor</i> , <i>Nezara viridula</i> , <i>M.</i> <i>obtusa</i> , <i>Mylllocerus</i> spp., <i>Exelastis Atomosa</i> , <i>H. armigera</i>	<i>Aphis</i> <i>craccivora</i>	Crop absent	<i>Apanteles</i> , <i>Coccinella</i> spp., Spider	Nil
Hardoi	<i>H. armigera</i>	Leaf webber, Termite, <i>H. armigera</i>	<i>Aphis</i> <i>craccivora</i>	<i>C. chloridae</i>	Spider, <i>Coccinella</i> spp.	Nil
Sitapur	<i>H. armigera</i>	<i>Grapholita critica</i> , <i>Odontotermes</i> , <i>Lampides</i> <i>boeticus</i> , <i>Tricentrus</i> <i>bicolor</i> , <i>Nezara viridula</i> <i>M. obtusa</i> , <i>H. armigera</i>	<i>Aphis</i> <i>craccivora</i>	<i>C. chloridae</i>	<i>Coccinella</i> spp., Spider, <i>Mentispa</i> <i>indica</i> , Rove beetle	Nil
Bahraich	Crop absent	<i>Grapholita critica</i> , <i>Odontotermes</i> , <i>Lampides</i> <i>boeticus</i> , <i>Nezara</i> <i>viridula</i> , <i>M. obtusa</i> , <i>Exelastis atomosa</i> , <i>Myllabris</i> spp., <i>H. armigera</i> , <i>Dysdercus</i> <i>cingulatus</i>	<i>Aphis</i> <i>craccivora</i>	Crop absent	Rove beetle, Spider, <i>Coccinella</i> spp., <i>Apanteles</i>	Nil



**Table 2:**

Pests/predators/parasitoids collected during *rabi* 2008-09 in different districts of Uttar Pradesh

Month/Year	Pests/Parasites/Predators	Order	Family	Host
<b>December 2008</b>	<b>Pests</b>			
	1. <i>Helicoverpa armigera</i>	Lepideptera	Noctuidae	Chick pea
	2. <i>Agrotis ipsilon</i>	Lepidoptera	Noctuidae	Chick pea
	3. <i>Aphis craccivora</i>	Hemiptera	Aphididae	Pigeon pea
	4. <i>Attractomorpha crenulata</i>	Orthoptera	Tettigonidae	Pigeon pea
	5. <i>Heiroglyphus</i> sp.	Orthoptera	Acrididae	Pigeon pea
	6. <i>Melanagromyza obtusa</i>	Diptrea	Agromyzidae	Pigeon pea
	7. <i>Odontotermes obesus</i>	Isoptera	Termitidae	Chick pea & Pigeon pea
	8. <i>Lampides boeticus</i>	Lepidoptera	Lycaenidae	Pigeon pea
	9. <i>Amrasca bigutulla</i>	Hemiptera	Cicadellidae	Pigeon pea
	10. <i>Grapholita critica</i>	Lepidoptera	Trtricidae	Pigeon pea
	11. <i>Myllabris postulata</i>	Coleoptera	Membracidae	Pigeon pea
	<b>Predators</b>			
	1. <i>Coccinella septempunctata</i>	Coleoptera	Coccineleidae	Aphids
	2. <i>Coccinella transversalis</i>	Coleoptera	Coccineleidae	Aphids
	3. <i>Mantisopa indica</i>	Neuroptera	Mantispidae	Aphids, Jassids, hoppers
<b>January 2009</b>	<b>Pests</b>			
	1. <i>Clavigralla gibbossa</i>	Hemiptera	Phyrhocoridae	Pigeon pea
	2. <i>Bagrada cruciferarum</i>	Hemiptera	Pentatomidae	Lentil
	3. <i>Tanymecus indicus</i>	Coleoptera	Curculionidae	Chick pea & Pigeon pea
	4. <i>Tricentrus bicolor</i>	Hemiptera	Membracidae	Pigeon pea
	5. <i>Aphis Crassivora</i>	Hemiptera	Aphididae	Lentil
	6. <i>H. armigera</i>	Lepidoptera	Nuctuidae	Chick pea
	7. <i>Melanogromyza obtusa</i>	Diptera	Agromyzidae	Pigeon pea
	8. <i>Clavigralla gibbossa</i>	Hemiptera	Coridae	Pigeon pea
	9. <i>Agrotis ipsilon</i>	Lepidoptera	Nuctuidae	Chick pea
	10. <i>Autographa nigrisigna</i>	Lepidoptera	Nuctuidae	Lentil
	11. <i>Dytsdercus cingulatus</i>	Hemiptera	Pyrhocoreidae	Pigeon pea
	12. <i>Spilarctia obliqua</i>	Lepidoptera	Arctidae	Pigeon pea
	13. <i>Attractomorpha crenulata</i>	Orthoptera	Tettigonidae	Pigeon pea
	<b>Parasites and predators</b>			
	1. <i>Coccinella</i> sp.	Coleoptera	Coccineleidae	Aphids
	2. Tachinid fly	Diptera	Tachi nidae	Pupal parasite
	3. <i>Trichogramma chilonis</i>	Diptera	Trichogrammatidae	Egg parasite
<b>February 2009</b>	<b>Pests</b>			
	1. <i>Aspongopus janus</i>	Hemiptera	Pentatomidae	Pigeon pea
	2. <i>H. armigera</i>	Lepidoptera	Noctuidae	Chick pea
	3. <i>Sphenoptera</i> spp.	Coleoptera	Buperestidae	Pigeon pea
	4. Carabid beetle	Coleoptera	Carabidae	Pigeon pea & Lentil

Month/Year	Pests/Parasites/Predators	Order	Family	Host
	5. <i>Aphis crassivora</i>	Hemiptera	Aphididae	Lentil
	6. <i>Nezara viridula</i>	Hemiptera	Penatomidae	Pigeon pea
	7. <i>Mylocerus undecimpustulatus</i>	Coleoptera	Curculionidae	Chick pea & Pigeon pea
	8. <i>Clavigralla gibbosa</i>	Hemiptera	Coreidae	Pigeon pea & Lentil
	9. <i>Agrotis ipsilon</i>	Lepidoptera	Noctuidae	Chick pea
	10. <i>Tricentrus bicolor</i>	Hemiptera	Membracidae	Pigeon pea
	11. <i>Odontotermes obesus</i>	Isoptera	Termitidae	Chick pea & Pigeon pea
	12. <i>Henosepilachna vigintioctopunctata</i>	Coleoptera	Coccinellidae	Pigeon pea
	13. <i>Pentatomomorpha</i> bug	Hemiptera	Coreidae	Pigeon pea
	<b>Parasites and Predators</b>			
	1. <i>Syrphus</i> spp.	Diptera	Syrphidae	Pest larvae
	2. Braconid wasp	Hymenoptera	Braconidae	Pest larvae
	3. <i>Eucelatoria bryani</i>	Diptera	Tachanidae	Pupal parasite
March 2007	4. <i>Apanteles</i> sp.	Hymenoptera	Braconidae	Pest larvae
	5. <i>Trichogramma chilonis</i>	Diptera	Trchogrammatidae	Egg parasite
	<b>Pests</b>			
	1. <i>H. armigera</i>	Lepidoptera	Noctuidae	Chick pea
	2. <i>Exelastix atomaria</i>	Lepidoptera	Pterophoridae	Chick pea & Pigeon pea
	3. <i>Fericiaria virgata</i>	Hemiptera	Coccidae	Pigeon pea
	4. <i>Melanogromyza obtusa</i>	Diptera	Agromyzidae	Pigeon pea
	5. <i>Aphis crassivora</i>	Hemiptera	Aphididae	Lentil
	<b>Parasites and Predators</b>			
	1. <i>Campolatis chloridae</i>	Hymenoptera	Ichneumonidae	
	2. <i>Coccinella septempunctata</i>	Coleoptera	Coccineidae	Aphids
	3. <i>Anegeis cardoni</i>	Coleoptera	Coccineidae	Aphids
	4. <i>Coccinella transversalis</i>	Coleoptera	Coccineidae	Aphids
April 2009	5. <i>Chilomenes sexmaculata</i>	Coleoptera	Coccineidae	Aphids
	6. <i>Lycosa</i> sp.	Araneida	Lycosidae	Adult insects
	<b>Pests</b>			
	1. <i>H. armigera</i>	Lepidoptera	Noctuidae	Chick pea
	2. <i>Exelastix atomaria</i>	Lepidoptera	Pterophoridae	Pigeon pea
	3. <i>Melanogromyza obtusa</i>	Diptera	Agromyzidae	Pigeon pea
	<b>Parasites and Predators</b>			
	1. <i>Campolatis chloridae</i>	Hymenoptera	Ichneumonidae	<i>H. armigera</i>
	2. <i>Apanteles</i> sp.	Hymenoptera	Braconidae	Pest larvae
	3. <i>Eucelatoria bryani</i>	Diptera	Tachinidae	Pupal parasite
	4. <i>Paradosa</i> sp.	Araneida	Lycosidae	Adult insect
May 2009	<b>Pests</b>			
	1. <i>H. armigera</i>	Lepidoptera	Noctuidae	Chick pea
	2. <i>Melanogromyza obtusa</i>	Diptera	Agromyzidae	Pigeon pea
	<b>Parasites and Predators</b>			
	1. <i>Apanteles</i> sp.	Hymenoptera	Braconidae	Pest larvae
	2. <i>Eucelatoria bryani</i>	Diptera	Tachinidae	Pupal parasite
	3. <i>Mantis religiosa</i>	Dictyoptera	Mantidae	Small insects