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Study of morphological characters of important predatory fauna found in kharif Agro-ecosystem from the region, Akola, Maharashtra, India

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Abstract

Accurate identification of agricultural pests is key requirement for the successful integrated pest management (IPM) program. Based on the above investigations, it can be concluded that among predators, lady bird beetle, syrphid fly, stink bug, robber fly, dragonfly, damselfly, earwigs, tiger beetle, preying mantid, ear wigs and various species of spiders' like *Neoscona* spp. *Thomisus* spp. and *Oxyopes* spp. were found active in various talukas of Akola districts in kharif season and playing an important role in natural pest management. They were also density dependant and their numbers rise as the prey numbers increases. This investigation may helpful to the farmers as well as researchers and students for awareness, identification and characterization studies of the different predatory fauna. This work emphasize the need for conservation of diversity of predatory insect fauna found in major kharif crop agro ecosystem for estimating the species diversity and easy identifying the predatory fauna at the farmer's level.

Keywords: Predators, fauna, kharif, agro-ecosystem

Introduction

Kharif crop play an important role in agriculture as well as basic resource for thousands of industrial products manufactured in India and play crucial role in national economy in both rural and urban sector. It provides raw material to industry and contributed one third of total foreign exchange of India (Mayee and Rao, 2002) [11]. Kharif crop consist of cotton, pigeonpea, mung bean, soybean, urd bean, jowar, bajara, cowpea, sunflower etc. Production of kharif in India is 114.63 million tonnes (Anonymous, 2010) [2].

There are various factors responsible for low production and productivity of kharif crop in which pest attack is a major limiting factor. Breeder developed new technologies for enhancing production but that faces the challenge of emerging many pests. In India, many species of insect and non-insect pests had recorded to cause considerable damage to kharif crops. Due to the changing environmental conditions many pests and a minor pest becomes major one. Diversity of natural enemy complexes attacking various stages of the pests prevalent in kharif crop agro ecosystem, which prevents severe pest outbreaks, maintain the biotic balance by reducing pest population below economic injury level.

Before 50's the indiscriminate use of pesticide was not common and many pests were under natural control, But in the 50's use of synthetic pesticide came into prominence and age of environment friendly practices were related to low priority. Due to indiscriminate use of insecticide natural pest's status has been changing now days. To avoids such problems in future there is need to increasing the use of bio-agents in kharif agro-ecosystem. There is a large scope to introduce predator as bio-agent because biological control has been accepted as an important component of bio-intensive integrated pest management (BIPM) (Dhaliwal and Koul, 2007) [3]. There is large scope to predators as biocontrol agent. Therefore, before exploitation of these agents for biocontrol, there is a need to generate information on their biodiversity in new areas (Omkar and Parvez, 2003) [15]. The majority of coccinellids species are beneficial because of their predaceous nature, both in the larvae and adults of the coccinellids feed on the scale insects, aphids, other small soft-bodied creatures, or their eggs (Iperti and Paoletti, 1999) [8]. It is know about the particular predator suitable for specific pest and if predator's morphological characters are also known for identification based on this one can collect the predatory fauna in large number. Mass multiply in laboratory and it can be

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mass release in the field for controlling the particular pest. Similar work also done by Steinmann *et al.* (1996) [21] study on European earwig that is *Forficula auricularia* as well as the common earwig species and they also studied that earwigs are predacious in nature and studied the morphological characters of earwigs. Gilot *et al.* (1995) [5] studied the characteristics, which distinguish the order Dermaptera from other insect order and also studied the predaceous nature of European earwigs and studied the morphological characters of earwigs. Subramanian *et al.* (2005) [23] studied the dragonfly and damselfly that include information on distribution ecology and behavior of dragonfly and studied the biodiversity, and developed the field key to adult dragonfly and damselfly. Naikwadi *et al.* (2015) [14] studied the diversity of predatory fauna for comparing the species richness and evenness in kharif crop agro-ecosystem of Akola district, Maharashtra.

At present, scanty information is available on the presence of the predaceous insect fauna in kharif crop agro-ecosystem in Akola district of Maharashtra. Looking into the significance of major predatory fauna the present study was undertaken to explore the predatory fauna of an agro ecosystem near Akola in relation to its diversity. It is not possible to list each of the natural enemy but attempt has been made to list each of the natural enemy but attempt has been made to list important ones with their reported status. The information is provided for important predators of kharif crops pest on few crops like cotton, pigeon pea, jowar, soybean, green gram, sunflower, cowpea etc. This work aimed to emphasize the need for conservation of diversity of predatory insect fauna found in major kharif crop agro ecosystem for estimating the species diversity and easy identifying the predatory fauna at the farmer's level.

Materials and Methods

Study areas

The present study on morphology of predatory fauna found in kharif crop Agro-ecosystem was carried out at Department of Entomology, Post Graduate Institute Dr. Panjabrao Deshmukh Krishi Vidyapeeth Akola, located at 22°42'N latitude and 77° 02' E longitudes with altitude of the place is 307.42 m above mean sea level during 2010 - 2011.

Collection of predatory fauna

Predatory fauna were collected periodically from kharif crop of all the talukas of Akola, Maharashtra between July and December 2011. The beetles were collected as per procedure adopted by Sharma (1987) [20], Joshi and Sharma (2008) [9] and Sharma and Joshi (2010) [19] which included the use of sweep nets, insect collection tubes and jars depending upon the habitat. Adults of coccinellids beetles were collected randomly by "Sweep Sampling Method" as per Gadakar *et al.* (1990) [4], aspirator and hand picking depending upon height of Kharif crop. Collection of predators such as dragonfly, damselfly was done by sweep net method and tiger beetle, and stinkbug done by using hand picking. Some coccinellids were collected by placing empty vials (5 cm length and 3 cm diameter) beneath the leaf blade and tapped loose with cap (Khan *et al.*, 2007) [10]. The specimens were then processed for identification for which they were killed in killing jar and spread and pinned properly.

Identification of specimens

Photographs of species and their behavioral patterns were

captured with the help of digital camera (Nikon SMZ 800 digital camera). Field collected predatory fauna were examined carefully for all morphological details under stereo zoom microscope (Nikon SMZ 800) with attached Nikon camera were used. The identification, of the predatory fauna was done with the help of available keys in the textbook of Imms, (1912) [7] and literature available in ICAR -Network Project on Insect Biosystematics laboratory, Department of Entomology, Dr. PDKV, Akola. Identification of predatory fauna were made on the bases of Based on morphological characters Predatory spiders were identified from Dr. G. N. Wankhede, Head of Department of Zoology, Sant Gadge Baba University, Amravati.

Results

A. Collection of predatory fauna: The present work on "Biodiversity study of predaceous insect fauna found in major kharif crops of Akola district was conducted during July-December, 2010-11. Predatory fauna was collected from all six talukas of Akola District. Collected specimens were preserved, labeled, and characterization study was carried out on insect biosystematics laboratory of Entomology Department, Post Graduate Institute, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola. The findings observed during the course of investigation were discussed under the light of previous available literature (Table 1).

B. Identification of predatory fauna by using morphological characters

Morphological characters exhibited by the collected specimens were such as antenna, head position; mouthparts, wing type, abdominal segment, tarsal characters, type of legs etc. The Morphological characters have been studied has been given below.

Lady bird beetle: Our specimens photo shows clear difference between two species of lady bird beetle (Plate 1 a) *Chilomenes sexmaculata* species of Ladybird beetle feeds on aphids and wavy markings were seen on wings of this species whereas, *Illeis cincta* species of lady bird beetle having pale yellowish elytra with one black spot on each basal portion of elytra, which feeds on powdery mildew of sunflower (Plate b) (Fig 1).

Syrphid fly: Our specimen photo showed various characters of Syrphid fly like protuberant eyes fascinated big, thickening of wing membrane i.e. spurious vein of wing, pretarsus consist of lateral adhesive pads under claws called pulvili (Fig 2).

Brown stinkbug: Adult stink bug which feeds on caterpillar along with various character of Brown stink bug like shield like prominent scutellum, 5 segmented antenna, prominent proboscis, cursorial type of legs (Fig 3).

Preying mantid: Preying mantid adult along with various character like filiform antenna, protuberant eyes, tagmina type of wings, forelegs were raptorial for the capturing the prey (Fig 4).

Dragonfly: Adult of dragonfly shows various characters of dragonfly like oval compound eyes and no space between two eyes, membranous type of wing, filiform antenna, abdomen having 5 segmented, compound eyes are large and covered

most of the head parts, prominent ptero stigma (Fig 5).

Damselfly: Adult damselfly species shows various characters like golden colour compound eyes and space between two eyes, basket type of legs, wings were found equal in size, prominent pterostigma seen on wings, abdomen sharp small in size at base (Fig 6).

Robber fly: Adult of Robber fly shows various characters like horny proboscis, protuberant eyes, tuft of hair on mouth, corneous ovipositor and membranous type of wing, prehensile pulvilli seen on legs (Fig 7).

Earwig: Adult of Earwig shows various characters like moniliform type of antenna, mandible sickle shaped, cerci unjointed and modified like forecep, abdomen 9 to 10 segmented (Fig 8).

Tiger beetle: Adult Tiger beetle shows various characters like marked prominent eyes, prothorax larger and broader than rest of the body, mandible sickle shaped, legs were cursorial type and 5 segmented and bear pair of claws, elytra type wing and yellow spot on wings (Fig 9).

Spiders: Various spider species like *Pseusetia* spp., *Neoscona* spp., *Thomisus* spp. and *Oxyopes* spp. found in Akola district. *Neoscona* species, which has abdomen may oval clothed with hair; anterior median eyes are larger than posterior median eyes, legs closed with spines and hair. *Oxyopes* spp. was hexagonal in shape, abdomen longer than wide, high, convex, and body colour varies from bright green to yellowish brown or dark brown etc. *Thomisus* spp. of spider look like crab and forelegs of this type of spider is strong and adaptive for preying host (Fig 10).

Discussion

Lady bird beetle: Based on morphological characters of elytra i.e., wave marking on forewings elytra it has been identification as *Cheilomenes sexmaculata*. *Illeis cincta* species had been identified by use of character like pale yellowish elytra with one black spot on each basal portion of elytra. Similar results were recorded by Menon (2002) [12] showed that *Illeis cincta* Fabricious (Coleoptera: coccinellidae) observed the population of grub is more in sunflower.

Syrphid fly: Results revealed that morphological characters of syrphid fly *syrphus* species such as yellow or striped band on abdomen, Spuverious vein present between R. Similar results were recorded by Schneiden, (1969) [17] who studied morphological character of syrphid fly.

Stinkbug: Our recorded observation state that morphological characters of stink bug agreement with results of Schouteden (1994) [18] state that stink bug possess characters such as two tarsi segmented, scutellum usually covering about half of the abdomen, well developed proboscis.

Preying mantid: Data revealed that preying mantid *Mantis religiosa* state that peculiar form of their front legs, powerful raptorial forelegs, and wings having tagmina type. This result was supported by Rilling *et al.* (1959) [16] who studied morphological character of preying mantid.

Dragonfly: Our observation were similar to results of (Ando, H 1957) [1] state that morphological characters of dragonfly like black and yellow form with hyaline wing, eyes are covered most of the head part, ovipositor incomplete. Our results agreement with the results of Sharma *et al.* (2010) [19] studied the dragonfly species and the studied the various morphological characters of dragonfly in various life stages.

Damselfly: As per our data many morphological characters of damselfly such as densely reticulate wing, enormous number of cross veins were agreement with the study of Subejo Paijo (2010) [22] who studied the morphological characters of dragonfly and damselfly and given the difference between feeding potential larvae of dragonfly and damselfly.

Robber fly: Our results showed that morphological characters of robber fly such as horny proboscis adapted for piercing prey, powerful and prehensile legs; pulvili large, corniceous ovipositor and conspicuous male genitalia it has been identified as *philonicus* species of Robber fly.

Earwig: Our study state that morphological characters like Eyes well developed, cerci forceps like, antenna filiform, membranous types of wing, it has been identified as *Forticula auricularia* species of Earwigs. Similar results were observed by Gilot *et al.* (1995) [5] and Steinmann *et al.* (1996) [21] studied the characteristics, which distinguish the order Dermaptera from other insect order and also studied the predaceous nature of European earwigs and studied the morphological characters of earwigs.

Tiger beetle: Our recorded data state the morphological characters of tiger beetle such as head and prothorax being larger and broader than rest of the body and brightly coloured spot on wing elytra based on that character it has been identified as a *Cicindela septumpunctata* species of tiger beetle (Horn 1938) [6].

Spiders: Our results revealed some important character of some of the spider species found in *kharif* crop agro-ecosystem. *Thomisus* species look like crab and forelegs of this species is strong and adapted for preying. *Oxyopes* spp. was hexagonal in shape, abdomen longer and wide, high and convex. *Neoscona species*, which has abdomen oval, clothed with hair, legs closed with spines. Our results are agreement with results of Nagrare *et.al* (2015) [13] who studied spider diversity in transgenic and non-transgenic cotton in rainfed agro ecosystem of central India.

Table 1: Collection and identification of predatory fauna in major *kharif* crops from Akola

| Sr. No | Specimen common name | Specimen Scientific Name | Family | Order |
|--------|----------------------|--------------------------------|---------------|------------|
| 1. | Lady bird beetle | <i>Cheilomenes sexmaculata</i> | Coccinellidae | Coleoptera |
| 2. | Lady bird beetle | <i>Illeis cincta</i> | Coccinellidae | Coleoptera |
| 3 | Syrphid fly | <i>Syrphus</i> spp. | Syrphidae | Diptera |
| 4 | Stink bug | <i>Podius</i> spp. | Pentatomidae | Hemiptera |
| 5 | Preying Mantid | <i>Mantis religiosa</i> | Mantidae | Mantodea |

| | | | | |
|----|----------------------|------------------------------|--------------|------------|
| 6 | Dragonfly | <i>Platygomphus</i> spp. | Gomphidae | Odonata |
| 7 | Damselfly | <i>Agiochmis</i> spp. | Agriidae | Odonata |
| 8 | Earwigs | <i>Forticula auricularia</i> | Forticulidae | Dermaptera |
| 9 | Robber fly | <i>Philonicus</i> spp. | Asilidae | Diptera |
| 10 | Tiger Beetle | <i>Cicindela</i> Spp. | Cicindelidae | Coleoptera |
| 12 | Spider (Lynx spider) | <i>Peusetia</i> spp. | Oxyopidae | Arachnida |
| 13 | Spider (Lynx spider) | <i>Oxyopes</i> spp. | Oxyopidae | Arachnida |
| 14 | Silver colour spider | <i>Neoscona</i> spp. | Aranidae | Arachnida |
| 15 | Crab spider | <i>Thomisus</i> spp. | Thomisidae | Arachnida |



Fig 1: Morphological characterization of Lady Bird beetle

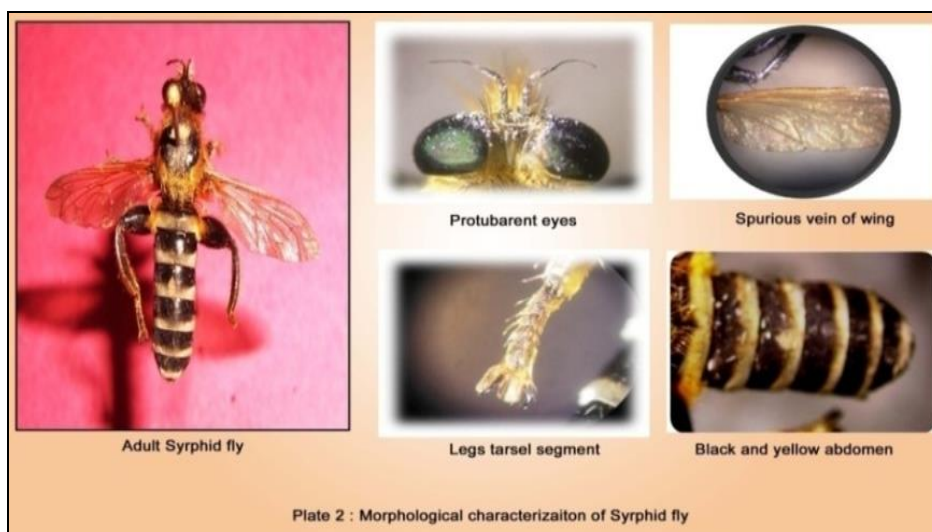


Fig 2: Morphological characterization of Syrphid flies *Syrphus* spp.

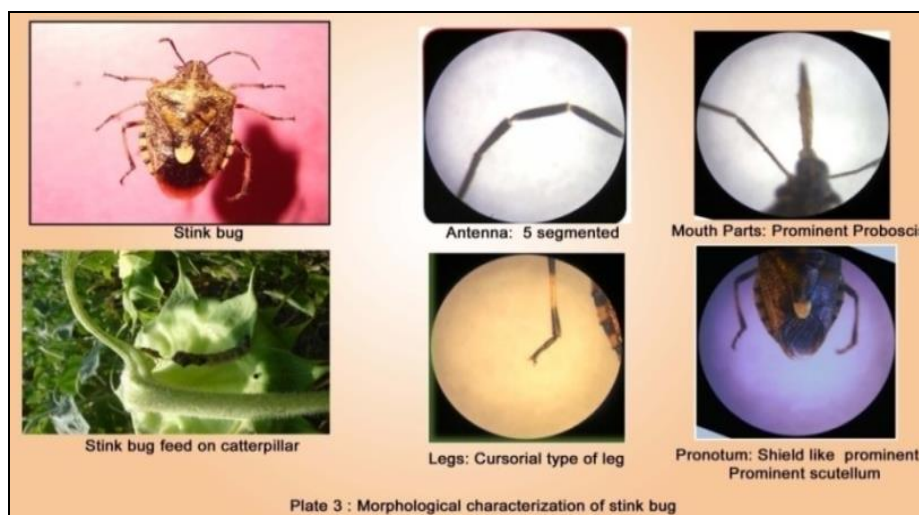


Fig 3: Morphological characterization of Brown stinkbug *Podius* spp.

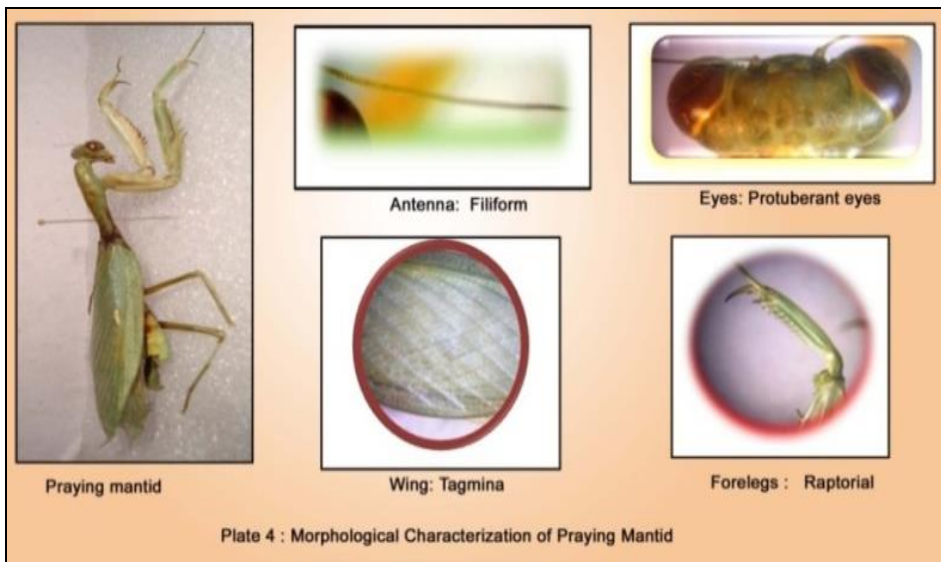


Fig 4: Morphological characterization of Preying mantid *Mantis religiosa*

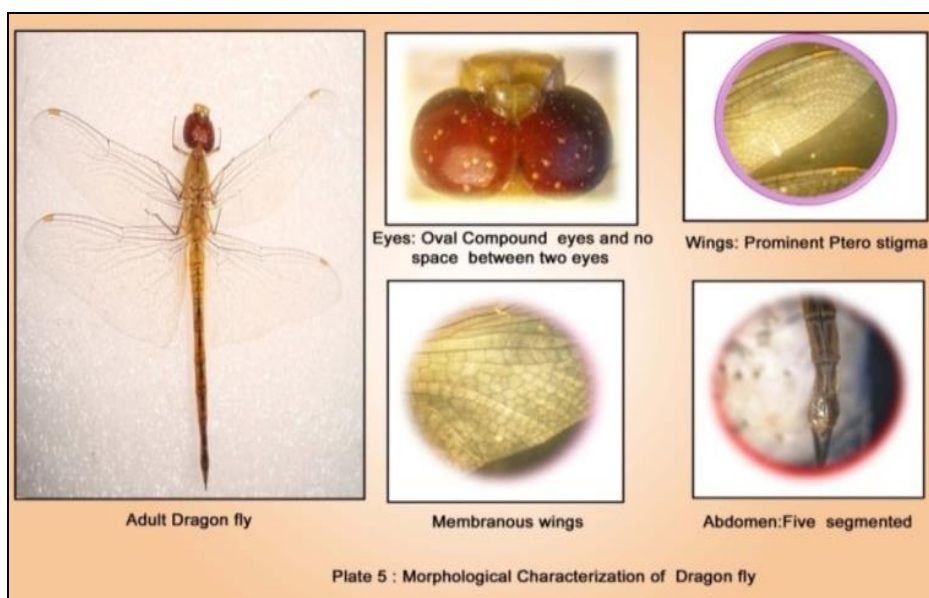


Fig 5: Morphological characterization of Dragonfly *Platygomphus spp.*

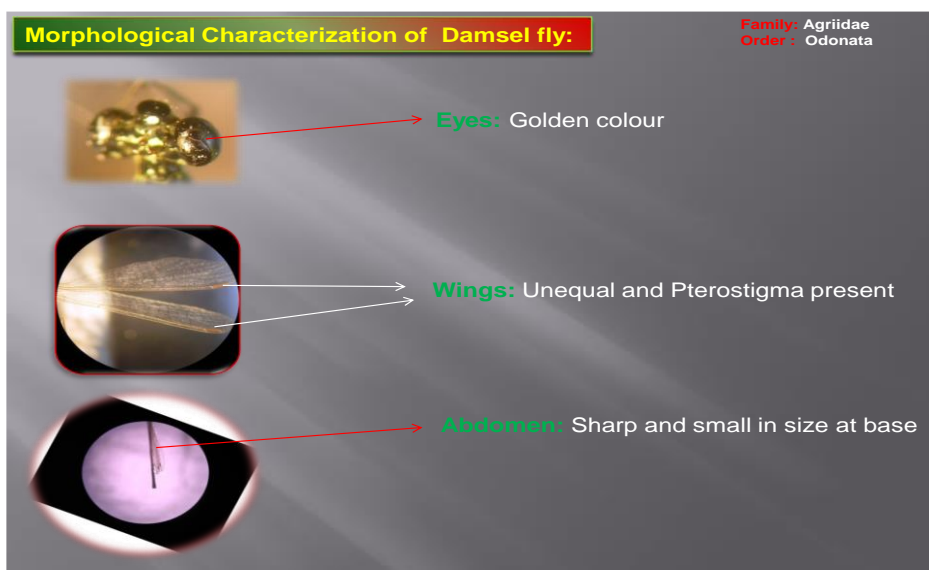


Fig 6: Morphological characterizations of Damselfly *Agiochmis spp.*

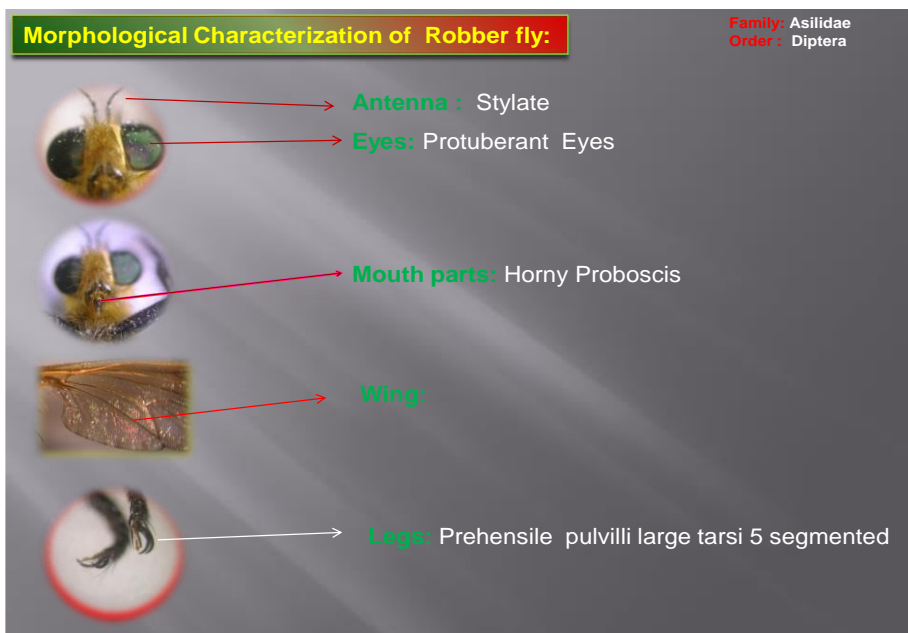


Fig 7: Morphological characterization of Robber fly *Philonicus* spp.



Fig 8: Morphological characterization of Ear wigs *Forticula auricularia*

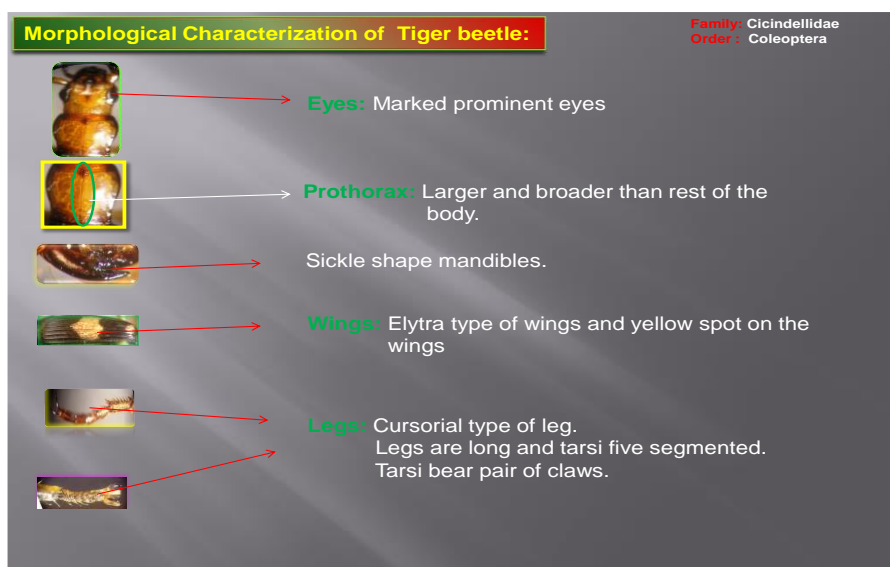


Fig 9: Morphological characterization of Tiger beetle *Cicindela* Spp.



Fig 10: Morphological characterization of various spider species

Conclusion

Based on the above investigations, it can be concluded that among predators, lady bird beetle, chrysopa, robber fly syrphid fly, and various species of spiders' like *Neoscona* spp. *Thomisus* spp. and *Oxyopes* spp. were found active in various talukas of Akola districts in kharif season and playing an important role in natural pest management. During the investigation, rich biodiversity in terms of Predatory fauna in all talukas of Akola District. It has been noticed that Predatory insects were active searchers for food and it had been known to arrive at heavily pest-infested field. They were also density dependent and their numbers rise as the prey numbers increases. The information collected in this study is useful in insect pest management. This investigation may helpful to the farmers as well as researchers and students for awareness, identification and characterization studies of the different predatory fauna.

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