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Diversity of Insects in Apti (Khurd) Village of Vikramgad Tehsil, Palghar, M.S., India

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ABSTRACT

The field survey was conducted at Apti (Khurd) village located in Vikramgad Tehsil of Palghar District in Maharashtra, India. The study area was divided into five zones: Residential Zone, Agriculture Zone, Streamside Zone, Industrial Zone and Forest Zone. A total of 73 species of insects were sampled which belong to 13 Orders under 39 Families. Sampled insects were distributed on basis of orders, families, zones and habitats. Fastly growing Industrial zone and human anthropogenic activities can badly affect insect diversity and ultimately environment. Invertebrates are more sensitive and quickly affected by changes in the environment than any other taxa. Thus, a strong understanding of insect responses to human activity will be useful to evaluate functional consequences of human disturbance on ecosystems. This attempt will be useful to make aware the authorities specially town planners about rich heritage of this area and to plan scientifically and sustainably.

Key words: *Apti (Khurd), Vikramgad, Palghar, Insects, Diversity.*

Introduction

About 8.7 million of total numbers of species have been estimated to be surviving on the earth (Mora and *et al.,* 2011). Insects are the most diverse organisms on the earth, which represents almost 75% of the recorded fauna of the world. They are found in tropics with an enormous richness of species and wide range of specializations (Loxdale, 2016).

Insects create the biological foundation for all terrestrial ecosystems. They cycle nutrients, maintain soil structure and fertility and have great utility in the field of medicine and forensics (Farook *et al*., 2020). Many species are highly beneficial as pollinators and seed dispersers (Bartomeus *et al.*, 2014), as biological control agents used to protect our crops and products (Southon *et al.,* 2019), as part of the traditional diets and as a rich source of protein (Tiencheu and Womeni, 2017).

Because of their high species diversity, ubiquitous occurrence, and importance in the functioning of natural ecosystems, insects can be used in environmental impact assessment (Rosenberg *et al.* 1986). This study will help to study and analyze the current degradation rate is and its future consequences. The main reasons of their decline are human disturbance, conversion of natural ecosystems to agricultural ones, agricultural intensification, increased use of pesticides, and urbanization. The climate change is likely to make some species go locally extinct. (Eggleton, 2020). This study will provide base for the planning conservation strategies. The main aim of this study was to collect and identify the insect species to know their diversity richness. The current study was designed for the very first time to document diversity of insects in Vikramgad tehsil.

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Materials and Methods

The Study Area

Apti (Khurd) is small beautiful village located in Vikramgad tehsil of newly formed Palghar district in Maharashtra (Table 1). Apti (Kh) is located between Geographic position of Latitude: 19° 41' 8.7072'' N and Longitude: 73° 4' 37.3836'' E. The Elevation from the sea level is 46m. The Corridor of Wada- Vikramgad passes through this town. The agriculture is the prominent practice followed by people and few industries are also established in this area. Since it is embedded in green forest, it may have wide diversity of insect fauna.

Methodology

The Study area was divided into five zones: Agriculture Zone, Forest Zone, Industrial Zone, Residential Zone and Streamside Zone. These sites were almost 200m away from center of the selected village. Sampling was done once per week from August to November in morning (07:30-10:00) and evening (15:00-17:30) hours. Beating or sweeping of shrubs with help of long stick and cloth was used to collect the falling insects. Most of the species were collected by using insect nets to catch them. (Graham *et al*. 2021), (Häuser and Riede, 2015). Some of the species were handpicked with the help of large forceps. All the collected species were captured in photographs by using Smartphone. After taking photographs, insects were returned to their respective natural habitats. Proper shoes, cloths, hand gloves and masks were used while sampling to avoid any health consequences.

Identification

Sampled species were identified with the help of available Standard Databases, Entomology Books and from citizen science internet portals such as iNaturalist, India Biodiversity, etc.

Results

Total 73 different species of insects were sampled from the study area which belong to 13 Orders and come under to 39 Families are mentioned in Table 2.

Order Wise Distribution

Among all the orders of sampled insects, the Lepidoptera was found to be prominent of all. The Odonta occupy the second position. These orders with their representative organisms are mentioned in (Figure 1).

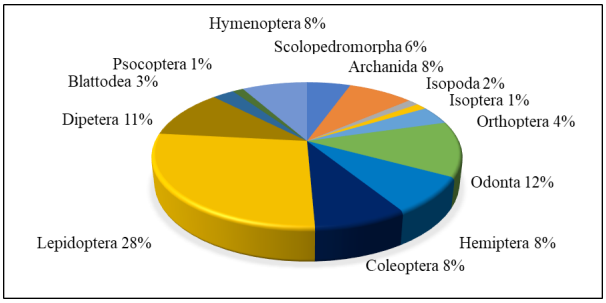


Fig. 1. Order wise distribution of Insects in Apti (Khurd) village

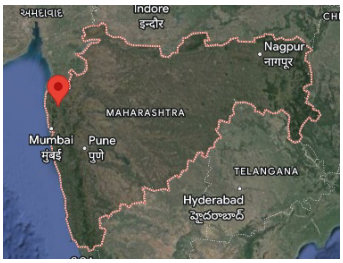
Family Wise Distribution

Nymphalidae family of order Lepidoptera was prominent among all while the Libellulidae family of order Odonta holds the second position (Fig. 2).

Zone Wise Distribution

Scolopedromorpha preferred deep forest zones and preferred solaced area. Species of Orb Weaver spiders were spotted in forest zone. Other Spiders species were also seen in other zones. Isopterans and Isopoda were found only in forest area under fallen big branches of trees. Surprisingly, some Orthopterans were sampled around industrial area.

Table 1. Google Map's Images of Apti (Khurd) Village.



Apti (Khurd) Village

Apti (Khurd) Village

Selected zones

Table 2. Inventory of species of insects from Apti (Khurd) Village.

Order	Family	Scientific Name	Common Name
Scolopedromorpha	Scolopedridae	*Rhysida longipes*	Minor blue leg
		Rhysida nuda immarginata	-
		Cormocephalus sp.	-
		Scolopedra sp.	-
Archanida	Tetragnathidae	*Tetragnatha genus*	Long-jawed orb-weavers
	Oxyopidae	*Oxyopes quadrifasciatus*	Orange strip lynx spider
	Araneidae	*Larinioides sp*	Orb weaver spider
		Araneus sp.	Angulate Orb Weavers
	Anyphaenidae	*Anyphaena sp.*	Sac Spider
	Lycosidae	*Arctosa sp.*	Wolf Spider
Isoptera	Rhinotermidae	*Coptotermes formosanus*	Formosan subterranean termite
Isopoda	Philosciidae	*Philoscia muscorum*	Common Woodlouse
Orthoptera	Acrididae	*Oedipoda coerulea*	Iberian band-winged
		Pezotettix giorna	Short horn Grasshopper
		Trilophidia sp.	-
Odonta	Libellulidae	*Diplacodes trivialisis*	Chalky percher skimmer
		Trithemis arteriosa	Red-veined dropwing
		Acisoma panorpoides	Asian pintail
		Brachythemis contaminate	Ditch jewel
		Indothemis carnatica	Black marsh skimmer
		Crocothemis servilia	Scarlet skimmer
	Coenagrionidae	*Ceriagrioncoromandelianum*	Coromandel marsh dart and yellow waxtail
	Platycnemididae	*Onychargia atrocyana*	Marsh dancer
	Coenagrionidae	*Ischnura aurora*	Aurora Bluetail
Hemiptera	Flatidae	*Siphanta acuta*	Turpedo bug
	Coreidae	*Acanthocephala terminalis*	Leaf-footed bug
	Miridae	*Stenoderma sp.*	Nearctic Plant Bug
		Orthotylus sp.	-
	Membracidae	*Centrotus cornutus*	Treehopper
	Plataspidae	*Coptosoma xanthograma*	Black Stink bug
Coleoptera	Coccinellidae	*Coccinella Transversalis*	Transverse lady beetle
		Propylea quatuordecim punctata	Spotted Laybird
	Chyrsomelidae	*Altica oleracea*	Blue-black Leaf Beetles
	Chyrsomelidae	*Gonioctena viminalis*	Leaf Beetle
	Scarabaeidae	*Oryctes rhinoceros*	Asiatic Rhinoceros Beetle
	Cerambycidae	*Xystrocera globosa*	-
Lepidoptera	Nymphalidae	*Euploea core*	Common Crow
		Danaus genutia	Common Tiger
		Tirumala limniiace	Blue Tiger
		Mycalesis perseus,	Common bushbrown
		Mycalesis mineus	Dark-band bush brown
		Mycalesis nicotia	Bright Eye Bushbrown
		Mycalesis intermedia	Intermediate Bush brown
		Mycalesis mineus Polydecta	Dakhan Dark-branded Bushbrown
		Neptis hylas	Common Sailer
		Junonia iphita	Chocolate pansy
		Junonia almanac	Peacock Pansy
	Lycaenidae	*Hemiargus ceraunus*	Ceraunus blue
		Euchrysops cnejus	Gram blue
		Castalius rosimon	Common Pierrot
	Pieridae	*Delias eucharis*	Common Jezebel
		Catopsilia pomona	Common Emigrant

Table 2. *Continued ...*

Order	Family	Scientific Name	Common Name
		Eurema hecabe	Common grass yellow
	Crambidae	*Spoladea recurvalis*	Hawaiian Beet Webworm
		Elophila nymphaeata,	Brown china mark
	Noctuidae	*Helicoverpa armigera*	Cotton bollworm
Diaptera	Calliphoridae	*Chrysomya albiceps*	Blowfly
	Anthomyiidae	*Pegomya hyoscyami*	Beet or Spinach leafminer
	Syrphidae	*Paragus bicolour*	-
		Melanostoma millineum	Hoverfly
	Asilidae	*Promachus vertebrates*	Robberfly
	Bombyliidae	*Anthrax sp.*	Beefly
	Muscidae	*Musca domestica*	Housefly
	Tipuloidae	*Tipula maxima*	Crane fly
Blattodea	Blattidae	*Periplaneta americana*	Ship Cockroach
	Ectobiidae	*Blattella germanica*	German Cockroach
Psocoptera	Liposcelididae	*Liposcelis sp.*	Booklice
Hymenoptera	Apidae	*Apis cerana indica*	Indian honeybee
		Apis florae	Dwarf honeybee
	Vespidae	*Vespa orientalis*	Oriental Hornet
		Delta pyriforme	Potter Wasp
	Formicinae	*Camponotus pennsylvanicus*	Black Carpenter Ant
		Solenopsis sp.	Fire Ant

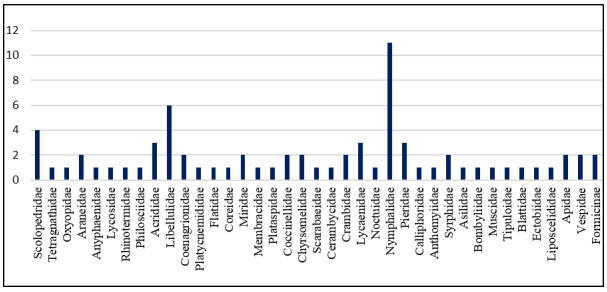


Fig. 2. Family wise distribution of Insects in Apti (Khurd) village.

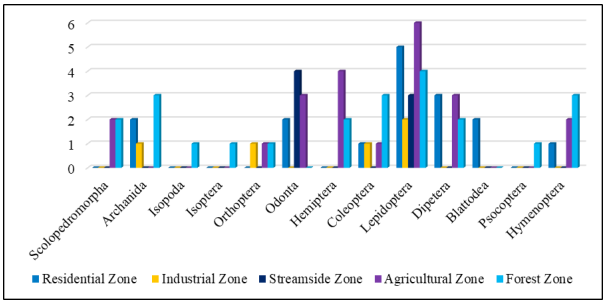


Fig. 3. Zone wise distribution of Insects in Apti (Khurd) village.

Odonatans were prominent near streamside zone and agriculture zones. Hemipterans preferred agricultural and forest zones. Coleopterans were found in all zones except for streamside zones. Lepidopterans inhabit all types of zones. Lot of caterpillars of were sampled during this study work, but unable to identify them, because of unavailability of knowledge and data. Dipterans were found mostly in residential and agricultural zones. Hymenopterans were prominent mostly in forest zone rather than all other zones. Agricultural zone also well suited for bees and wasps. One Species of order Psocoptera also has been sampled (Figure 3).

Habitat Wise Distribution

Insects were found to survive on grasses, on trees, inside soil & even under dead wood & dead leaves. Different types of Grasses were the major habitat. (Figure 4).

Discussion

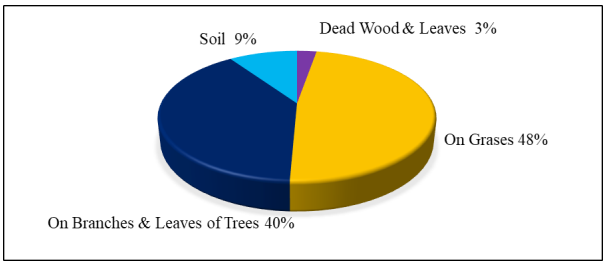


Fig. 4. Habitat wise distribution of Insects in Apti (Khurd) village Results and Discussion

Diversity depends upon Vegetation of that area. Specific insect needs specific host plant for survival (Zhu, *et al.*, 2008). Industrial zone had less vegetation as compare to all other zones, so few species were found to be surviving in that area. In Agricultural zone, smaller number of species were observed. As only one type of crop (monotonous crops) is cultivated in this area, so few specific insects were found. Residential zone also showed limited kind of vegetation, specifically most of vegetation were covered by flowering plants, so again specific species of insects such as bees, beetles were spotted. Streamside zone had good level of vegetation; thus, different types of insects were recorded. The which kind of vegetation would be beneficial for survival of which kind species can be understood through this study.

The Pollution is one of the major factors which affect diversity of the insects. It causes decline in diversity of species Luckily selected area had industrial zone which helped for doing comparative analysis. Very few numbers of species of insects were spotted in and surrounding area of industries, which shows that pollution affect the survival. Surprising to know that moths (Lepidoptera) and grasshoppers (Orthoptera) were also observed near industrial zone which show that they might have developed some sort of adaptations. Rest of the zones had limited level of pollution; thus, insects were prominent in other zones. At what level pollution can affect the insects and ultimately the humans can be estimated through this work.

Odonatans were prominent in the streamside zone. Major reason for their high numbers that they lay their eggs in water and larvae of odonatans complete their life cycle inside water. For laying purpose, they prefer water source. Odonatans are considered to be good indicators of environmental health and water quality as well (De Moor, 2017). Also, Dragonflies are predators of mosquitoes (Vatandoost, 2021). They feed on eggs of mosquitoes and other vectors which are capable of causing different diseases. So, they play important role in control of mosquitoes ultimately disease.

Many times, even after spraying of insecticides, the crops get damaged off as well as the beneficial microorganisms. Also, a lot of insecticides level can alter soil fertility as well as can harm organisms surviving in soil (Gunstone *et al.*, 2021). The reason behind this is probably using wrong type of insecticide. Through such study work, which kind of pest is infecting the crop can be identified and according that insecticides can be applied.

Lepidopterans were capable of surviving in all zones which show that they are adapted for all types of environmental aspects. It will be very interesting to know that how they are facing all these conditions and surviving in further work. Hymenopterans (Honeybees) helps in Pollination (Khalifa and *et. al.*, 2021), thus are essential for reproduction of plants, especially cross fertilization.

Conclusion

This kind of work was done for the very first time in Vikramgad Tehsil to find out the biodiversity of insects. This study shows that selected study area i.e., Apti (Khurd) is rich in diversity. Along with pollution, the loss of vegetation can affect the survival and distribution of insects. A clearing of land for different purposes (Anthropogenic Activities) will badly affect the diversity and ultimately environment. An Apiculture can be practice as two honeybee's species are sampled and also this village having good level of vegetation which will provide job opportunities to local people and boost economic growth. This attempt will be useful to make aware the authorities such as the government bodies, the developmental organizations and specially, the town planners about rich heritage of this area and to plan sustainably. Proper awareness, regarding the importance of insects and their essential role in the ecosystem to the local peoples through different programs should be encouraged. This will ultimately help for the protection of insect fauna of this area. This information will assist all stakeholders to identify beneficial species and also managing noxious species.

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Declarations

Conflict of interest

The authors have no conflicts of interest to declare. Both authors have seen and agree with the contents of the manuscript and there is no financial interest to report. We certify that the submission is original work and is not under review at any other publication.

Informed consent

The manuscript in part or in full has not been submitted or published anywhere.

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