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# Arthropoda fauna prevailing on chilli crop

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**Abstract**
A two year (2018- 19 and 2019- 2020) field trial to study arthropod fauna in chilli agro ecosystem was conducted at Vegetable Research Center, Pantnagar. The study revealed the occurrence of arthropod fauna belonging to diverse insect order (11 orders). Maximum number of arthropods which included both insects pests and natural enemies belonged to the order Coleoptera (9 species) followed by Hemiptera (4 species) and Lepidoptera (4 species). The correlation coefficient was also calculated between insect pests and predator population and the results revealed a positive and significant association which showed the tendency of the predators to balance the population of insect pests.

**Keywords:** arthropod, fauna, chilli, insect pest population

## Introduction
Chilli (*Capsicum annuum* L.) an important cash crop of India belongs to the family Solanaceae. This family includes more than 200 chilli varieties [13]. Five species of chilli namely *Capsicum annuum* L., *C. frutescens*, L., *C. chinense* Jacq, *C. pubescens* L. and *C. baccatum* Jacq are domesticated. India with a share of 25% ranks first in the global chilli market [11]. In India, Karnataka with an area of 45.4 thousand hectare and production of 607.94 thousand tonnes ranks first in terms of area and production of chilli [12]. Other chilli growing states in the country are Madhya Pradesh, Andhra Pradesh, Bihar, Maharashtra and Chhattisgarh. From India chilli as a commercial spice crop is widely exported to countries like Bangladesh, USA, Japan, Israel, UAE, Bahrain and Malaysia [8].
Chilli is widely cultivated for its valuable fruits in India. It is used for the preparation of pickles, condiments, sauces, soups, chutneys, Oleoresin and various curries. It is regarded as one of the best spices in India which is used to add colour and flavor to the Indian dishes. Chilli can be used in many forms; as raw fresh green, Chopped chilli; broken split, ground to a paste, or whole form. Chilli pods either fresh or dry are used for culinary purposes. It is nutritionally very rich, with high amount of vitamins particularly vitamin A, B and C (111.0 mg per 74 gm of chilli), minerals like K, Fe, Mg, Mn, dietary fibers and folic acid.
The composition of 100 gm of chilli fruit is 0.3 gm fat, 1.3 gm protein, 4.3 gm carbohydrate, 5.3 gm sugars, 88 gm water and 40 kilo calorie energy [2]. Chilli has the therapeutic values as well. Its consumption dilates the blood vessels and strengthens the arteries possibly preventing heart diseases [1]. The antioxidants present in chilli helps to protect the body from the adverse effect of free radicals that may be generated due to any disease or the stress condition.
Over 20 species of insect pests attack chilli crop [4]. The major insect pests attacking chilli crop are *Scirtothrips dorsalis*, *Aphis gossypii*, *Bemisia tabaci*, *Spodoptera litura*, *Amrasca bigutulla bigutulla*, *Polyphagotarsonemus latus* and *Helicoverpa armigera* [16]. Insects being the prime production constraints can cause the yield loss ranging from 50-90 percent [10]. These insect pests are under natural control by several predators. Spiders, *Brumus suturalis*, *Menochilus sexmaculatus*, *Coccinella septempunctata*, syrphid flies, robber flies, *Geocoris* spp., *Aphidius colemani* etc. are some of the natural enemies found in chilli agroecosystem. Invertebrates represent more than 90% of the planet's 10 million or so animal species [7]. Among arthropods, insects occupy topmost position and maintain stability of ecosystems by being part of the food chain [6]. The present work was planned to conduct the investigation to study arthropod fauna associated with chilli crop ecosystem.

## Materials and Methods
### Study site
The arthropod diversity prevailing in chilli agro ecosystem was recorded at Vegetable Research

Centre, GBPUAT, Pantnagar, Udham Singh Nagar (Uttarakhand) during the *rabi* season for two subsequent years 2018 and 2019 in Pusa Jwala variety of chilli.

**Experimental Layout**

The 45 days old chilli seedlings were transplanted in the field during the *rabi* season in the month of October in both the years. All the recommended package of practices was followed to raise the crop [3]. Insect pest management practices were not followed during this period. The experiment was laid out in Randomized Block Design (RBD) with three replications.

**Monitoring of insect pests**

Chilli crop was surveyed for the diversity of insect pests immediately after germination till the final harvesting of chilli fruits. The experimental plots were examined in a weekly interval for recording arthropod population. The arthropod fauna was recorded on five randomly selected plants.

**Sucking pest complex (aphids, thrips and whitefly)**

For sucking pest complex the nymphs and adult population was recorded on six leaves per plant (two each from upper, middle and lower canopy) [5]. During the reproductive stage the thrips population was also recorded on flowers and fruits.

**Borer complex (*Helicoverpa armigera* and *Spodoptera litura*)**

The borer population was counted on whole plant basis. The entire chilli plant was searched thoroughly for presence of larvae of borer and their number counted and noted down if present [9].

**Natural enemies (Coccinellids and Spiders)**

The adult coccinellids and spiders were also counted on whole plant basis. Syrphid flies, robber flies were also recorded. All these insect pests and predators were collected and identified at the species level in the laboratory.

**Results and Discussion**

Based on an immense survey of chilli crop during both the years the results of present study and relevant discussion have been presented as follows (Table 1, 2 and fig. 1). The results revealed the occurrence of thirty one species of arthropod fauna in the trial field. These arthropod fauna included fourteen species of insect pests, fourteen species of natural enemies and one species of pollinator. Among insect pest, order Coleoptera (9 species) ranked first with maximum number of insect pests followed by Hemiptera (4 species), Lepidoptera (4 species), Orthoptera (2 species) and Thysanoptera (1 species). In the experimental field these insect pest had assumed different status (major pests and minor pests) on the basis of their number and level of damage they caused to the chilli crop. Whitefly, aphids, thrips, fruit borer and tobacco caterpillar were categorized to be major pests while those belonging to the order coleoptera (red pumpkin beetle, flea beetle and ash weevil) were categorized as minor pests. Among natural enemies maximum number of predators belonged to family coccinellidae and order coleoptera. This was further followed by Diptera (2 species), Hymenoptera (2 species), Neuroptera (1 species), Odonata (1 species) and Arachnida (1 species). One species of pollinator also belonged to the order Hymenoptera. The present results are in accordance to the work of some previous studies conducted by researchers [9] who reported fourty one species (14 species of insect pests, 14 species of natural enemies, 12 species of casual visitors and 1 species of pollinator) of arthropod fauna associated with the chilli crop at Ludhiana. Some researchers **[14]** recorded a total of 10 species of insect pests belonging to 8 families and 6 orders in chilli ecosystem at Karnataka. Similarly, some investigators [6] recorded a total of 24 insect species on mix cropping of chilli and onion belonging to diverse orders.

**Table 1:** Diversity of insect pests associated with chilli crop at VRC, Pantnagar during Rabi 2018 and 2019.

| S. No. | Pests | Family | Order | Status |
|---|---|---|---|---|
| 1 | Whitefly (*Bemisia tabacci*) | Aleyrodidae | Hemiptera | Major |
| 2 | Aphids (*Myzus persicae*) | Aphididae | Hemiptera | Major |
| 3 | Thrips (*Scirtothrips dorsalis*) | Thripidae | Thysanoptera | Major |
| 4 | Gram pod borer (*Helicoverpa armigera*) | Noctuidae | Lepidoptera | Major |
| 5 | Tobacco caterpillar (*Spodoptera litura*) | Noctuidae | Lepidoptera | Major |
| 6 | Jassids (*Amrassca bigutulla bigutulla*) | Cicadillidae | Hemiptera | Minor |
| 7 | Red Pumpkin Beetle (*Aulacophora foveicollis*) | Chrysomelidae | Coleoptera | Minor |
| 8 | Ash weevil (*Myllocerus spp.*) | Curculionidae | Coleoptera | Minor |
| 9 | Flea beetle (*Monolepta signata*) | Galeurcidae | Coleoptera | Minor |
| 10 | Bihar hairy caterpillar (*Spilosoma obliqua*) | Arctididae | Lepidoptera | Minor |
| 11 | Treehopper | Membracidae | Hemiptera | Minor |
| 12 | Cabbage butterfly (*Pieris brassicae*) | Pieridae | Lepidoptera | Minor |
| 13 | Short horned grasshopper (*Hieroglyphus banian*) | Arctididae | Orthoptera | Minor |
| 14 | Field cricket (*Gymnogryllus spp.* ) | Gryllidae | Orthoptera | Minor |

**Table 2:** Diversity of Beneficial insect associated with chilli crop at VRC, Pantnagar during Rabi 2018 and 2019.

| S. No. | Beneficial Arthropods | Scientific Name | Family | Order |
|---|---|---|---|---|
| 1 | Ladybird beetle | *Coccinella septempunctata* | Coccinellidae | Coleoptera |
| 2 | | *Menochilus sexmaculatus* | | |
| 3 | | *Coccinella transversalis* | | |
| 4 | | *Brumoides suturalis* | | |
| 5 | Rove beetle | Paederus fuscipes | Staphilinidae | Coleoptera |
| 6 | Ground beetle | | Carabidae | Coleoptera |
| 7 | Preying mantis | *Mantis religiosa* | Mantidae | Dictyoptera |
| 8 | Syrphid fly | *Eristalis quiquestriatus* | Syrphidae | Diptera |

| | | | | |
|---|---|---|---|---|
| 9 | Robber fly | *Philodicus femoralis* | Asilidae | Diptera |
| 10 | Green lacewing | *Chrysoperla carnea* | Chrysopidae | Neuroptera |
| 11 | Dragonfly | *Pantala flavescens* | Libelludidae | Odonata |
| 12 | Spiders | | | Arachnida |
| 13 | Black ant | *Polyrhachis simplex* | Formicidae | Hymenoptera |
| 14 | Aphidus | *Aphidius colemani* | Brachonidae | Hymenoptera |
| 15 | Carpenter bees (Pollinator) | *Pithitis smaragdula* | Anthophoridae | Hymenoptera |

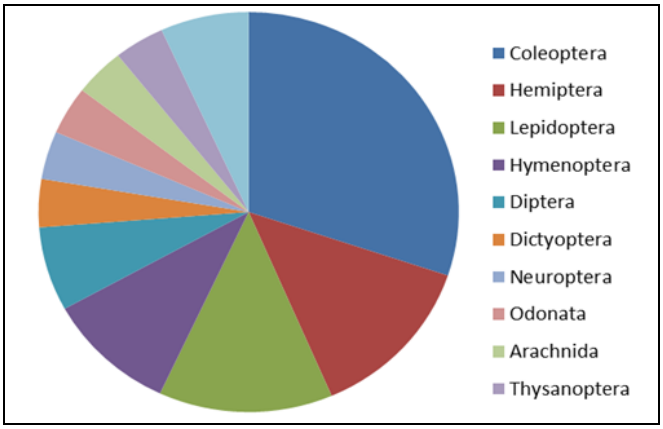


**Fig 1:** Prevalence of orders of arthropod fauna on chilli crop during 2018-19 and 2019-2020.

In the experimental field aphids, thrips and whitefly, fruit borer and tobacco caterpillar were the major pest infesting chilli crop. Coccinellids and spiders were the main predators recorded in the field. Therefore, a correlation was calculated between predator population and major insect pests of chilli. During both the years of trial duration a positive association of insect pest population was observed with the natural enemies. The correlation coefficient (r) in the year 2018-19 (first season) has been depicted in the table 3. There was a positive and a highly significant association of *Helicoverpa armigera*, *Spodoptera litura* with both the predators (coccinellids and spiders) in the first crop growing season. A non-significant but positive relation was recorded between thrips and predators (r=0.015 for coccinellids and r=0.115 for spiders). However, aphid population was positively and significantly associated with coccinellids (r= 0.122*) while a positive and non-significant association was observed between aphid and spider population (r= 0.002).

Following the similar trend during second crop growing season in the year 2019-2020 there was a positive and significant association of all the insect pests with predator (coccinellids and spiders) population in the trial field (Table 4). The results of the present study are in accordance with the study of researchers [15] who also found a positive relationship between sucking insect pest and the predator population in the cotton field. Some other studies revealed a strong positive association ($R^2$ = 0.90) of *Thrips tabacci* with predator abundance in the onion field [6].

**Table 3:** Correlation coefficient of major insect pests of chilli with predators in the year 2018-19

| Pests | Predators | |
|---|---|---|
| | Coccinellids | Spiders |
| Thrips | 0.015 | 0.115 |
| Aphids | 0.122* | 0.002 |
| Whitefly | 0.337* | 0.319 |
| *Helicoverpa armigera* | 0.885** | 0.897** |
| *Spodoptera litura* | 0.863** | 0.846** |

**Table 4:** Correlation coefficient of major insect pests of chilli with predators in the year 2019-2020

| Pests | Predators | |
|---|---|---|
| | Coccinellids | Spiders |
| Thrips | 0.609** | 0.528** |
| Aphids | 0.421* | 0.493* |
| Whitefly | 0.803** | 0.831** |
| *Helicoverpa armigera* | 0.889** | 0.831** |
| *Spodoptera litura* | 0.887** | 0.832** |

## Conclusion

From the present study it is evident that the diverse group of arthropods prevailed in the chilli field. It is also evident that the insect pest population prevailing in chilli agro-ecosystem coincides with the predator population which further depicts the existence of natural balance in the chilli ecosystem and reduces the reliance on synthetic chemicals to manage the insect pest population.

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