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INSECT FAUNA ASSOCIATED WITH GREEN PEA CROP IN MANSEHRA DISRICT KPK PAKISTAN

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Key words:
Mansehra, Prevailing, Pest species, Predators, Dipterous, Butterflies.

ABSTRACT

This research study was conducted in district Mansehra to dig out the insect fauna prevailing in the fields of Green Pea in different localities of District Mansehra. A total of 22 different insect species were collected belonging to 6 orders, 11 families and 22 genera. These include 2 pest species, 5 predator species and 14 pollinator species. Pest insect's i-e Pea leaf Minor and Cow Pea aphid is more abundant than predators and pollinators. Among pest infestation of pea leaf minor was found more injurious with 34.90% than cow pea aphid (7.85%). Among predators *Coccinella septumpunctata* was found highly abundant 49.09% population. A reasonable amount of pollinators species (14) was found active in the pea cropping areas which include some important Dipterous flies and Butterflies.

1. INTRODUCTION

Pea is important vegetable, as it is uniquely grown in district Mansehra through broadcast method. Green Pea (*Pisum sativum* L.) a member of the family Leguminoseae, most likely originated in southwestern Asia, probably northwestern India, Pakistan [1, 2]. It is grown throughout the world for diverse uses as food and Fodder [3]. It is an excellent human food, either eaten as a vegetable or used in preparation of soup. The peas are full of nutrition because its grain is rich in protein (27.8%), complex carbohydrates (42.65%), vitamins, minerals, dietary fibers and antioxidant compounds [4]. In Pakistan, it is grown over 17,194 hectares with a total production of 1, 13,067 tons. In Khyber Pakhtunkhwa, it is grown over 1944 hectare land with a total production of 13,472 tons [5]. It was introduced in 1989 as a rotational crop for potato in Kaghan Valley of Khyber Pakhtunkhwa province of Pakistan which was formerly called North West Frontier Province (NWFP) and providing highly economical since then [6]. There are many biotic and abiotic factors which directly or indirectly affect the growth and yield of Pea like other crops. Among biotic factors, insects are more crucial factor and greatly influence crop yield either as pest or pollinator. Insect pests significantly reduced the pea yield [7, 8]. There are more than 200 species of insects have been reported on pea [9, 10, 11] Reported Pea leaf minor, Cutworm, Cow pea Aphid, Pod Borer and thrips as important pests from Pakistan. Among these, Pea leaf miner (*Phytomyza horticola*) is a serious hinders and causes 90% damage [12, 13] Rafi *et al.,* Recorded the infestation level of pea leaf miner in selected areas of Khyber Pakhtunkhwa and found that infestation of Pea leaf Miner is higher (81.52

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%) in the plain areas (Peshawar region) to 26 % in mountain areas (Swat and Kalam) of Khyber Pakhtunkhwa. Other prominent pest species include Pea thrips, Cow Pea Aphid, Pod Borer and Cutworm. Other than pest, there are a lot of insects in fields of Green Pea which acts as predator and pollinator. The presences of these agents are important for pollination of pea crop and hence boosting yield. On another hand, predator keeps the pest population at economic level. The insect fauna especially predatory and pollinators insects are commonly under pressure due to indiscriminate use of pesticides and ecosystem disturbance under climate change scenario. This is the time to investigate the whole insect fauna associated with the Pea crop. The resultant information will helpful for ecosystem management and in the development of Insect Pest Management (IPM) programme. The present study is therefore, planned to explore the insect fauna associated with the pea crop in District Mansehra along with its spatial and temporal distribution, population fluctuation and species abundance.

2. MATERIALS AND METHODS

Study Area

The current study was conducted in different Pea crop growing localities of District Mansehra. The selected localities of Mansehra as shown in (Fig. 1), are located in central Mansehra, which is somewhat plain area. Mansehra is located at the eastern border of the Khyber Pakhtunkhwa Province. The district is located at 34° – 12' and 35° – 50' and 47° – 07' longitude. Due to favorable climatic conditions, the district is rich in vegetables and fruits. Cabbage, carrot and reddish in vegetables and peaches, plums and pears in fruit are grown in the area. District Mansehra is rich in flora.

Insect Collection

The sampling of insects was done from the pea fields of selected sites. Insects were collected from the field during day time when the insects were active. Each locality was visited at weekly intervals from February to April during 2014. Collection tools such as aspirator, hand picking, and fine hair brush were used for the collection of slow moving insects or immature stages of insect. Large and flying insects were collected with the aid of insect net. Sweeping of net over pea crop was also carried out to collect hidden insects. Captured insects were shifted into the air tight killing jar, containing cotton soaked Ethyl acetate as killing agent. Each insect collection was marked with complete record of data, collector name, date, locality, latitude and longitude and crop name.

Insect Sampling

During the present survey, different insects were sampled as follows:

- Pea leaf Minor: Number of larvae/ 5 plants.
- Cow pea aphid: Average number of aphids/5 plants
- Ladybird beetles: Number of beetles/ 10 plants/locality
- Syrphid flies: Number of flies/ 10 sweeps
- Butterflies: Number of Butterflies collected/ I hour
- Bees: Number of Bees/ 10 sweeps

Preservation

Adult insects were pinned and deposited directly in the insect box. Each insect was pinned with suitable pin on the basis of their body structure and size. Legs, wings and antennae were properly set on the stretching board. However small sized insects, difficult to pinned were mounted on cardboard. Nepthalene balls were used as insect repellent in insect box so that they can be preserved well from the attack of museum pest. Soft body insects and larvae were preserved in 70 % alcohol as wet collection. Leaf minor infested leaves were kept in papers.

Labeling

Labeling of the collected specimens was done properly with date of collection, locality, type of insect and name of the crop from which they were collected, mentioned accurately.

Identification

All the collected specimens were taken to the National Insect Museum, National Agriculture Research Centre (NARC), Islamabad for identification. The specimens were identified with the help of available literature[9, 13, 14] and by comparing with previous identified record present in the National Insect Museum.

Table 1- Coordinates of selected localities for the collection of insect fauna of pea field from District Mansehra from Feb-April 2014.

District	Localities	Latitude°n	Longitude°e
Mansehra	Bafa	34.34	73.20
	Dhodial	34.44	73.22
	Shinkiari	34.42	73.25
	Oghi	34.5	73.01

3. RESULTS

During the present study insect fauna of Pea crop was explored in selected localities of district Mansehra namely; Dhodial (L1), Baffa (L2), Shinkiari (L3) and Oghi (L4) during Feb-April 2014. In the result of this survey, a total of about 700 insect specimens were collected. The taxonomic treatment of these collection revealed that the collected insects belong to 6 orders, 11 families and 22 genera.

As shown in Table 1 and II, the insect fauna generally comprised of three main categories i.e Insect Pest, Predatory insects and pollinators. The data is also categorized insect order wise and the insect belong to

order Diptera, Coleoptera, Hymnoptera, Odonata, Orthoptera and Lepidoptera. Further the pest include 2 major pest which are; Pea Aphid *Acyrthosiphon pisum* and Pea leaf minor *Chromatomyia horticola*. Predators include *Coccinella semptumpunctata, Pterostichus melanarius, Orthetrumpruinosum, Crocothemisservilia, Lucilliasericata*. While pollinators include *Eristalis tenax, Eristalis arbustorum, Apis mellifera, Bombus haemorrhoidalis, Xylocopa dissimilis, Pieris brassicae, Colias fieldi, Junonia orithya, Pontia diplidace, Pieris canidia, Collias erate, Cynthia cardui, Neptis hylas and Eurema laeta.*

A. Insect Pest of Pea Crop

1. Pea Leaf Minor *Chromatomyia horticola* (Agromyzidae; Diptera)

Pea Leaf Minor is a very serious pest of Green Pea in larval form. Its larvae (maggot) are white, without legs and wedge-formed. Adult is a partly black small fly. During the present study Pea leaf minor was found in all localities. Table 2 shows that the major infestation was found in Dhodial (L1) with an average of 64 larvae/5 plants, followed by Baffa (L2) ≥ Shinkiari (L3) ≥ Oghi (L4). As shown in Fig. 1, infestation of pea leaf minor was nil in February, started in March with an average of 88 larvae and reaches up to the peak in April and then start decline in May.

2. Cow Pea Aphid *Acyrthosiphon pisum* (Hemiptera; Aphididae)

This is small, reddish to dark brown aphid with cauda dark, slightly pointed and has bristles. During the present research Cow pea aphid was recorded in all 4 localities with maximum infestation in L2 (13.8) followed by L1 ≥ L3 ≥ L4.

As shown in Table. 2 and Fig. 1 infestation of Cow Pea Aphid was on peak during the month of Feb with an average of 12.55, start to decrease in March while become nil in April.

Table 2- Temporal distribution of Major Insect pests of pea crop in district Mansehra

Species	Feb	March	April	Total
Chromatomyiahorticola	0	88	154	242
Acyrthosiphon pisum	12.55*	1.05*	0	13.6

*Figures in decimal show average aphid population/5 plants

B. Predatory Insects

1. Lady Bird Beetle *Coccinella septempunctata* (Linnaeus, 1758) (Coleoptera; Coccinellidae)

Ladybird Beetle is common and important predator, which feed on soft-bodied insects both in larval and adult form. Adult is medium sized beetle and is mostly oval shape. Elytra are mostly seven spotted. Larvae are elongated and crocodile shaped. During the present study, adult of Ladybird beetle *Coccinella septempunctata* was found in all the four localities of District Mansehra. As shown in Table. 3, maximum population (29) was found in Dhodial (L1), followed by Oghi(19) , Shinkiari (13) and Baffa (12). As shown in Table.4 and Fig.6, population of predatory coccinellid *Cocinella septumpunctata* was found at peak in April with 49.09% while found absent in February and March.

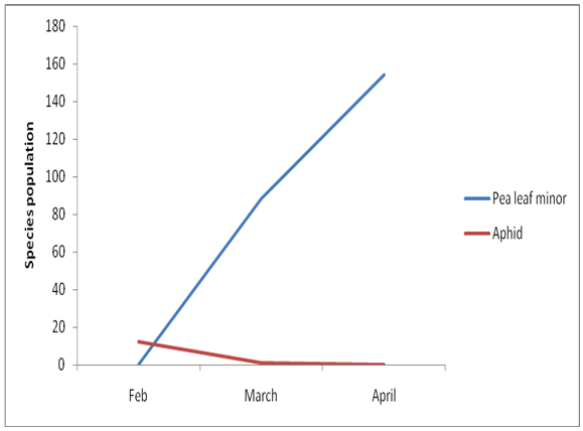

Figure 1- Population fluctuation of major insect pests of Pea crop in District Mansehra.

2. Ground Beetles *Pterostichus melanarius* (Latreille, 1802) (Coleoptera; Carabidae)

Ground beetle has dark glossy black body with big eye, large jaws spiny long legs. During the current stud, it was found only in one locality Dhodial (L1) with 3 specimens during March.

3. Yellow-legged Hornet *Vespa velutina* (Lepeletier, 1836): (Hymenoptera; Vespidae)

This hornet is black to brown colour with shadow crosswise line in the centre. During collection, this was collected from only 2 localities. Two specimens of *V. velutina* were collected each from Dhodial (L1) and Oghi (L4). As shown in the Table. 3 and Fig. 2, this hornet is active in March and April.

4. Blue/green bottle fly *Lucilia sericata* (Meigen, 1826): (Diptera; Calliphoridae)

This fly is blue green with shadowy patterns; covered with small, thin dark spines and with three cross-grooves on thorax. During the present survey, *Lucilia sericata* was

collected from all 4 localities with maximum number of 6 in Dhodial (L1), followed by Shinkiari (L3) > Oghi (L4) > Baffa (L2) as shown in Table: 3. It ppeared in the month of February and raises to peak in April as shown in Fig. 2.

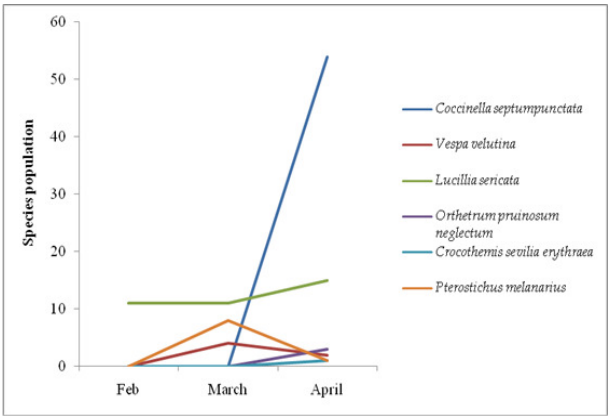

Figure 2- Population fluctuation of Bio-control agent in Pea crop.

5. Scarlet skimmer *Crocothemis servilia* (Fraser, 1936):
(Odonata;Libellulidae)
Scarlet skimmer is a dragonfly of red clour and with moderate body size. It can be identified by its forewing with oblique discoidal cell. During the present study, only one specimen was collected in locality (1) Dhodial in April.

6. Common Red Skimmer *Orthetrum purinosum* (Rambur, 1842):
(Odonata; Libellulidae)
Body color usually red but mostly unstable in colour. It can be differentiated from Scarlet Skimmer by black central carina on 8th and 9th segment on dorsum. During the present study conducted in 4 localities of District Mansehra, this Dragon fly species *Orthetrum purinosum* was found only in Dhodial (L1) with 8 specimens only in March as shown in Table 3 and Fig. 3.

S. No	Species	Feb	March	April	Total	%
1	*Coccinellaseptumpunctata*	0	0	54	54	49.09
2	*Vespa velutina*	0	4	2	6	5.45
3	*Lucilliasericata*	11	11	15	37	33.63
4	*Orthetrumpruinosum neglectum*	0	0	3	3	2.72
5	*Crocothemisseviliaerythraea*	0	0	1	1	0.9
6	*Pterostichusmelanarius*	0	8	1	9	8.18
Total		11	23	76	110	

C. Pollinators Insects

1. Honey bee *Apis mellifera* (Linnaeus, 1758) (Hymenoptera; Apidae)
Honey bee is a common insect and can be found everywhere. Besides, producing honey it is also important due to its role in pollination of field and horticulture crops. However, it was recorded only from two localities L1 and L2. Maximum number of honey bees was collected during February and March when the crop was in blooming stage.

2. Syrphid Fly *Eristalis tenax* (Linneaus, 1758)
3. (Diptera; Syrphidae)
This Syrphid species is yellowish orange with grayish wings. Maximum number of this species was recorded from L4 (Oghi) followed by L1 > L2 >L3 respectively. Its activity was at peak during February and March as shown in Fig. 3.

3. *Eristalis arbustorum* (Linneaus 1758) (Syrphidae; Diptera)
This Syrphid fly species is dirty dark on thorax with dainty marks and yellowish wings.
It was collected from all 4 localities but in variable number. Maximum activities were observed in March and April as shown in Table.5 and Fig.7

4. Bumble Bee *Bombus haemorrhoidalis* (Smith, 1852) (Bombicidae; Hymenoptera)
Bumble bee is very active pollinator and this species is of dark colourwith blackish hair. It has bright yellow pubescence on basal two abdominal segments and reddish on the rest of abdominal segments. During the present study, it was found in all 4 localities as shown in Table.5. It appears in March and get peak in population in April.

5. Carpenter Bee *Xylocopa dissimilis* (Lepeletier, 1841):
(Xylocopidae; Lepidoptera)
Carpenter bee is a common pollinator. It can be recognized pale pubescence on head and, densely scattered with stretched black hairs. Wings more or less fusco-hayline.
During present survey it was found rarely in all selected localities. Its population is at peak in April with increase in temperature as shown in Table.5 and Fig.7

6. Butterflies complex
(Lepidoptera)
A large number of butterfly species were observed in Green Pea fields in all localities during this survey course.

Adult of about 9 species of Nymphalid and Pierid butterflies were found in the fields of Green Pea crop. Although some of these butterflies are pest of cruiceferous vegetables but act as pollinators in adult stage. The list of these butterflies species are:

- Large Cabbage White *Pieris brassicae* (Lineaus ,1758)
- Indian Cabbage White*Pieriscanidia*(Sparrman, 1768).
- Bath White *Pontiadaplidice* (Linnaeus, 1758):
- Dark Clouded Yellow *ColiasFieldi* (Menetries, 1855):
- Spotless Grass Yellow*Euremalaeta*(Boisduval, 1836)
- Eastren Pale Clouded Yellow *Coliaserate* (Butler, 1880)
- Painted Lady *Cynthia cardui* (Lineaus, 1758)
- Blue Pansy *Junonia orithya* (Linnaeus, 1758)
- Common Sailor *Neptis hylas* (Linneaus, 1758)

Table 3- Temporal distribution of Pea pollinators in District Mansehra.

Species	Feb	March	April	Total	Percentage %
Apismelifera	5	4	2	11	3.5483871
Eristalistenax	16	9	3	28	9.03225806
Eristalisarbustorum	9	13	1	23	7.41935484
Bombushaemorrhoidalis	0	5	8	13	4.19354839
Vespa velutina	0	4	2	6	1.93548387
Xylocopadissimili	0	1	15	16	5.16129032
Lucilliasericata	11	11	15	37	11.9354839
Neptishylus	0	1	0	1	0.32258065
Pierisbrassicae	6	14	46	66	21.2903226
Pieriscanidia	0	15	18	33	10.6451613
Pontiadiplidace	0	0	36	36	11.6129032
Coliasfieldi	1	0	18	19	6.12903226
Cynthhiacardui	0	0	9	9	2.90322581
Junoniaorithya	0	0	7	7	2.25806452
Euremalaeta	0	4	0	4	1.29032258
Coliaserate	1	0	0	1	0.32258065
Total	**49**	**81**	**180**	**310**	

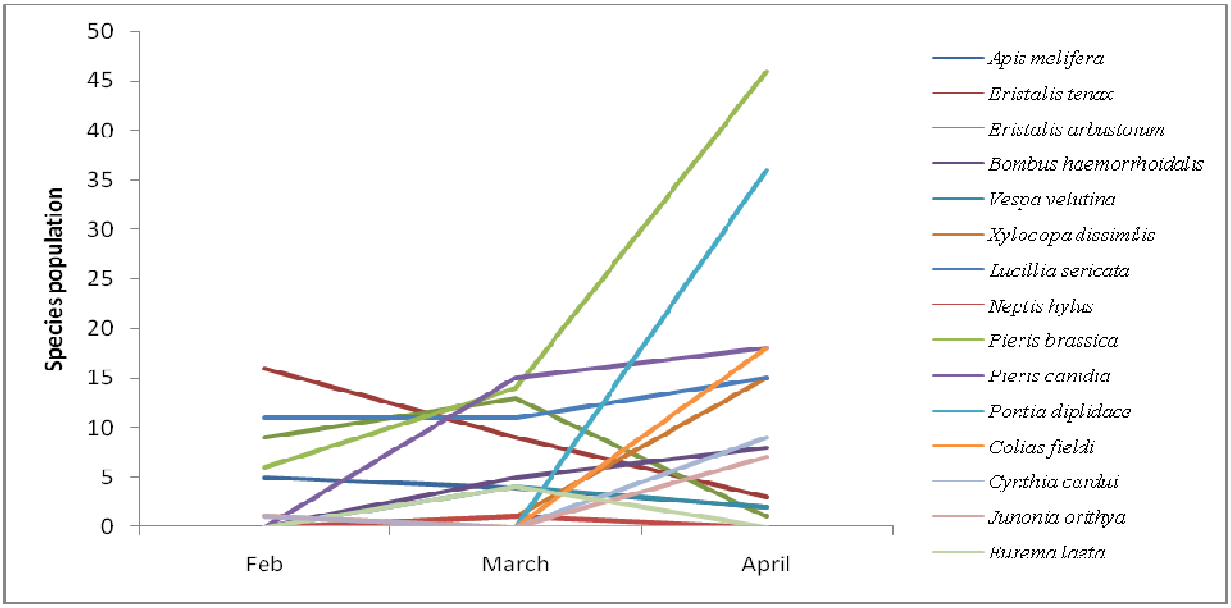

Figure 3- Population fluctuation of insect pollinators of pea crop at District Mansehra.

4. DISCUSSION

Diversity of flora and fauna is the gift of nature. An area or region rich in plant and animal diversity is considered blessing for their residents. Insect fauna in this connection is also has its own significance in nature. It is due to the importance of insect as pest, pollinator, biocontrol agent, and decomposer, source of food (Honey), source of raw silk for textile industry and source of food for higher animals in food web. Human disturbance of nature ultimately effect insect fauna of the area which include industrialization, urbanization, monocropping and pesticide use. The present study is therefore conducted to explore the insect fauna associated with Green Pea crop cultivated in different localities of district Mansehra namely; Dhodial, Baffa, Oghi and Shinkiari. In the results of this survey, a total of 22 different insect species were collected belonging to 6 orders, 11 families and 22 genera namely Coleoptera, Diptera, Hemiptera, Hymenoptera, Lepidoptera and Odonata. The identified insect species of pea crop were further categorized insect pests, predator and pollinators. Among insect pests category there are two major insect pests of pea crop found in the study area i.e Pea Leaf minor *Liriomyza chinensis* and Cow pea aphid *Acyrthosiphon pisum*. [14] also reported these two species as pest of pea crop from Tando Jam, sindh beside other insect pest Pea Pod Borer (*Helicoverpa armigera*) and PeaThrips. Similarly [15, 16] and [17] reported pea crop is attacked by different insect pests like Cutworms, thrips, aphids, Pod Borer and Pea leaf minors. As shown in the results, Pea leaf minor is dominant pest of pea crop in the area with 34.90 percent infestation Similar results were reported by [13] from other selected Pea growing areas of the province NWFP (currently Khyber Pakhtunkhwa) with 81.52 % from Peshawar region, 30.93 % from Swat and 26.74 % from Kalam. Infestation of Pea leaf minor was also reported by [14] from Tando Jam, Sindh with infestation 3.45/leaf. [11] also reported it as serious pest of crop from Pakistan. Another significant pest species is Cow Pea Aphid *Acynthosiphon pisum* of pea crop in district Mansehra with 13 % infestation. [14] also reported it as pest of pea crop from Tando Jam, Sindh with 2.25 aphids/plant infestation level. Similarly [11] also reported that pea aphid is widely distributed pest of pea crop in Pakistan. Among predators insects in the insect fauna of Pakistan, there are 5 species namely Ladybird beetle *Cocinella septumpunctata,* Ground beetle *Pterostichus melanarius,* Dragonfly *Orthetrum pruinosum, Crocothemis servilia* and *Lucillias ericata*. Ladybird beetle *Coccinella septumpunctata* was found as the dominant predator during the present study with 49 percent of the predator insect category in Pea crop. It is universal and voracious predator of aphids and other soft bodied insects. It has been collected and reported by many workers from plains to mountains of Pakistan [18]. Among dragonflies, two species were recorded during the present study. These species are; *Orthetrum pruinosum* and *Crocothemis ilivia*. Among these, *O. pruinosum* was recorded from Dhodial. These are widely distributed as it has been reported from Punjab and KPK, Pakistan [19]. The third component of insect fauna of Pea crop in district Mansehra is Pollinator insects. Insect as pollinator play important role for ensuring cross pollination in plants which results in good quality of high seed and fruit production. A reasonable number of pollinator species were collected from the pea crop fields in district Mansehra with 14 insect pollinators. Most of these pollinators are Syrphid fly, Bees and Butterflies.

5. CONCLUSION

Insect fauna of Green Pea crop in district Mansehra carries 22 different insect species were collected belonging to 6 orders, 11 families and 22 genera. Insect fauna include two pest species, 5 predator species and 14 pollinator species. Pea leaf minor was found more injurious. It is concluded that the insect fauna especially predator and pollinator insect fauna is comparatively rich.

6. CONFLICT OF INTEREST

All authors have declared that there is no conflict of interest regarding publication of this article.

RECOMMENDATIONS

- Pea leaf minor is the serious pest of Pea crop in the area with high infestation rate. Therefore IPM strategy needs to be developed for its management compatible. with the agro-climatic conditions of the study area.
- Infestation of pest species usually starts in early March and become high in April. Therefore control measures must be initiated in early March.
- The area is harbouring a reasonable amount of beneficial insects in the shape of predators and pollinators. For the conservation of these useful insects to sustain their services in the nature, judicious use of pesticide must be applied.
- The farmers do not follow crop rotation in the pea crop growing areas. Monocropping leads to the depletion of biodiversity. Therefore proper crop rotation and encouragement of natural flora must be carried out.

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