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To Study the Collection, Preservation and Identification of Dipteran Diversities in Pune, Maharashtra

Meghna M. Kulkarni
Prof. Ramkrishna More College of Arts, Commerce and Science
Akurdi, Pune.
(Affiliated to Savitribai Phule Pune University, Pune).
meghsandesh1973@gmail.com
And

Dr. Shakera A. Inamdar
Department of Zoology
Modern College of Arts, Science and Commerce
Ganeshkhind, Pune, India.
moderninamdar@gmail.com

Abstract

Diptera is one amongst the diverse insect orders. It is the order of insects having a pair of wings and a pair of halters. It is the most successful group of organisms on earth and has biological diversity too. This study is mainly based on identifying dipteran species diversity in and around Pune city. Another aim of this study is to prove the dipteran food habits as is proved by their habitat. The present study on dipteran diversity was done during 2016-18 in and around Pune city. The collection was done by field visits to various areas (Viz., Malvali, Talegaon Dhamdhere, Panshet, Khadakvasla, Dange chowk, Chinchwadgaon, Sambhajinagar) and the specimen were collected by aerial net. Dipterans were collected from various habitats like garbage bins, fish market, fruit and vegetable market, cow sheds, crop fields etc. The observations showed some dipterans with patterned wings, some having stripes on their thorax dorsally etc. The wing pattern and antennae sizes of the collected dipterans suggested their families by going through the available key. Some 17 families of diptera containing nearly 25 species were observed out of which some were pollinators, some were disease causing vectors while most of them Diptera is one amongst the diverse insect orders. It is the order of insects having a pair of wings and a pair of halters. It is the most successful group of organisms on earth and has biological diversity too. This study is mainly based on identifying dipteran species diversity in and around Pune city. Another aim of this study is to prove the dipteran food habits as is proved by their habitat. The present study on dipteran diversity was done during 2016-18 in and around Pune city. The collection was done by field visits to various areas (Viz., Malvali, Talegaon Dhamdhere, Panshet, Khadakvasla, Dange chowk, Chinchwadgaon, Sambhajinagar) and the specimen were collected by aerial net. Dipterans were collected from various habitats like garbage bins, fish market, fruit and vegetable market, cow sheds, crop fields etc. The observations showed some dipterans with patterned wings, some having stripes on their thorax dorsally etc. The wing pattern and antennae sizes of the collected dipterans suggested their families by going through the available key. Some 17 families of diptera containing nearly 25 species were observed out of which some were pollinators, some were disease causing vectors while most of them were decomposers.

Keywords: Diptera, Disease causing vectors, Pollinators, Decomposers, Forensic diptera.

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Introduction

Diptera- Greek-Di-"two" and ptera- "wings" meaning two winged animals. It is an order of class Insecta belonging to phylum Arthropoda. Insects of this order are commonly called as true flies. They use only a single pair of wings to fly. The hindwings are evolved into advanced mechano sensory organs of rotational movement and allow dipterans to perform advanced aerobatics. It's a large insect order containing an estimated 1,000,000 species which include crane flies, horse flies, fruit flies, mosquitoes, etc., These insects have a moveable head with a pair of large compound eyes and mouthparts designed for piercing and sucking or lapping and sucking type etc., In different groups. Below the head, the body shows divisions called thorax and abdomen.

The thorax id divided into pro, meso and metathorax. Mesothorax greatly developed compared to prothorax and metathorax which have dense bristles showing characteristic arrangement. Below thorax is the distinctly segmented abdomen.

The order diptera is classified into two sub-orders (Brauer's arrangement) based on the method employed by the imago to escape from the pupal shell. Certain recent systems divide the orders into six suborders. The classification adapted in Imms (1957) seems logical and accordingly the class is divided into three suborders- Nematocera, Brachycera and Cyclorrapha. The most primitive living diptera belong to Nematocera.Brachycera is an intermediate group and Cyclorrapha, the most advanced. The fossil record of diptera indicates that the earliest known fossil diptera were found in Liassic strata. Many families are represented in tertiary deposits. Tillyard thought that a four-winged fossil from the upper Permian of Australia represented a mecopteran stock; dipteran fossils are abundant in the Mesozoic, especially in the late Jurassic and early Cretaceous. Diptera is one among the species abundant orders of insecta and it is also among the most important flower visiting orders of insecta. Some flower visiting groups had diversified during the mid-cretaceous, consistent with the rise of angiosperms to wide spread floristic dominanceaccording to fossil record revelations (Evolution of lower Brachycera flies-Diptera-and their adaptive radiation with Angiosperms- Qingqing Zhang and Bo Wang, April2017).

Diptera is one of the major insect orders having great species diversity. But basically, all the dipterans undergo metamorphosis showing stages like Egg-Larva-Pupa-Adult in their life

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cycle. The eggs are laid on the larval food source and the larvae which lack limbs, develop in their food source (often), into pupa which is a tough capsule from which the adult emerges when it is ready. Adult flies mostly have short lives.

The body of an adult shows a head which is relatively larger than body and which is Prognathus. Head bears a pair of large, compound eyes occupying most of the dorsum of head capsule. The vision may be holoptic in mostly in mostly males (both eyes may be fused) or dichrotic in most of the females (separated eyes). Ocelli mostly three in number are arranged in a triangle. Antennae show variations. In Nematocera – filiform in females, plumose in males. In Brachycera – stylet type, in Cyclorrapha- aristate type. Mouth parts of diptera also show variations. In Cyclorrapha they are well equipped for blood sucking. Labium universally forms proboscis. Mandibles are absent or greatly reduced in non-sucking cyclorrapha. In the blood sucking Cyclorraphans, proboscis alone functions as piercing organ and the labella bear prostomial sharp teeth for cutting the tissue of the host but lack pseudotrachea. In Nematocera and Brachycera, the mandible stylet is present. Thorax bears single pair of forewings which help in flight. Hindwings are modified into club shaped halters. Wings are membranous, hyaline or colored, covered with setae or scales. Venation on wings-reduced 2A, 3A as vestigial and atrophy of Cu is common. Posterior margin of wings at base possess lobes-thela and squammae in many species. In Hippoboscidae, the wings are wanting in some of its forms. Legs are slender or stout, weakly developed, mostly fit for clinging. Tarsi are 5 segmented, claws are paired with empodium and pulvilli (secretory pads in Cyclorrapha). Pulvilli are reduced or wanting in Nematocera or replaced by a single arolium. Abdomen is distinctly segmented. Genitalia in females are on 6 or 10 segments, often modified into telescopic ovipositors or oviscapt; In only genus Tipula, the ovipositors are valvular. Male genitalia are on 9^{th} or 10^{th} segments and form a curved, twisted hypopygium supplemented with a pair of claspers, aedeagus and with or without some accessory structure.

There are nearly an estimated 150,000 different kinds of dipteran flies worldwide and perhaps more than a quarter of a million species in some 150 families (Encyclopedia of Insects-Second Edition -2009). There are nearly 20,000 species of diptera in the Nearctic Region, a significant proportion of which is catalogued (Stone et al., 1965). Order Diptera is of considerable ecological and human importance. As observed, most of them are beneficial

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to the human beings as pollinators through their feeding habit and increasing the crop yield (Skevington and Dang 2002, Marshal 2012) or by acting as biological control agents, controlling the pest insects by eating pest larvae or by helping in degradation of decaying organic matter like dung, carrion etc. They also play an important role in forensic sciences (Singh and Bharti 2000). They are also used in genetic studies as model organisms. The benefits of diptera are significant but due to very less work on these true flies, their benefits remain less understood. But whatever studies have been conducted on diptera until now, it is clear by their habit and habitat that a majority of them are beneficial to the ecosystem.

MATERIAL AND METHODS:

STUDY AREA: A study of dipteran flies conducted in Pune region (Pune University, Malvali, Talegaon Dhamdhere, Panshet, Dange chowk, Chinchwadgaon, Sambhajinagar etc.) with an area of nearly about 450.69$Km^{2.}$ The geographical condition of study area is Latitude 18.34'N and Longitude 73.50'E. Pune district is located 560m above sea level on western margin of Deccan Plateau. It is hilly and raised area. Pune has dry and tropical wet climate. The average temperature ranges between 20-28^{o} Celcius.

METHOD FOR COLLECTION: The present study was conducted to collect the diptera from October 2016 to September 2018. The sampling was carried out at each site at an interval of one week. The specimens were collected by hand net and aerial net from each selected locality and at different times of the day during each collection.

INSECT COLLECTION NET:

It is used for capturing the insects. It consists of a wire cloth bag and handle. It can also be made out of a damaged badminton racket, tied with a netlon cloth around its mainframe. The handle can be of wood or metal and is attached to the main ring of about 30cm. in diameter. In such a way an aerial net for collecting insects is used successfully.

INSECT PRESERVATION: After collection, they were kept in a jar consisting of a cotton ball dipped in chloroform. This was used to kill the insects instantly. The specimens were spread on a spreading board and kept in a scientific oven at 40^{o}C for 48 hours, after which they are removed as they were completely dried. It was made sure that the abdomen of the insects was straight so that pinning the insects after drying was easy. And their pinning was done. Each insect was pinned slightly to the right on the midline on the metathoracic region.

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Then all the dried, pinned specimen were kept in a wooden box with naphthalene balls in it to protect the specimen from insect pests or any fungal growth.

All the specimens were labelled as follows: Locality, Date, Collector, environment from which specimens were collected.

IDENTIFICATION OF SPECIMEN: The specimens were identified with the help of available literature. The photographs of the diptera were taken with the help of android digital camera and were identified with the help of standard keys like pictoral keys to Dipteran flies by H.R. Dodge and Jeffrey Hahn, University of Minnesota, Department of Entomology and with the help of Dr. Bulganin Mitra(Former scientist 'C', Zoological Survey of India, Kolkata- 700053.

OBSERVATIONS: The observations showed dipterans having variety of body patterns.

The wing patterns suggest the families to which the dipterans belonged and even the antennae regions which were of different sizes, suggested their families by studying the text referred till now and also by taking help of expert.

RESULTS AND DISCUSSIONS:

Phormia regina Musca autumnalis *Cophinopoda chinensis*

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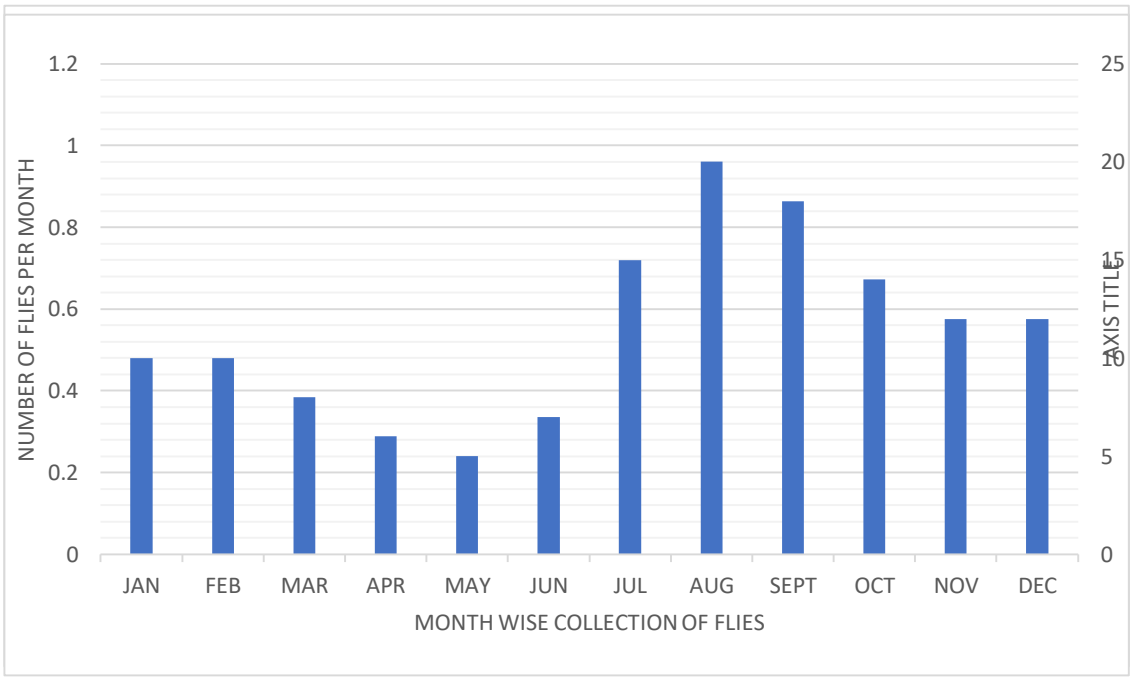
Bactrocera cucurbitae *Drosophila melanogaster* Aedes *aegypti*

Psychoda alternata *Ptychoptera contaminata* *Sepsis fulgens*



These charts give an idea of flies collection data (monthly collection) as well as family wise collection during the research study on the dipteran diversities in the Pune region. More number of flies from certain families were during rainfall period whereas certain pollinating flies were abundant during the other period when bloom in flowering was observed.

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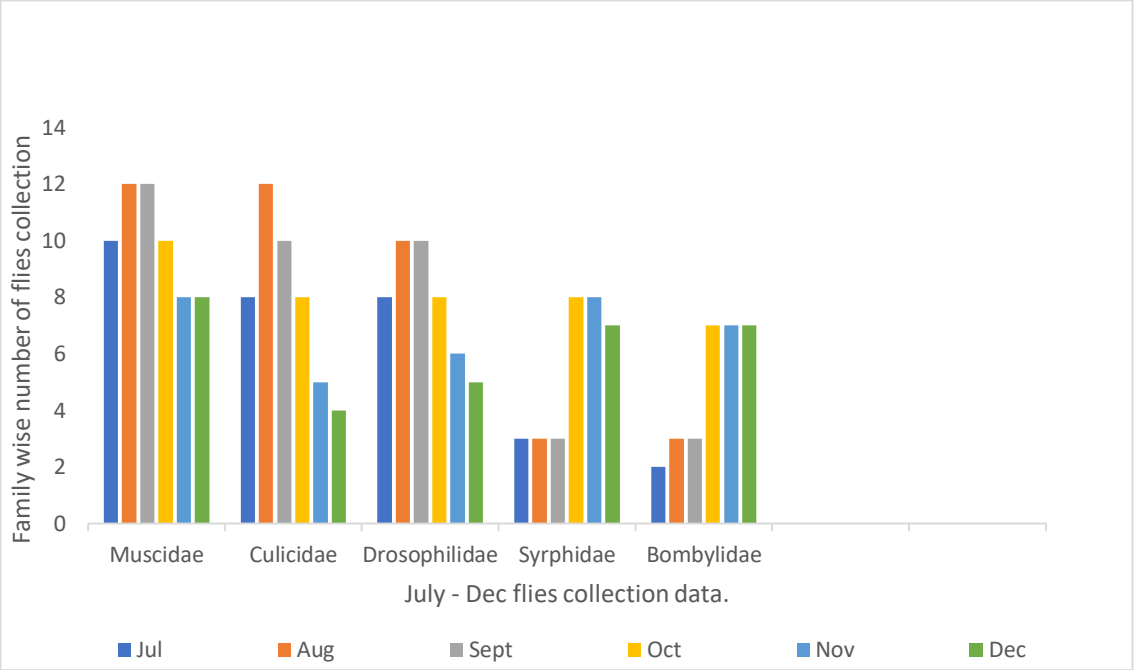

The present study on dipteran diversities in Pune has resulted in identification of nearly 25 species belonging to 17 dipteran families. As most of the collections were done from areas like fish markets, fruit markets, vegetable markets, garbage bins etc., where decomposing matter is present and attracts dipteran flies, the data includes most of them from Muscidae, Fannidae and Drosophilidae. The collection done from January to December shows maximum collections in August as there is enough rainfall by August in Pune and it is the breeding season of these flies and so the collections are very high during this month.

Most of the dipterans collected are beneficial to the ecosystem by acting as scavengers. In this study nearly 58% of the dipterans are found on decomposing animal or plant matter whereas nearly 23% of them are plant visitors while only 17% are vectors for the spread of some common diseases.

It is confirmed through various studies that generally insects respond quickly to the environmental changes (Schowalter 2011). In natural areas, nature provides insects with diverse niches to be occupied but due to urbanization, the natural habitats of many vertebrates and invertebrates like insects get destroyed. Due to deforestation, growth of concrete jungles, environmental pollution in urban areas, promotion of biotic homogenization by reducing the diversity of some species and increasing abundance of certain species tolerating such

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disturbances, occurs (Richmond and Buczkowski 2012). For instance, many of the flies caught for the study belonged to muscidae and among the mosquitoes caught only a few species of mosquitoes such as Aedes aegypti breed in urban areas. Other species were abundantly available in natural areas surrounded by vegetation, ponds, lakes etc. This study shows the recent developments in the pune city due to industrialization and the trend of growth of diptera in this part.

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