FAUNSTIC STUDY OF LEPIDOPTERANS IN AKOLA VICINITY

THESIS

Submitted to the
Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola
In partial fulfillment of the requirements
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MASTER OF SCIENCE
IN
AGRICULTURE
(AGRICULTURAL ENTOMOLOGY)

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Enrolment Number - II/118 **2016**

DECLARATION OF STUDENT

I hereby declare that the experimental work and its interpretation of the thesis entitled **"FAUNISTIC STUDY OF LEPIDOPTERANS IN AKOLA VICINITY"** or part thereof has neither been submitted for any other Degree or Diploma of any University, nor the data have been derived from any thesis or publication of any scientific organization. The sources of material used and all assistance received during the course of investigation have been duly acknowledged.

Place: Akola

Date: 16/06/2016

(Zamre Sonali Dinkar)

Enrolment No: II/118

CERTIFICATE

This is to certify that the thesis entitled **"FAUNSTIC STUDY OF LEPIDOPTERANS IN AKOLA VICINITY"**, submitted in partial fulfillment of the requirements for the degree of **"Master of Science in Agriculture (Agricultural Entomology)"** of Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola is a record of bonafide research work carried out by **Zamre Sonali Dinkar** under my guidance and supervision.

The subject of the thesis has been approved by the student's advisory committee.

Place: Akola
Date: 16 /06/2016

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16/06/2016

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Place: Akola

Date: /2016

(Zamre Sonali Dinkar)

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Dr. PDKV	:	Dr. Panjabrao Deshmukh Krishi Vidyapeeth.
%	:	per cent
C.N	:	Common Name
et al,	:	et alia(And Others)
etc	:	Etcetera
Fig	:	Figures
IPM	:	Integrated Pest Management
Sp	:	species
No.	:	Number
S.N	:	Scientific Name
i.e	:	id est (that is)

(E) THESIS ABSTRCT

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ABSTRACT

The present investigation entitled "Faunistic study of lepidopterans in Akola vicinity" was carried out during the year 2015-2016 in Department of Entomology, Dr.Panjabrao Deshmukh Krishi Vidyapeeth Akola.

Lepidopterans were collected from field crop of Akola vicinity by using net and light traps, and preserved for further study. These fauna were sorted out and categorized up to family based on morphological characterizations using appropriate taxonomic key. For studying the distinguishing morphological characters of different specimens, stereo zoom microscope (Nikon SMZ800) with attached Nikon camera was used.

In Lepidoptera order, twelve family observed viz; Noctuidae, Nymphallidae, Pieridae, Papillionidae, Sphingidae, Arctiidae, Lycaenidae, Hesperidae, Geometridae, Notondidae and Pyrallidae, Pterophoridae.

Lepidopteran faunal activity was noticed from second week of July 2015 i.e. 28th meteorological week (Table - 2 fig 1). It is revealed from the data that peak activity was noticed in 37th meteorological week (10 Sept-16 Sept) during this period total 59 specimen were trapped and preserved. Second peak was recorded in 36th (48 Specimen) were trapped followed by 33rd week (44 specimen).

Family wise recorded data showed that family Noctuidae observed rich fauna during the course of study and contributing about 26.57 per cent, followed by Nymphallidae 24.28 per cent, Pieridae 19.71 per cent, Papillionidae 9.7 per cent and family Notondidae and Pyrallidae observed the minimum fauna in Akola vicinity.

Noctuidae family fauna showed the abundance in population (-0.3520), followed by Nymphallidae (-0.3315), Pieridae (-0.3199), Papillionidae (-0.2264), Sphingidae (-0.1349), Arctiidae (-0.1469), Pterophoridae (-0.09421) had the moderate abundance of lepidopteran fauna. Family Notondidae and Pyrallidae showed lower population of lepidopteran fauna.

Tobacco leaf eating caterpillar, *Spodoptera litura* (-0.2724) showed the abundance in population, where as American bollworm, *Helicoverpa armigera* (-0.02186),Lemon butterfly, *Papilio demoleus* (-0.1976), Monarch butterfly, *Danais plexxipus* (-0.01973) had a moderate abundance. Rich Shannon Biodiversity index (H'=-2.36707) was noticed in terms of species of Lepidoptera in Akola vicinity.

Noctuidae family showed the dominance in collection population 40.68 per cent, Pyrallidae 9.6 per cent, Pieridae 9.6 per cent, Lycaenidae 6.89 per cent. However family cossidae, Sphingidae, Bombycidae, showed the lower population of Lepidoptera Insect Biosytsematics Lab, Department of Entomology, PGI, Dr. P. D. K. V, Akola.

CHAPTER I

INTRODUCTION

1.1 Background information

Lepidoptera is the second largest order after coleoptera which comprises moths, butterflies and skippers. There are about 2, 00,000 species of Lepidoptera out of which 15,000 species belongs to butterflies (papilionidea) and remaining are moths' over world (Holloway et al., 1992). The order Lepidoptera belongs to holometabolous, endopterygotes and scale winged insects, which includes butterflies and moths (Richards, 1977).

Lepidopteran insects are characterized by having broad wings covered with minute overlapping scales, usually brightly coloured. The moths are generally nocturnal while butterflies are diurnal in habit. They are beautiful insect representing species specific colour pattern of the wings. The adults feeds upon the nector and juices of the flowers and fruits (over ripe one) while larvae exclusively feed upon a variety of plants and are destroying foliage, shoot of trees, food grains, flowers, clothings etc and behave as the external feeders or internal borers. The lepidopteran larvae are therefore, pest of various economic crops and timber. The adults are on the contrary, harmless except some species of fruit sucking moths, such as the citrus fruit sucking moth, *Eudocima* spp. and caster semilooper.

This includes butterflies and moths that show complete metamorphosis and pass through egg, larva, pupa and adult stages. All these stages have characteristic features in structure, habit and habitat so as to readily differentiate butterflies from moths. Lepidoptera is a large and well known group with cosmopolitan distribution of which India is no exception. The members are of great value both for conservation and for environmental planning in local scale. Individuals have great potential for inclusion in the faunistic analysis and environmental monitoring. This is particularly true for the butterflies due to the colour and pattern of their

wings, variegated food plants, wide range of habitats, abundant local and weedy species along with diverse forms, etc.

Recent estimates report over 1, 27,000 species of moths from all over the world (Alfred et al. 1997) of which over 12,000 species are recorded from India (Chandra and Nema, 2008).

India is known for its rich heritage of biological diversity, having already documented over 89, 000 species of fauna (Alfred et al., 1997) and 45,000 species of flora (Mudgal and Hajra, 1999) in its 10 biogeographic regions. Mountains have been the home for various species of flora and fauna, diversified landscapes, different climatic conditions and equally for numerous small creatures like insects since time immemorial. India is one among the twelve mega–diversity countries of the world. The Indian sub continent (CISC) has about 1439 species of butterflies out of which 100 species are endemic to it and at least 26 taxa are today globally threatened as per the IUCN (Singh and Pandey, 2004).

According to Gaonkar (1996) India hosts 1,501 species of butterflies, of which peninsular India hosts 350 and the Western Ghats, 331. Butterflies are sensitive biota which gets severely affected by the environmental variation and changes in the forest structure as they are closely dependent on plants. They also react quickly to any kind of disturbance and changes in the habitat quality making a good indicator to study changes in the habitat and landscape structure variations. An area rich in biodiversity is of great importance for conservation. Butterflies form an important component of biodiversity. Apart from their aesthetic appeal, they are good pollinators. As butterflies are highly sensitive to any environmental change and are delicate creatures, they act as good bio-indicators of the health of a habitat. However these creatures are under a real threat due to various developmental factors (Sidhu 2011).

Moths (Insecta: Lepidoptera) are commonly nocturnal, holometabolous and phytophagous insects. They occur in all kinds of habitats including natural forests, grasslands, agro horticulture fields and crop plantations. The moths provide valuable ecosystem services such as

pollination of crepuscular and night blooming flowering plants and their role as prey in food chain. These insects are often considered as bio- indicator material in biological studies because they are sensitive to habitat change. Being primary herbivorous insects, they help in natural control of weeds in an agro-ecosystem. The larvae of moths are active devourer of the tender parts of host plants hence, they are often recognized as pests of variety of crops, vegetables and forest plantations and hence they are treated as economically important insects (Shah and Mitra, 2015).

Super family Noctuoidea is one of the largest groups among the macrolepidopteran families in tropical and subtropical countries includes dominating families like Noctuidae, Erebidae and Notodontidae etc. Among these families Noctuidae is dominating, both in terms of species diversity and numerical strength. This is probably the largest macrolepidopteran family with more than 20,000 described species (Srivastava, 2002). It includes numerous species having economic importance, stems borer, root feeders, many defoliators, flower, fruit and seed feeders and also predators. The noctuid moths are very important component of natural and agricultural ecosystems. Due to the high diversity of species, the abundance of many species is highly reproductive, migratory and phytophagous feeding of their larvae, many species have posed serious problem of agricultural and forest pests (Kononenko and Pinnarata, 2004).

The noctuid moths can be easily recognized from other lepidopterans by their prominent eyes and comparatively robust structure. The noctuids mostly have drab forewings, although some have brightly coloured hind wings. The overwhelming majorities of noctuid fly at night and is almost invariably strongly attracted to light. Noctuid are well represented in all important zoogeographic regions and occur in lower montane to upper montane, sandy ocean beaches, dunes, river basins, deserts and a wide variety of habitats. Noctuids are a prominent group of terrestrial insect fauna and food web, including innumerable ecological and economically important species. Several species have larvae that live in the soil and as agricultural or horticultural pests. Majority of species are

polyphagous but restricted to herbaceous vegetation in distributed habitats in the tropics, a category which includes agricultural crops (Shivshankaran et al., 2011).

IMPORTANCE OF STUDY

This study would help to know the prevailing lepidopterans in Akola Vicinity. Lepidopterans cause damage to cotton, pigeon pea, urd bean, mung bean, ground nut, sunflower, jowar, wheat, soybean, okra, brinjal, tomato, sesamum, gram, etc. By knowing the prevailing species of lepidopteran in vicinity and by correctly identifying them, facilitates to formulate pest management strategies. Biodiversity of insect would be summarizing with its components species richness and evenness. The richness indicates the number of species present on the designated area where as evenness stands for the relative abundance of species. Richness provides an extremely useful measures of diversity when completes catalogues of species in the community where obtained. As information regarding biodiversity of lepidopteran in vidarbha that too in crop ecosystem is scanty. The present investigations were carried out with following objectives.

OBJECTIVE

1. To explore lepidopterans fauna in Akola vicinity.
2. To study the morphological characteristics of collected fauna as well as deposited fauna in museum in Department of Entomology.
3. To develop the pictorial key for identification up to family level.

SCOPE AND LIMITATION

There is lot of scope to explore the lepidopteran fauna and character there of Being the diversified cropping ecosystem and natural habitat, there is lots of possibility to explore rich fauna of Lepidoptera. The present study would be more informative and act as ready reckoners to IPM worker has to decide tactics. Insect taxonomy is basic science and as far as this region is concerned there is lot of scope to carry out such type of study. Most of insect fauna of vidarbha region is unexplored and

undescribed. Largest part of insect fauna are still waiting to describe and as well as to identify, studying morphological character of prevailing lepidopterans in Akola vicinity also having large scope as so as to classify the lepidopterans fauna into proper place.However, due to lack of resources, expertise in taxonomical work. There is certain limitation, to carry out such type of investigation. Nevertheless, efforts have been made to explore and carry out the characterization studies of lepidopterans having economic purpose.

HYPOTHESIS

Crop play important role in Indian economy in rural and urban sector. To enhancing g production new technologies developed by breeder that faces the challenge of emerging a new pests. Therefore correct identification of pest at least necessary and taxonomy plays an important role in this regards. The information on the activity of particular fauna in particular agro ecosystems is needed to generate the information on the level of active fauna and it's predominance in that ecosystem. For clearly identification of insects, based on the activities, behavior, feeding habit to discriminate harmful lepidopteran fauna. With this hypothesis present investigation has been carried out.

CHAPTER II

REVIEW OF LITERATURE

Present study conducted to access the "Faunistic study of lepidopterans in Akola vicinity" to estimate the family richness evenness and diversity in agro ecosystem and to know their role as bio indicator in agro ecosystems. To undertake this study literature was reviewed and briefed under following sub heading.

2.1 Collection and faunistic studies of lepidopterans

Mathew and Rahamathulla, (1995) recorded 318 species of moths belonging to 19 families. The families Geometridae, Noctuidae and Pyrallidae contained maximum number of species recorded. The study also indicated that the Heterocera of Silent Valley is rich and diversified.

Shah et al. (2001) made a survey of Kohat and collected 10 species belonging to only family pieridae from seven different localities over a period of 7 months during 1999.

Ghosh (2003) studied the geometrid moths of Sikkim and reported 525 species and cited a total of 460 and 260 species of geometridae from Meghalaya and West Bengal, respectively.

Mathew et al. (2004) catalogued 202 species of Lepidoptera from Shendurny wildlife Sanctuary, Kerala of which 73 were moths from 9 families, with Noctuidae and Pyrallidae the dominant families.

The moth fauna of northen Maharashtra is highly diversed but after evaluation of collection data of the 245 species recorded and identified, it was also observed that due to the topographical changes and loss of natural habitat (Mahajan,2004).

Ambrose and Raj (2005) evaluated Kalakad-Mundanthurai Tiger reserve Southern India butterfly fauna. Survey was done from Sept 2002- March 2003. Study revealed that 24 species of butterfly.

Joshi and Arya (2007) reported that butterfly communities were studied along altitudinal gradients in the Pindari area of the Nanda Devi Biosphere Reserve in the Bageshwar district of Uttaranchal, India, during April 2005 to March 2006. A transect method was used to collect the data. Four transects, two in each site, of a length of 1000 m each, were laid. From 96 sets of data, a total of 5038 individuals from the Papilionidea super family (butterflies) of Lepidoptera, representing 54 species and 9 families were recorded. The family Nymphalidae was the most abundant both in terms of the number of species and individuals, while the two most common species were *Vanessa cashmirensis* Fru and *Pieris canidia indica* Sparr recorded from all the four transects and contributed 8.3 per cent and 6.4 per cent of all individuals collected from all the four transects, respectively. The families Danaidae and Hesparidae were confined to the lower altitude site with broad-leaved forest. *Rahinda hardonia* Stoll, *Caprona ransonnetti* Felder, *Atella phalanta phalanta* Drury, *Chilaria kina* Hewiston, *Parnara guttatus* Bremer, *Colias erate* (Esper.), *Vanessa indica indica* Herbst and *Dodona durga* Kollar were recorded only on a few occasions from all the four transects and need to be monitored regularly.

Chandra (2007) studied the moth diversity of Madhya Pradesh and Chhattisgarh and recorded 142 species from 90 genera in 16 families Noctuidae and Crambidae dominant in that area.

Chandra and Nema (2008) studied 48 species of moths belonging to 42 genera under 10 families collected from different localities of Bandhavgarh National Park by the survey team of Zoological Survey of India, Jabalpur. All the species were reported for the first time from this National Park.

Borang et al. (2008) yielded 134 species of butterflies from area of Dihang Dibang Biospehere Reserve of Arunachal Pradesh, India. Recorded butterflies belong to 81 genera and 8 families whereas in the present research 8 genera belong to 3 families were reported. Nymphallidae comprises 28 genera, Papillionidae 9 and Pieridae 10 genera.

Muhammad (2009) collected moths from different parts of Peshawar during June to August in 2007 to determine their diversity, species richness and evenness. A total number of 774 moth specimens were collected by using simple light traps operated from dusk to dawn daily for sixty nights. The moths caught were identified up to family level. Families Noctuidae, Pyralidae, Arctiidae, Geometridae, Sphingidae and Lymantriidae were represented in collection samples. The diversity index, species richness and evenness of moth fauna in Peshawar were 3.14, 5.26 and 0.87, respectively.

Sharma and Joshi (2009) carried out butterfly species diversity at Dholbaha Dam in District Hoshiarpur, Punjab, India during 2002-04. The studied area has a moist deciduous forest surrounding it. A total of 41 butterfly species belonging to five families of order Lepidoptera were recorded during the study period. The family Nymphalidae, represented by 19 species was the dominant followed by Pieridae (10 species), Lycaenidae (8 species), Papilionidae (3 species) and Hesperiidae (1 species).

Tiple and Khurad (2009) recorded 145 species of butterflies at the eight study sites, of which 62 species were new records for the Nagpur city. The highest number of butterflies was recorded belonging to the Nymphallidae (51 species) with 17 new records, followed by Lycanidae (46 species) with 29 new records, Hesperidae (22 species) with 14 new records, Pieridae (17 species) with 4 new records and Papillionidae (9 species). Nymphallidae was dominant family with a highest number of species in 6 out of 8 sites.

Panthania and Anita Kumar (2009) recorded 28 species belonging to 19 genera i.e. *Aglais* Dalman, *Anosia* Hubner, *Ariadne* Horsifield, *Hypolimnas* Hubner, *Jumonia* Hubner, *Morpho* Fabricius, *Neptis* Fabricius, *Pyronia* Hubner, *Satyrus* Westwood, *Papilio* Linnaeus, *Atella* Doubleday, *Catopsilia* Hubner, *Cepora* Billberg, *Colias* Fabricius, *Delias* Hubner, *Eurema* Hubner *and Pieris* Schrank of the three families.

Diversity of butterflies inhabiting the department of atomic energy campus at Kalpakkam was recorded through a modified line transect methodology by setting butterflies observed within a 5m distance around observer. They recorded 55 species belonging to 5 families of order Lepidoptera out of these Nymphalidae were the most common with 20 species (Ramesh et al.,2010).

Sharma and Srivastava (2010) Surveyed for the Lepidopteran fauna of an agro-ecosystem near Bikaner (Western Rajasthan, India) in relation to its diversity and density was carried out. Both, butterflies and moths were documented from the region of study, numbers of species of moths were observed to be more (21), while, number of butterfly species collected was less (14). In all, butterflies belonging to 6 families and moths belonging to 4 families were reckoned from the agro-ecosystem.

Shamsudeen and George (2010) reported three species namely, *Brachy cyttarus subte ralbata, Pteroma plagiophleps* and *Metisa plana* have reported from the Kerala part of Western Ghats.

East Culcutta Westlands (ECW), lying east of the city of Kolkatta (formerly culcutta), West Bengal in India, demonstrated the usages of city sewage for traditional practices of fisheries and agriculture. As a Ramsar Site, the wetland demands exploration of its bio resources for better understanding and management of the ecosystem operating therein. Butterflies are potent pollinators and ecological indicator. As butterflies depends on preferred host and nectar plant during their larval and adult stages, respectively. The lack of these sources in some part of ECW indicates degraded habitats with low species richness (Chowdhury and Rohi, 2011).

Smetacek (2011) suggested that less than 50 per cent of the Indian Lepidoptera is represented in Indian collection. Approximately 70 per cent of the total of around 1300 species of Indian butterflies is represented and perhaps 40 per cent of an estimated 10,000 species of moth is represented.

Subhalakshmi et al. (2011) reported an inventory of 418 species of moths (303 identified to species, 116 identified to genus) from 28 families belonging to 15 superfamilies, which were recorded by light trapping at eight sites in northern Western Ghats, India. The dominant families were Erebidae, Geometridae, Sphingidae and Crambidae. The highest numbers of moths were recorded from Malshej Ghat, Sanjay Gandhi National Park and Bheemashankar Wildlife Sanctuary. The highest species diversity was recorded from Sanjay Gandhi National Park. Amboli, Koyna Wildlife Sanctuary and Malshej Ghat showed a number of new records and seem to support interesting and endemic moth fauna. Extensive sampling in Sanjay Gandhi National Park resulted in many range extensions for the northern Western Ghats.

Aland et al. (2011) studied diversity of wild sericigenous insect's i.e Silk producing moths in Amba Reserve Forest of Kolhapur District of Maharashtra State. A periodic survey was conducted during 2007-2009 which revealed presence of 5 species belonging to 5 genera viz. *Loepa katinka* Westwood, *Attacus atlas* Linnaeus, *Actias selene* Hubner, *Cricula trifenestra* Helfer and *Antheraea mylitta* Drury.

Sanyal et al. (2011) collected 1992 specimens of moths belonging to 16 families from the 20 sampling sites and were primarily sorted into 784 morph species, among which 1480 individuals could be assigned to the family level and 234 were identified up to the species level. The 20 sampling points were broadly grouped into six major vegetation zones, from lower to higher elevation zones: Chir Pine Forest, Agricultural Mixed Land, Mixed Riverine Forest, Broadleaved Mixed Forest, Conifer Forest and Alpine Scrubland.

Chowdhury and Soren (2011) reported that East Calcutta Wetlands (ECW), lying east of the city of Kolkata (formerly Calcutta), West Bengal in India. The diversity study, conducted for two consecutive years (Jan. 2007-Nov. 2009) in all the three seasons (pre-monsoon, monsoon and post-monsoon), revealed seventy-four species.

Gurule et al. (2011) identified macro moth species diversity of super family Noctuoidea in north Maharashtra. A total 372 species are collected from various families; 173 species of moths identified from super family Noctuoidea, which represent the most diverse group includes family Noctuidae and Notodontidae and Erebidae. A preliminary checklist of Noctuoidea moth species collected from the north Maharashtra is presented based on studies carried out from July 2008 to June 2010 in various localities. Although 789 species have been recorded from Maharashtra state particularly; from Pune, Satara, Mumbai & Khandala but, no record of moths found from Nashik, Dhule, Jalgaon & Nandurbar districts.

Farzana Perveen (2012) conducted study to prepare baseline faunal inventory for the butterflies of Kohat region. The butterflies were collected during September-December 2008 from 5 different localities of Kohat region. The collected specimens yielded 21 species from families Namphalidae, Papilionidae and Pieridae covering 33 per cent, 10 per cent, and 57 per cent butterfly diversity the area, respectively. Family Namphalidae included: species *Argynnis hyperbius* Linnaeus, *Ariadne merione* (Cramer), *Cynthia cardui* (Linnaeus), *Junonia almanac* Linnaeus, *J. orithya* Linnaeus, *Phalantha phalantha* (Drury), and *Hipparchia parisatis* (Kollar). Representative family Papilionidae included *Papilio demoleus* Linnaeus and *P. polytes* Linnaeus. While Pieridae included: *Colias croceus* (Geoffroy), *Catopsilia pomona* Fabricius, *C. etrida Boisduval, Colotis protractus* Butler; *Eumera hecab (*Linnaeus), *Gonepteryx rhamni (*Linnaeus), *Ixias pyrene* Linnaeus, *Belenoi aurota* Bingham, *Pieris ajaka* Moore, *P. brassicae* Linnaeus, *P. napi* (Linnaeus), *P. rapae* Linnaeus.

Majumdar et al. (2012) recorded species richness and abundance of butterfly communities of different habitat types in Trisha wildlife sanctuary. A total of 1005 individuals representing 59 species in 48 genera belonging to five families were recorded in the present study. Of these, 23 species belonged to the family Nymphalidae and accounted for 38.98per cent of the total species and 45.20per cent of the total number of

individuals. Out of 59 species, 31 are new records for Tripura state, while 21 are unique species and nine are listed in the threatened category.

Islam et al. (2013) studied moth fauna during May-October, 2011 in the campus of Atomic Energy Research Establishment (AERE), Savar, Dhaka. Moths were collected by using a light trap for one hour following the sunset. A total of 153 moth species belonging to 113 genera, 25 sub-families under 14 families were recorded. The recorded moth families were Noctuidae, Pyralidae, Arctiidae, Geometridae, Sphingidae, Lymantriidae, Ctenuchidae, Lymacodidae, Drepanidae, Psychidae, Nolidae, Notodontidae, Lasiocampidae and Hypsidae. The most dominant moth families in the AERE campus were Pyralidae, Noctuidae and Arctiidae their relative abundance was 45.86, 31.09 and 13.90, respectively. Whereas, Psychidae, Nolidae and Lasiocampidae were found to be minor family and relative abundance to those families was 26.68.

Ashok kumar (2013) conducted study in three sites of taluka Jhagadia, Ankleshwar, District-Bharuch, Gujarat. In the study a total of 484 individuals belonging to 58 species of 9 families were identified. Among which Pieridae was found to be the most dominant family. The area of study having rich diversity of butterflies, therefore it should be of great importance for conservation.

Qureshi et al. (2013) reported that survey-cum-collection tour was undertaken in the Kupwara district of J&K from 2007- 2009. Thirty six species of butterflies belongs to 8 families and 30 genera were collected. The butterfly activity was observed from March to November and the highest abundance was in summer season (June-August) whereas there was no butterfly activity in winter (December-February). The most dominant family was Nymphalidae followed by Pieridae, Satyridae and Lycaenidae. Highest distribution was observed in habitats like forests, hilly areas, gardens near forests in areas like Batpora (Magam), Drugmulla, Karnah, Langate, Lolab Valley, Mawar, Panzgam, Rajwar, Trehgam, and Villgam.

Choudhary and Chaudhary (2013) reported that Moth species were studied from some selected districts of Assam (i.e., Cachar and Barpeta district).The moths were collected by applying specialized trapping methods using UV light operating during night. Collected moth species were identified up to family-genus species level. Diversity index, species richness and evenness of Arctiidae moth fauna in Cachar were 6.955, 0.6557, 3.104 and geometride moth fauna were 3.433, 7.902, and 0.8153, respectively. The diversity index, species richness and evenness of Arctiidae moth fauna were 3.027, 6.981, 0.6065 and Geometriidae moth fauna were 3.207, 7.37, and 0.7247, respectively in Barpeta district.

Jana et al. (2013) reported 29 lepidopteran insect species belonging to 26 genera and 10 families have been recorded from eight different sites having contrasting ecological characters in the coastal areas of Midnapore (East), District of West Bengal, India.

Senyal et al. (2013) conducted survey at different altitudes and land-use areas in the two protected areas, viz., Gangotri National Park and Govind National Park of Uttarkashi District, Uttarakhand, India. A total of 475 specimens of moth representing 436 morph species were collected using light trap method during the survey conducted between September 2008–May 2010. Preliminary findings show a decreasing diversity with increasing altitude. Subalpine areas were least diverse and subtropical areas had the highest diversity of moths. The greatest number of specimens was collected during the summer and post-monsoon period. The lunar phase had a significant effect on catch success with new moon days resulting in the largest catches and full moon days resulting in the least number of species as well as individuals.

Chandra et al. (2013) studied fauna of the sanctuary during 2009 to 2011, resulted the enumeration of 12 species of hawk moths belonging to 10 genera and 3 subfamilies. Of these, one species viz. *Agnosia microta* (Hampson) is new addition to the fauna of Madhya Pradesh. All the specimens are deposited in the national repository of Zoological Survey of India, Jabalpur.

Gadhikar et al. (2013) Collection of moths was carried out from August 2012 to January 2013 to determine their diversity and occurrence. A total number of 41 moth specimens were collected by using simple light traps operated from dusk to dawn. The moths were identified up to family level. Families Noctuidae, Arctiidae, Geometridae, Sphingidae, Saturniidae, Crambidae, Lasiocampidae and Lymantridae were presented in collection samples.

Six insect pest *Crocidolomia binotalis* Zeller, *Hellula undalis* (Fabricus), *Leucinodes orbonalis* Guenee, *Maruca testulalis, Spoladea recurvalis (*Fabricus), (Lepidoptera- Cerambidae) were recorded as major pest on vegetable from north India. These pests have been reviewed taxonomically and compiled with diagnostic feature (Kumar et al, 2013).

Gurule and Nikam (2013) reported checklist of owlet and under wing moth (Lepidoptera-Noctuidae) from Nasik District (MS) India. They collected a total 728 moth specimen which were classified into 245 species (789 species previously recorded from Maharashtra) and place in 177 genera and 20 families an estimated 10,000 species of moth is represented. The result of survey indicated that the moth fauna of northern Maharashtra is characterized by larger proportions of Erebidae, Noctuidae, Crambidae, Geometridae and Spingidae, which are also among the most diverse families of moths in the Nasik region.

Thakur et al. (2013) examined and identified sub family Noctuinae by their wing venation and genitalia. Four species *Agrotis ipsilon* Hufnagel, *Agrotis segetum* Denis and Schiffmuller, *Xestia c- nigrum* linnaeous and Xestia renalis moore were collected from different conifer forest of Himachal Pradesh.

Total 96 species of butterflies belonging to 68 genera and five families during the study period were recorded of which 13 species were under the rare catergory (included 9 rare and 4 very rare) during the course of present study it was observed that the family Nymphalidae represented by (23 genera and 34 species) was the most dominant followed by Lycaenidae (19 genera and 20 species) Hesperiidae (13 genera and 15

species) and Papillionidae (4 genera and 13 species) (Bora and Meitei, 2014).

Singh and Banyal (2014) studied on the Lepidoptera from Khajjiar Lake of District Chamba of Himachal Pradesh revealed the presence of 49 species of butterflies belonging to 41 genera and 10 families. Family Nymphalidae and Satyridae (12 species each) dominated the Lepidoptera fauna of Khajjiar lake catchment, followed by Pieridae and Lycaenidae (6 species each), Hesperiidae (4 species), Papilionidae (3 species), Erycinidae and Danaidae (2 species each), and Acraeidae and Riodinidae (1 species each). Categorization of the species further revealed that of these 49 species, 5 were very common, 32 common, 5 uncommon and 7 were rare.

Thakur and Kumar (2014) collected moth from different part of Seraj valley of Himachal Pradesh during May 2010 to September 2013. A total of 1376 specimens were collected by using simple light traps operated from dusk to dawn daily for eighty nights. The moths caught were identified up to the subfamily level. Subfamilies Geometridae, Ennominae, Larentiinae and Sterniihae were presented in the collection sample. The diversity index, species richness and evenness of geometrid moths' fauna of Seraj valley were 2.54, 4.39 and 1.26, respectively.The Satpura mountain province in Maharashtra. The highest number of species were documented in Nymphalidae (31 species) followed by Pieridae (16 species), Papillionidae (8 species), Lycaenidae (7 species) and Hesperidae (4 species) were recorded during the survey period. The observed butterflies were categorized as Common (C) 49.2per cent (31 species), Rare (R) 41.3 per cent (26 species) and Very Rare (VR) 9.5 per cent (6 species). Most of the butterflies were observed near water holes and scrub areas. Out of 66 species, Six species of butterflies namely *Pachliopta hector*-Linnaeus, *Hypolimna smisippus*-Linnaeus, *Appis albina*-Boisduval, *Euploea core*-Gramer, *Euchrysopscnejus*-Fabricious and *Lampidas boelicus*-Linnaeus are scheduled species.

Prabhakaran et al. (2014) studied the diversity of butterflies in Tiruvallur district, which constitutes of 9 talukas, a total of 63 genera and 97 species belonging to 5 families were recorded. Out of these, individuals of the family Nymphalidae were dominant with 31 species under 19 genus, followed by the family Hesperiidae with 25 species under 18 genus, family Pieridae with 20 species under 12 genus, family Lycaenidae with 14 species under 11 genus and family Papilionidae with 7 species under 3 genus.

Patil and Shende (2014) reported Gorewada international bio-park as a good habitat for biodiversity of butterflies. Total 92 species of butterflies were recorded belonging to 59 genera and 5 families. Out of total 92 butterfly species 48.92per cent, 38.04per cent and 13.04per cent are common, occasional and rare species respectively. Nymphalidae family is consisting of maximum number of genera and species. Maximum species richness reported from July to January and its number decline from late March to last week of June.

Deshmukh and Dharamkar (2014) surveyed from June 2011-February 2012 Dnyanganga wild life sanctuary Buldhana near the Dnyanganga river of Maharashtra, India. butterflies were found and identified from their morphological key characters by using available literature *Eurema hecabe* (common grass yellow), *Hasora chromus* (common banded awl), *Jamides celeno* (common cerulean), *Euploea core* (common crow), *Cepora nerissa* (common gull), *Castalius rosimon* (common pierrot), *Cigaritis vulcanus* (common silver line), *Pareronia valeria* (common wanderer), *Pachliopta hector* (crimson rose), *Junonia almanac* (peacock pansy), *Graphium Agamemnon* (tailed jay), *Junonia orithya* (blue pansy), *Vanessa cardui* (painted lady), *Ypthima huebnerii* (common four ring), *Danaus chrysippus* (plain tiger), *Danaus genutia* (stripped tiger), *Catopsilia Pomona* (lemon emigrant), *Catopsilia pyranthe* (mottled emigrant), *Ariadne merione* (common castor), *Ariadne ariadne* (angled castor), *Hypolamnas bolina* (great egg fly), *Hypolamnas misippus* (danaid egg fly), *Zizeeria karsandra* (dark grass blue), *Pachliopta*

aristolochiae (common rose) In the present study family Nymphalidae is found dominant than Hespiiidae, Pieridae, Lycanidae, Papilionidae.

Bharamal (2015) reported the results from surveys for moth in the Amboli reserve forest during 2009-2011.This presents an inventory of 56 species of moths from 14 families which were recorded by light trapping at Amboli.

Sharma (2015) investigated 41 species of butterflies under 8 families viz. Paplionidae, Acraeidae, Danidae, Nymphalidae, Pieridae, Saturnidae, Lycaenidae, Hesperidae.Pieridae was found to be the most dominant family represented by 19 species, followed by Nymphalidae-9, Papilionidae- 4, Danidae -3, Saturniidae- 2, Lycaenidae- 2, Acraeidae- 1, Hesperidae- 1. The study revealed *Calotis etrida* and members of family Pieridae were first to emerge (from March) and members of family Hesperidae were most late in emerging. The peak butterfly activities were observed during the months of March - April and September - October and November incorporating all 8 families covering 41 species. The highest butterfly diversity was during March, April, September, October and November.

Nimbalkar and Shinde (2015) recorded the maximum number of butterfly species than the species moths viz., family Lycaenidae (15 species), Nymphalidae (10 species), Hesperiidae (8 species), Pieridae (7 species), and from Papilionidae, Danaidae and Acraeidae six, three and one species respectively. In the present study recorded 99 species of order Lepidoptera comprising 49 species of moth and 50 species of to butterflies. Moths belong to eight families out of these Pterophoridae and Hyblaeidae consist single species. Family Eupterotidae and Hypsidae constitute with two species family Arctiidae comprises three species and family Sphingidae, Pyralidae and Noctuidae constitute with seven, eleven and twenty two species of moths respectively. Study on the occurrence of cotton bollworm, *Helicoverpa armigera* and tobacco cutworm *Spodoptera litura* was conducted by using Pheromones traps.

Pawara and Patel (2015) studied 21 species of butterflies belonging 18 genera and 3 families as Nymphalidae, Pieridae and Papilionidae were recorded. Butterflies were observed from different parts of Amalner during July, 2013 to February, 2014 to determine their diversity.

Shukla and Maini (2015) studied butterfly in southeast region of Narmada valley Jabalpur, Madhya Pradesh as part of an extensive study of biodiversity.Presented a preliminary study and status of butterfly from Jabalpur southeast region having aggregation of up to 25 species belonging to 5 families and categories on the basis of their status.

Chandekar and Nimbalkar (2015) reported during Aug 2007 to Aug 2009 in various habitats from the study area, they observed 56 species of Butterflies belongs to 5 families namely Papilionidae (4), Pieridae (12), Nymphalidae (21), Lycaenidae (15) and Hesperiidae (4). The seasonal pattern in the abundance of butterflies, their biotopes and nectar food plants were also studied.

Dubey et al. (2015) studied the diversity of butterflies in Bastar District (C.G). Survey was made during September 2012 to August 2013, 7 species of butterflies, all belonging to family Hesperiidae, were recorded for the first time from Kanger valley National Park and Machkot region in Bastar district of Chhattisgarh.

Ansari et al. (2015) conducted study over the period of three years from March 2010 to February 2013 in Surajpur wetland by applying standard methods. During the study period, a total of 2916 individuals belong to 53 butterfly species and 5 families were recorded with Nymphalidae as the dominant family with 23 species and 1800 individuals. Out of 53 butterfly species, 16.98 per cent (n=9) were recorded abundantly, followed by 15.09 per cent (n=8) frequent, 18.87 per cent (n=10) common, 26.42 per cent (n=14) occasional and 22.64 per cent (n=12) rare species. Habitat-wise composition of butterfly species recorded maximum in woodland (39 species) followed by grassland (24 species) and wetland habitat (14 species). However, woodland and grassland habitat showed highest number of shared species (n=16). Species wise overall

Plain Tiger butterfly *Danaus chrysippus* recorded maximum sighting frequency (42 individuals) during the study period. Out of 20 selected butterfly species, 16 species recorded in morning hours and 14 species recorded in evening hours. Month-wise, out of total 444 sightings of butterfly individuals, November recorded maximum number of individuals 17.34 per cent (n=77) and May recorded least number of individuals 4.05 per cent (n=18), while on seasonal basis, monsoon recorded maximum number of species (37 per cent) followed by summer (32 per cent) and winter (31per cent). According to the IUCN Red List, 5 species listed as Least Concern (LC) while the rest 47 species as Not Evaluated (NE) and 5 species listed as Schedule species in Indian Wildlife Protection Act 1972.

Shangpliang and Hajong (2015) studied the diversity of wild silk moths from Khasi Hills of Meghalaya, North East India. A survey was conducted for a period of three years (2011-2013) to study wild silk moths, their distribution and host plants of the moths. Total of fifteen species belonging to nine genera were recorded. Maximum numbers of individuals were recorded during the monsoon period and lesser in the pre and post monsoon period.

Sekhon (2015) studied to identify macro moth species diversity of family Noctuidae in Chamba district. A total 144 specimens were collected.

Gadhikar et al. (2015) studied diversity moths from different parts of the Amravati city. A total number of 628 moths were identified up to the family level. Families Sphingidae, Noctuidae, Geometridae, Crambidae, Arctiidae, Lymantiidae and Saturnidae were represented in the identified samples. The diversity index of Noctuidae family 2.63 was high as compared to the other families.While the lowest diversity index was found in family Geometridae and Saturnidae.

Annomynous (2016) reported predominance of major pest of kharif crop ecosystem viz, *Spodoptera litura, Heliocoverpa armigera, Eudocima fullonica, Eudocima materna, Exelestes atomosa, Earias insulana, Papilio demoleus* in Akola vicinity.

4.2 morphological characteristic of lepidopteran fauna

Kaleka (2000) studied the morphological characters of external genitalia of two Indian species viz. *Chrysorabdia viridata* and *Chrysorabdia bivitt.*

Rose and Pooni (2005) studied 18 species belonging to 14 genera of respective super family Pterophoridae had been collected from north-western India and deal with taxonomically. Key to presently examined 13 genera of the subfamily Pterophoridae had been prepared on the basis of wing venation and male and female genetic characters. The genus *Tomotilus yano* is being reported for first time from India. Three new species, one of genus *Lantanophaga* and two of genus *Megalorripida* have been reported from the area.

Mal et al. (2014) reported that *Eurema hecabe* is redescribed on the basis of external morphology, especially colouration of wings, structure of mouthparts, antennal structure, segments, thoracic segments, wing structure, venation, leg structure, abdomen segments, internal male genitalia and female genitalia.

Panthia et al. (2014) studied various morphological characters such as antennae, labial palpi, legs, wing venation and wing masculation for identification of family Sphingidae.

Dar and Kriti (2015) recognized the two species of genus *Calyptra rectistria* Gunee and *Calyptra bicolor* Moore. Male and female genitalia attributes are provided, both species reported first time from Kashmir Himalayas

CHAPTER III

MATERIAL AND METHODS

The study was carried out at Department of Entomology, Post Graduate Institute, Dr. P.D.K.V. Akola during 2015-2016. The lepidopteran fauna were collected from Akola vicinity and for this study material required and methodologies followed are detailed.

3.1 Material required

3.1.1 Material

The material required for collecting a lepidopterans were, insect collecting net, setting board, insect killing bottle, forceps, hand lens, entomological pins, drying chamber, small hair brush, ethyl alcohol (90per cent), Stereozoom microscope (NikonSMZ 800) attached camera for a photograph , different colour century paper, insect preservation boxes, light trap etc.

3.2 Method of insect collection

Mostly moths were collected from light trap and some moth and butterfly were collected from crop of Akola vicinity by using net, and preserved for further study. These fauna were sorted out and categorized under family.

3.2.1 Insect collecting net

Insect collecting net made up of wooden handle with collecting bag made up of ordinary mosquito net cloth used for collecting insect. These insects were collected by sweeping the net in the different crop ecosystem.

3.2.2 Killing of collected insects

Fully developed insects, were killed immediately as soon as they captured for killing them ethyl acetate blended cotton swab was used in polythene bags as and when required.

Plate 1(a). Stereo zoom microscope with attached camera (Nikon SMZ 800)

Plate 1(b). Pinning technique in lepidopteran insect

3.3 Method of pinning the specimen

The entomological pins of different size and numbers made up of stainless steel nickel plated, rust free which were slender, hard with pointed tip and small head were used along with some locally available pins.

3.3.1 Pinning of specimen

The correct pinning of insect was essential for easy identification of their taxonomic character for which specimen were held between the thumb and forefinger in one hand and the pin was inserted into the insect with the help of other hand.

By keeping 1/3 rd portion of the pin above the body of insect specimen and 2/3 below to lepidopteran fauna.

3.4 Labeling

Collected specimen looses the value, if they are not properly and accurately labeled. Labeling was done as soon as insects were dried to avoid lose of vital information. Labels were printed with information like.

Label 1: Specimen Name

Host

Location

Name of collector

Date of collection

3.5 Specimens care

3.5.1 Material required

Insects were preserved by killing, pinning, and drying. The material required for preservation were relaxing chamber, entomological pins, setting board, paper folds, butter paper, needle, oven, insect drying chamber, Naphthalene ball, fumigation media etc.

1. Relaxing chamber

The collected insects when become hard to pin and stretch, such insect were placed in relaxing chamber i.e. Dessicators in which relaxing fluids was placed. The care taken that they should not come in

contact with relaxing fluid and was made airtight for 24 hours. Then after 24 hours when insect become soft they were removed from relaxing chamber and then pinned and stretched.

2. Setting board

For setting the collected insects for spreading the wings, stretching the legs, antennae, the setting board and also thermocol sheet was also used. Cut grooved were made to thermocol sheet to stretch the wings of insect properly so that all character could be observed properly during the study.

3. Butter paper

Butter paper was also used for stretching the insect wings during stretching.

4. Preservation of collected specimen

Fumigation media prepared by mixing carbolic acid 2.5 gm and naphthalene balls 125 gm to 1 litre of petrol and solution was kept in umber coloured bottle in sunlight for one days so as to fumigation solutions formed. The cotton swab was dipped in the solutions and was placed in collection box in the provided grooved and the fumigation for collected insect was carried out. This was under taken to preserve the specimen from saprophytic insects and fungal damage.

3.5 Method of preservation

Dry preservation

After pinning and stretched collected specimen were dried in insect drying chamber so that morphological and taxonomical characters could be preserved and used for further study.

3.6 Storage

3.6.1 Insect storage box

For displayed preserved insect wooden boxes of dimension 45 x 30 x 15 cm were used. The boxes were air tight and moisture proof with well hinged lid. A slit was provided inside to keep the fumigants. Cork sheets were glued to the bottom of the box to permit pinning. Storing of

specimen was made according to the common external characters shown by insect for placing family wise.

3.7 Identification

For studying the distinguishing morphological characters of different specimens sterozoom microscope (Nikon SMZ 800) with attached Nikon camera was used by adjusting the magnifying knob, zoom characters were studied under microscope based on taxonomic keys for different families.

Family level identification of all lepidopteran fauna collected during investigations was carried out at Insect Biosystematic Laboratory, Department of Entomology, Post graduate Institute, Dr. P.D.K.V, Akola during 2015-2016.

3.8 Preparation of pictorial keys

A pictorial key of the Lepidopterans fauna was prepared by taking microscopic photographs of distinguished morphological character for the identification up to family level.

Online Preliminary/Draft Key To The Commonly Encountered Families Of Lepidoptera was used to distinguished the fauna up to family level as well as fauna of British India used to clarify the character.

1. Diurnal (active in day-time) ..... (butterflies, plus a few others)

2-Nocturnal..... (moths)11

2. Base of hindwing with frenulum (spine or group of spines) ..... (a few diurnal moths) 3

-Base of hindwing without frenulum; antenna with distal club..... butterflies) 5

3. Wings mostly transparent (scales absent except on veins)..... 4

-Wings pigmented (scales present on most of surface)..... 11

4. Stout-bodied, abdomen blunt distally, forewing length 2 cm or greater ..... Sphingidae (*Hemaris*)

- Body more slender, tapered distally, forewing length less than 2 cm, wasp-like ..... Sesiidae

BUTTERFLIES

5. Antennal club with terminal portion slender, often hook-shaped (apiculus); stout bodied,shortwinged. ..... Hesperiidae

- Antennal club without apiculus; slender bodied 6

6. Forewing length 4 cm or greater; hindwing with a tail-like projection ..... Papilionidae

- Forewing less than 4 cm; hindwing without a tail-like projection (may have thread-like projection) 7

7. Foreleg greatly reduced, only two pairs of walking legs (medium to large butterflies) ..... Nymphalidae

- Foreleg not greatly reduced, three pairs of walking legs (medium to small butterflies) 8

8. Ground color of forewing mostly white or yellow; forewing length usually > 2 cm; eye not emarginated (indented) at base of antenna..... Pieridae

- Ground color of forewing not white or yellow; forewing length usually < 2 cm; eye emarginated (indented) at base of antenna 9

9. Hindwing with a hair-like tail (or triangular projection) ..... Lycaenidae (hairstreaks)

-Hindwing without a hair-like tail..... 10

10. Forewing above with at least some shiny blue ..... Lycaenidae (blues)

- Forewing mostly orange or brown above..... Riodinidae

MOTHS

11.Forewing length greater than 1.2 cm ..... (mostly macrolepidoptera) 12

- Forewing length less than 1.2 cm.....(mostly microlepidoptera) 18

MACROLEPIDOPTERA

12. Forewing length usually greater than 3 cm.... (Bombycoidea plus)13

- Forewing length usually less than 3 cm..... (various families) 15

13. Forewing long and slender (greater than 3 times as long as wide), pointed apically; frenulum well developed; proboscis well developed; body usually not excessively hairy ... Sphingidae (hawk moths)

- Forewing broadly triangular, often rounded apically; frenulum poorly developed; proboscis reduced or absent; body usually very hairy..... 14

14. Wings usually held flat; hindwing usually patterned ..... Saturniidae (silk moths)

- Wings usually held tent-like; hindwing usually not patterned ..... Lasiocampidae (*Dicogaster*)

15. Tympanum present (on last thoracic or first abdominal segment) 16

- Tympanum absent ..... (Zygaenoidea) 30

16. Tympanum present on first abdominal segment 17

- Tympanum present on last thoracic segment (may be "scoops" on first abdominal segment) 18

17. Base of proboscis scaled; forewing narrow triangular ..... Pyraloidea (Pyralidae and Crambidae)

- Base of proboscis naked; forewing usually broadly triangular ..... Geometridae

18. Male antennae usually plumose in basal half and simple in distal half; forewing venation with M2 arising midway between M1 and M3 ..... Notodontidae

- Male antennae usually moderately uniform throughout; forewing venation with M2 almost touching M3 19

19. Underwings, arctiids, tussock moths (and others) ..... Erebidae

Cutworms, loopers, flower moths (and others) ..... Noctuidae

MICROLEPIDOPTERA

20. Base of proboscis scaled ..... (Pyraloidea, Gelechioidea) 22

- Base of proboscis naked 21

21. Metathorax with tympanum ..... (small macrolepidoptera) go back to 12

- Metathorax without tympanum..... 27

22. First abdominal segment with tympanum ..... Pyraloidea (Pyralidae and Crambidae)

- First abdominal segment without tympanum..... (Gelechioidea) 23

23. Labial palpi mostly straight (porrect); dorsum of abdomen with tiny paired patches of spines or modified setae subdorsally on at least one segment ..... Coleophoridae

- Labial palpi mostly upcurved; dorsum of abdomen without tiny paired patches of spines 24

24. Dorsum of abdomen with row of copper-colored spines at the intersection of most segments; male antenna frequently notched near base ..... Blastobasidae

- Dorsum of abdomen without row of copper-colored spines; male antenna without notch 25

25. Hindwing broad, somewhat rounded throughout, with rounded apex; labial palpi long, upcurved (tusk-like) ..... Elachistidae (Ethmiinae, Stenomatinae)

- Hindwing variable, but usually pointed apically; labial palpi variable 26

26. Hindwing rather broad, mostly parallel-sided, usually with falcate apex (sometimes only pointed apically); labial palpi long, upcurved (tusk-like) ..... Gelechiidae

- Hindwing narrower, often lanceolate, pointed apically, but not falcate; labial palpi variable ..... Oecophoridae

27. Forewing and hindwing divided into numerous lanceolate "branches"; legs extremely long ..... Pterophoridae

- Forewing and hindwing entire, not divided; legs not conspicuously long 28

28. Forewing very narrow throughout; antenna nearly as long (or longer than) forewing; head usually smooth scaled..... Gracillariidae

- Forewing variable; antenna conspicuously shorter than forewing; head variable,but frequently rough scaled 29

29. Head with erect setae; base of labial palpus usually with a few long, stiff, dark bristles ..... Tineidae

- Head rough or slightly smooth scaled; base of labial palpus without bristles 30

30. Body short and stout, densely hairy (larger moths) Limacodidae/ Megalopygidae

-Body more slender, not so hairy (smaller moths) 31

32. Hindwing ovate-lanceolate (head without chaetosemata ..... Plutellidae

- Hindwing broad basally, narrowed apically (head with chaetosemata) Tortricidae

DIVERSITY INDEX FORMULA

Shannon's diversity index will be worked out from the data of identified fauna by the following formula.

$$H = - \sum_{i=1}^{k} pi \ln (pi)$$

H = Shannon's diversity index

Pi = ni/N

N = Total number of individual of all species

Pi = Relative abundance of species 'i

K = Total number of species

CHAPTER IV

RESULT AND DISCUSSION

The present work on "Faunstic study of lepidopterans in Akola vicinity" was conducted during July- December 2015. Lepidopteran fauna was collected from Akola vicinity. Collected specimens were preserved, labeled, and characterization study was carried out at Insect Biosystematics Laboratory, Entomology Department, Post Graduate Institute, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola. Result thus obtained during the course of investigations was discussed under respective headings and subheadings in light of previous available literature.

4.1 Collection of Lepidopteran fauna from Akola vicinity

During this study, 350 specimens of lepidopteran fauna were collected belonging to twelve different families from Akola vicinity.

The details of lepidopteran fauna collected through light trap as well as from various crop ecosystem of Akola vicinity is listed in Table 1.

A total 350 specimens of lepidopterans were explored, collected and preserved for further morphological and identification studies. While collecting the lepidopteran source/host of insects was mentioned with date of collection and as per visual observation, common name was given with number of specimens collected locationwise.

Table 1: Collected lepidopteran fauna in Akola vicinity

Sr.No	Date	Location	Host	Common Name	No. Of Specimen
1	09/07/2015	Girls Hostel, Dr.P. D. K. V, Akola	Weed	Monarch butterfly	3
2	09/07/2015	Girls Hostel, Dr.P. D. K. V, Akola	Weed	Cabbage butterfly	2
3	09/07/2015	Girls Hostel, Dr.P. D. K. V, Akola	Weed	Blue tiger butterfly	1
4	09/07/2015	Girls Hostel, Dr.P. D. K. V, Akola	Weed	Lemon pancy	1
5	09/07/2015	Girls Hostel, Dr.P. D. K. V, Akola	Weed	Mottled emigrant	1
6	09/07/2015	Girls Hostel, Dr.P. D. K. V, Akola	Weed	Common emigrant	2
7	09/07/2015	Girls Hostel, Dr.P. D. K. V ,Akola	Weed	Crimpson tip	3
8	03/08/2015	Cotton Research Unit, Oilseed Research Unit,Dr.P.D.K.V. Akola	Weed	Monarch butterfly	4
9	03/08/2015	Cotton Research Unit, Oilseed Research Unit,Dr.P.D.K.V. Akola	Weed	Common rose	1
10	03/08/2015	Cotton Research Unit, Oilseed Research Unit ,Dr.P.D.K.V. Akola	Weed	Lemon butterfly	1
11	03/08/2015	Cotton Research Unit, Oilseed Research Unit,Dr.P.D.K.V. Akola	Weed	Cabbage butterfly	1
12	03/08/2015	Cotton Research Unit, Oilseed Research Unit,Dr.P.D.K.V. Akola	Weed	Common crow	3
13	03/08/2015	Cotton Research Unit, Oilseed Research Unit,Dr.P.D.K.V. Akola	Weed	Blue tiger butterfly	6
14	03/08/2015	Cotton Research Unit, Oilseed Research Unit,Dr.P.D.K.V. Akola	Weed	Lemon pancy	1
15	03/08/2015	Cotton Research Unit, Oilseed Research Unit,Dr.P.D.K.V. Akola	Weed	Mottled emigrant	2

16	03/08/2015	Cotton Research Unit, Oilseed Research Unit,Dr.P.D.K.V. Akola	Weed	Common emigrant	2
17	03/08/2015	Cotton Research Unit, Oilseed Research Unit,Dr.P.D.K.V. Akola	Weed	Crimpson tip	1
18	03/08/2015	Cotton Research Unit, Oilseed Research Unit,Dr.P.D.K.V. Akola	Weed	Pioneer white	2
19	03/08/2015	Cotton Research Unit, Oilseed Research Unit,Dr.P.D.K.V. Akola	Weed	Nymphallidae	1
20	11/08/2015	Horticulture College, Dr.P.D.K.V Akola	Weed	Monarch butterfly	2
21	11/08/2015	Horticulture College, Dr.P.D.K.V , Akola	Weed	Blue tiger butterfly	4
22	11/08/2015	Horticulture College, Dr.P.D.K.V, Akola	Weed	Lemon pancy	2
23	11/08/2015	Horticulture College, Dr.P.D.K.V , Akola	Weed	Lemon butterfly	5
24	11/08/2015	Horticulture College, Dr.P.D.K.V , Akola	Weed	Common crow	1
25	11/08/2015	Horticulture College, Dr.P.D.K.V , Akola	Weed	Mottled emigrant	2
26	11/08/2015	Horticulture College, Dr.P.D.K.V , Akola	Weed	Nymphallidae	2
27	11/08/2015	Horticulture College, Dr.P.D.K.V , Akola	Weed	Nymphallidae	1
28	17/08/2015	Khadaki Takli Village	Weed	Monarch butterfly	11
29	17/08/2015	Khadaki Takli Village	Weed	Blue tiger butterfly	5
30	17/08/2015	Khadaki Takli Village	Weed	Lemon pancy	4
31	17/08/2015	Khadaki Takli Village	Weed	Common emigrant	5
32	17/08/2015	Khadaki Takli Village	Weed	Crimpson red	2
33	17/08/2015	Khadaki Takli Village	Weed	Lemon butterfly	6
34	17/08/2015	Khadaki Takli Village	Weed	Common crow	1
35	17/08/2015	Khadaki Takli Village	Weed	Common mormon	1
36	17/08/2015	Khadaki Takli Village	Weed	Pioneer white	3

37	17/08/2015	Khadaki Takli Village	Weed	White orange tip	1
38	17/08/2015	Khadaki Takli Village	Weed	Great egg butterfly	4
39	17/08/2015	Khadaki Takli Village	Weed	Nymphallidae	1
40	23/08/2015	Hostel Campus,Dr.P.D.K.V.Akola	Light	-	1
41	23/08/2015	Hostel Campus,Dr.P.D.K.V.Akola	Light	Spingid moth	1
42	23/08/2015	Field of Entomology, Akola	Soybean	Hairy caterpillar	3
43	23/08/2015	Malkapur Block	Weed	Monarch butterfly	3
44	23/08/2015	Malkapur Block	Weed	Blue tiger butterfly	3
45	23/08/2015	Malkapur Block	Weed	Lemon butterfly	7
46	23/08/2015	Malkapur Block	Weed	Lemon pancy	3
47	23/08/2015	Malkapur Block	Weed	Lycanidae butterfly	1
48	23/08/2015	Malkapur Block	Weed	Mottled emigrant	2
49	23/08/2015	Malkapur Block	Weed	Crimpson red	1
50	23/08/2015	Malkapur Block	Weed	White orange tip	6
51	23/08/2015	Malkapur Block	Weed	Great egg butterfly	1
52	23/08/2015	Malkapur Block	Weed	Peacock pancy	1
53	23/08/2015	Malkapur Block	Weed	Baronet butterfly	1
54	01/09/2015	Field of Entomology, Akola	Soybean	American bollworm	1
55	01/09/2015	Field of Entomology, Akola	Cotton	Noctuids	1
56	02/09/2015	Field of Entomology, Akola	Okra	Silver moth	1
57	02/09/2015	Hostel Campus,Dr.P.D.K.V.Akola	Light	Spingid moth	1
58	03/09/2015	Field of Entomology, Akola	Okra	Skipper	1
59	03/09/2015	Hostel Campus,Dr.P.D.K.V.Akola	Light	American bollworm	1
60	03/09/2015	Hostel Campus,Dr.P.D.K.V.Akola	Light	Geometer moth	2
61	03/09/2015	Hostel Campus,Dr.P.D.K.V.Akola	Light	Silver moth	1

62	08/09/2015	Veterinary and Dairy college, Dr. P.D.K.V.Akola	Weed	Monarch butterfly	2
63	08/09/2015	Veterinary and Dairy college, Dr. P.D.K.V.Akola	Weed	Lemon pancy	1
64	08/09/2015	Veterinary and Dairy college, Dr. P.D.K.V.Akola	Weed	Common emigrant	8
65	08/09/2015	Veterinary and Dairy college, Dr. P.D.K.V.Akola	Weed	Lemon butterfly	4
66	08/09/2015	Veterinary and Dairy college, Dr. P.D.K.V.Akola	Weed	Common crow	1
67	08/09/2015	Veterinary and Dairy college, Dr. P.D.K.V.Akola	Weed	Crimpson yellow	2
68	08/09/2015	Veterinary and Dairy college, Dr. P.D.K.V.Akola	Weed	Common grass yellow	1
69	08/09/2015	Department of Entomology, Dr.P.D.K.V.Akola	Light trap	Spingid moth	1
70	08/09/2015	Department of Entomology, Dr.P.D.K.V.Akola	Light trap	Notondidiae	1
71	08/09/2015	Department of Entomology, Dr.P.D.K.V.Akola	Light trap	Tobacco leaf eating caterpillar	4
72	08/09/2015	Department of Entomology, Dr.P.D.K.V.Akola	Light trap	Hairy caterpillar	4
73	08/09/2015	Department of Entomology, Dr.P.D.K.V.Akola	Light trap	Geometer moth	1
74	08/09/2015	Department of Entomology, Dr.P.D.K.V.Akola	Light trap	Nymphallidae	7
75	08/09/2015	Department of Entomology, Dr.P.D.K.V.Akola	Light trap	American bollworm	1
76	09/09/2015	Hostel Campus,Dr.P.D.K.V.Akola	Light trap	Hairy caterpillar	1
77	10/09/2015	Hostel Campus,Dr.P.D.K.V.Akola	Light trap	Hawk moth	2
78	10/09/2015	Field of Entomology, Akola	Okra	American bollworm	13
79	10/09/2015	Hostel Campus,Dr.P.D.K.V.Akola	Light trap	Geometer moth	1
80	10/09/2015	Field of Entomology, Akola	Okra	Skipper	1
81	10/09/2015	Field of Entomology, Akola	Okra	Silver moth	1
82	10/09/2015	Hostel Campus,Dr.P.D.K.V.Akola	Light trap	Spingid moth	1
83	10/09/2015	Hostel Campus,Dr.P.D.K.V.Akola	Light trap	Fruit sucking moth	1
84	10/09/2015	Field of Entomology, Akola	Okra	Tobacco leaf eating caterpillar	20
85	11/09/2015	Hostel Campus,Dr.P.D.K.V.Akola	Light trap	Fruit sucking moth	1
86	13/09/2015	Hostel Campus,Dr.P.D.K.V.Akola	Light trap	Spingid moth	3

87	13/09/2015	Field of Entomology, Akola	Soybean	Tobacco leaf eating caterpillar	10
88	16/09/2015	Field of Entomology, Akola	Soybean	Tobacco leaf eating caterpillar	4
89	16/09/2015	Hostel Campus,Dr.P.D.K.V.Akola	Light trap	Hawk moth	1
90	20/09/2015	Khadaki Takli Village	Light trap	Notondidae	1
91	20/09/2015	Khadaki Takli Village	Light trap	Hairy caterpillar	1
92	09/10/2015	Hostel Campus,Dr.P.D.K.V.Akola	Light trap	Spingid moth	1
93	09/10/2015	Agronomy Field, Dr.P.D.K.V.Akola	Weed	Lemon butterfly	4
94	09/10/2015	Agronomy Field, Dr.P.D.K.V.Akola	Weed	Lycaenidae moth	4
95	09/10/2015	Agronomy Field, Dr.P.D.K.V.Akola	Weed	Common crow	2
96	09/10/2015	Agronomy Field, Dr.P.D.K.V.Akola	Weed	Common grass yellow	2
97	09/10/2015	Agronomy Field, Dr.P.D.K.V.Akola	Weed	Nymphallidae	2
98	09/10/2015	Field of Entomology, Akola	Soybean	Tobacco leaf eating caterpillar	10
99	09/10/2015	Cotton Research Unit,Dr.P.D.K.V.Akola	Okra	American bollworm	4
100	15/10/2015	Hostel Campus,Dr.P.D.K.V.Akola	Light trap	Hairy caterpillar	1
101	17/10/2015	Hostel Campus,Dr.P.D.K.V.Akola	Light trap	Fruit sucking moth	1
102	19/10/2015	Dairy Field,P.D.K.V.Akola	Sorghum	Stem borer	1
103	19/10/2015	Hostel Campus,Dr.P.D.K.V.Akola	Light trap	Spotted bollworm	1
104	19/10/2015	Hostel Campus,Dr.P.D.K.V.Akola	Light trap	Geometer moth	1
105	20/10/2015	Field of Entomology, Akola	Cowpea	Lycaenidae moth	3
106	20/10/2015	Field of Entomology, Akola	Cowpea	Skipper	4
107	20/10/2015	Field of Entomology, Akola	Weed	Silver moth	2
108	20/10/2015	Field of Entomology, Akola	Weed	Geometer moth	1
109	24/10/2015	Hostel Campus,Dr.P.D.K.V.Akola	Light trap	Geometer moth	1
110	24/10/2015	Hostel Campus,Dr.P.D.K.V.Akola	Light trap	Hairy caterpillar	1

111	24/10/2015	Hostel Campus,Dr.P.D.K.V.Akola	Light trap	Fruit sucking moth	1
112	27/10/2015	Department of Entomology, Dr.P.D.K.V.Akola	Light trap	Spingid moth	1
113	27/10/2015	Department of Entomology, Dr.P.D.K.V.A kola	Light trap	Hawk moth	1
114	30/10/2015	Hostel Campus,Dr.P.D.K.V.Akola	Light trap	Geometer moth	2
115	30/10/2015	Hostel Campus,Dr.P.D.K.V.Akola	Light trap	Hairy caterpillar	1
116	09/11/2015	Khadaki Takli Village	Light trap	Spingid moth	2
117	09/11/2015	Khadaki Takli Village	Sorghum	Stem borer	1
118	09/11/2015	Khadaki Takli Village	Grasses	Common rose	3
119	09/11/2015	Khadaki Takli Village	Grasses	Lycaenidae moth	2
120	09/11/2015	Khadaki Takli Village	Grasses	Cabbage butterfly	1
121	09/11/2015	Khadaki Takli Village	Cotton	American bollworm	2
122	09/11/2015	Khadaki Takli Village	Weed	Tiger moth	2
123	09/11/2015	Field of Entomology, Akola	Okra	American bollworm	9
124	24/11/2015	Field of Entomology, Akola	Tur	Hairy caterpillar	1
125	24/11/2015	Field of Entomology, Akola	Tur	Lycaenidae moth	3
126	24/11/2015	Field of Entomology, Akola	Weed	Common grass yellow	5
127	06/12/2015	Shivar	Weed	Common rose	2
128	06/12/2015	Shivar	Weed	Blue tiger butterfly	1
129	06/12/2015	Shivar	Light	Fruit sucking moth	1
130	06/12/2015	Shivar	Light	Fruit sucking moth	1
131	06/12/2015	Shivar	Weed	Lycaenidae moth	1
132	06/12/2015	Shivar	Weed	Monarch butterfly	2
133	06/12/2015	Field of Entomology, Akola	Tur	Tur plume moth	9
134	06/12/2015	Department of Entomology, Dr.P.D.K.V. Akola	Rearing	Wax moth	4

Table 2: Meteorological week wise collection of lepidopteran fauna

Sr. No	Meterological Week	Date	Rainfall		Temperature		Relative humidity		No of specimen collection
			N	A	N	A	N	A	
1	28	9-15 July	42.8	0.0	32.3	35.8	83	65	13
2	29	16-22July	52.8	26.2	31.9	32.6	84	75	-
3	30	23-29JuLy	43.4	45.9	31.3	31.3	86	84	-
4	31	30July-5Aug	49.6	226.5	30.9	31.6	86	85	25
5	32	6-12Aug	61.0	40.7	29.9	28.9	88	90	19
6	33	13-19Aug	35.9	36.5	30.4	30.3	87	86	44
7	34	20-26 Aug	42.5	0.0	30.4	33.6	87	80	34
8	35	27-Aug-2 Sept	42.4	16.4	30.5	31.4	87	83	4
9	36	3-9Sept	33.6	22.4	31.0	32.9	87	87	48
10	37	10-16 Sept	22.0	61.6	32.1	34.3	85	88	59
11	38	17-23 Sept	23.7	78.9	32.9	31.3	84	87	3
12	39	24-30 Sept	24.4	1.4	33.5	33.1	84	86	-
13	40	1-7 Oct	23.4	0.0	33.7	35.6	82	84	-
14	41	8-14 Oct	13.1	0.0	34.0	37.0	78	71	28
15	42	15-21 Oct	6.1	0.5	33.7	36.5	76	71	21
16	43	22-28 Oct	7.6	0.0	33.1	35.6	74	72	5
17	44	29Oct-4 Nov	2.3	0.0	32.7	32.9	73	77	3
18	45	5-11Nov	3.0	0.0	32.3	33.8	71	72	22
19	46	12-18 Nov	5.3	0.0	31.6	33.5	73	73	-
20	47	19-25 Nov	7.7	0.0	31.0	32.4	72	67	9
21	48	26Nov-2Dec	5.5	0.0	30.5	33.3	71	73	-
22	49	3-9 Dec	1.0	0.0	30.0	32.5	71	72	13

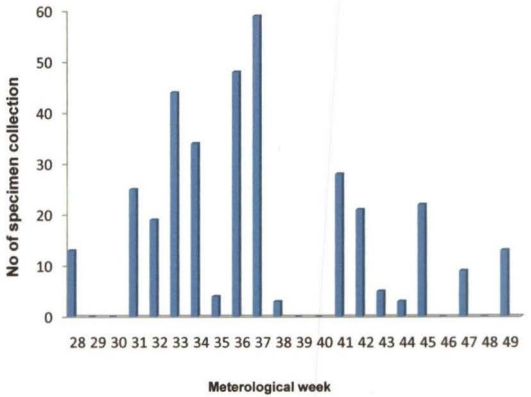


Fig. 1 Meterological week wise collection of lepidopteran fauna

Lepidopteran faunal activity was noticed from second week of July 2015 i.e. 28th meteorological week (Table - 2 fig-1). It is revealed from the data that peak activity was noticed in 37th meteorological week (10 Sept-16 Sept) during these period total 59 specimens were collected and preserved, the recorded rainfall in 36th meteorological week is 33.6 mm, temperature 31.0 °C and relative humidity is 87 per cent. Second peak was recorded in 36th meteorological week (48 Specimens) were trapped followed by 33rd week (44 specimens). The recorded meteorological data in 35th week 42.4mm rainfall, temperature 31.0 ^{0} C and relative humidity is 87 per cent.

Based on morphological characters the collected lepidopteran fauna was classified into different families, using taxonomic key.

Key to families of Lepidoptera:

Online Preliminary/Draft Key To The Commonly Encountered Families Of Lepidoptera was used to distinguished the fauna up to family level as well as fauna of British India used to clarify the character.

1. Diurnal (active in day-time) ..... (butterflies, plus a few others) 2

-Nocturnal..... (moths)11

2. Base of hindwing with frenulum (spine or group of spines) .....

(a few diurnal moths) 3

-Base of hindwing without frenulum; antenna with distal club.....

(butterflies) 5

3. Wings mostly transparent (scales absent except on veins) 4

-Wings pigmented (scales present on most of surface)..... 11

4. Stout-bodied, abdomen blunt distally, forewing length 2 cm or greater

..... Sphingidae (*Hemaris*)

- Body more slender, tapered distally, forewing length less than 2 cm, wasp-like ..... Sesiidae

BUTTERFLIES

5. Antennal club with terminal portion slender, often hook-shaped (apiculus); stout bodied,shortwinged. ..... Hesperiidae

- Antennal club without apiculus; slender bodied 6

6. Forewing length 4 cm or greater; hindwing with a tail-like projection ..... Papilionidae

- Forewing less than 4 cm; hindwing without a tail-like projection (may have thread-like projection) 7

7. Foreleg greatly reduced, only two pairs of walking legs (medium to large butterflies) ..... Nymphalidae

- Foreleg not greatly reduced, three pairs of walking legs (medium to small butterflies) 8

8. Ground color of forewing mostly white or yellow; forewing length usually > 2 cm; eye not emarginated (indented) at base of antenna ..... Pieridae

- Ground color of forewing not white or yellow; forewing length usually < 2 cm; eye emarginated (indented) at base of antenna 9

9. Hindwing with a hair-like tail (or triangular projection) ..... Lycaenidae (hairstreaks)

-Hindwing without a hair-like tail 10

10. Forewing above with at least some shiny blue ..... Lycaenidae (blues)

- Forewing mostly orange or brown above ..... Riodinidae

MOTHS

11.Forewing length greater than 1.2 cm ..... (mostly macrolepidoptera) 12

- Forewing length less than 1.2 cm .....(mostly microlepidoptera) 18

MACROLEPIDOPTERA

12. Forewing length usually greater than 3 cm..... (Bombycoidea plus) 13

- Forewing length usually less than 3 cm..... (various families) 15

13. Forewing long and slender (greater than 3 times as long as wide), pointed apically; frenulum well developed; proboscis well developed; body usually not excessively hairy ... Sphingidae (hawk moths)

- Forewing broadly triangular, often rounded apically; frenulum poorly developed; proboscis reduced or absent; body usually very hairy 14

14. Wings usually held flat; hindwing usually patterned ..... Saturniidae (silk moths)

- Wings usually held tent-like; hindwing usually not patterned ..... Lasiocampidae (*Dicogaster*)

15. Tympanum present (on last thoracic or first abdominal segment) 16

- Tympanum absent ..... (Zygaenoidea) 30

16. Tympanum present on first abdominal segment..... 17

- Tympanum present on last thoracic segment (may be "scoops" on first abdominal segment)..... 18

17. Base of proboscis scaled; forewing narrow triangular ..... Pyraloidea (Pyralidae and Crambidae)

- Base of proboscis naked; forewing usually broadly triangular ..... Geometridae

18. Male antennae usually plumose in basal half and simple in distal half; forewing venation with M2 arising midway between M1 and M3 ..... Notodontidae

- Male antennae usually moderately uniform throughout; forewing venation with M2 almost touching M3 19

19. Underwings, arctiids, tussock moths (and others) ..... Erebidae

Cutworms, loopers, flower moths (and others) ..... Noctuidae

MICROLEPIDOPTERA

20. Base of proboscis scaled ..... (Pyraloidea, Gelechioidea) 22

- Base of proboscis naked 21

21. Metathorax with tympanum ..... (small macrolepidoptera) go back to 12

- Metathorax without tympanum 27

22. First abdominal segment with tympanum ..... Pyraloidea (Pyralidae and Crambidae)

- First abdominal segment without tympanum..... (Gelechioidea) 23

23. Labial palpi mostly straight (porrect); dorsum of abdomen with tiny paired patches of spines or modified setae subdorsally on at least one segment ..... Coleophoridae

- Labial palpi mostly upcurved; dorsum of abdomen without tiny paired patches of spines 24

24. Dorsum of abdomen with row of copper-colored spines at the intersection of most segments; male antenna frequently notched near base ..... Blastobasidae

- Dorsum of abdomen without row of copper-colored spines; male antenna without notch 25

25. Hindwing broad, somewhat rounded throughout, with rounded apex; labial palpi long, upcurved (tusk-like) ..... Elachistidae (Ethmiinae, Stenomatinae)

- Hindwing variable, but usually pointed apically; labial palpi variable 26

26. Hindwing rather broad, mostly parallel-sided, usually with falcate apex (sometimes only pointed apically); labial palpi long, upcurved (tusk-like) ..... Gelechiidae

- Hindwing narrower, often lanceolate, pointed apically, but not falcate; labial palpi variable ..... Oecophoridae

27. Forewing and hindwing divided into numerous lanceolate "branches"; legs extremely long ..... Pterophoridae

- Forewing and hindwing entire, not divided; legs not conspicuously long 28

28. Forewing very narrow throughout; antenna nearly as long (or longer than) forewing; head usually smooth scaled..... Gracillariidae

- Forewing variable; antenna conspicuously shorter than forewing; head variable,but frequently rough scaled 29

29. Head with erect setae; base of labial palpus usually with a few long, stiff, dark bristles ..... Tineidae

- Head rough or slightly smooth scaled; base of labial palpus without bristles 30

30. Body short and stout, densely hairy (larger moths) .....
Limacodidae/Megalopygidae

-Body more slender, not so hairy (smaller moths) 31

32. Hindwing ovate-lanceolate (head without chaetosemata ..... Plutellidae

- Hindwing broad basally, narrowed apically (head with chaetosemata)
Tortricidae

Morphological characterization of lepidopteran insect fauna found in Akola vicinity and deposited in museum.

1. Noctuidae

Noctuidae family was composed of four species encountered in Akola locality during 2015 which are described below.

Forewing length is less than 3 cm, Tympanum present on last thoracic segments (may be scoop on first abdominal segments), Male antennae usually moderately uniform throughout; forewing venation with M2 almost touching M3. Well developed frenulum present, relative long tibial spurs.

2. Nymphallidae

Nymphallidae family was composed of five species of butterfly encountered during 2015 which were described below.

Medium to large butterfly, forewing length is less than 4 cm, antennae are clubbed, hind wing without a tail like projection, forelegs greatly reduced, only two pairs of walking legs. Arolium is either reduced or absent.

3. Pieridae

Pieridae family was composed of seven species of butterfly encountered during 2015 which were described below.

Medium to small butterfly, fore wing length is less than 4 cm, forelegs not greatly reduced, three pair of walking legs, ground color of forewing mostly white or yellow, fore wing length is usually >2 cm, eye is not emarginated (indented) at base of antennae, amplexiform wing coupling apparatus is present.

4. Sphingidae

Sphingidae family was composed of two species, spingid moth, *Acherontia styx* and Hawk moth, *Herse convolvuii* were encountered during 2015 in Akola vicinity.

Forewing length is greater than 1.2 cm, forewing long and slender (greater than 3 times as long as wide), pointed apically, antennae is thickened, frenulum well developed (wing coupling apparatus), proboscis well developed, body is not excessively hairy.

5. Papilionidae

Papilionidae family composed of three species, *Papilio demoleus, Papilio aristolochiae, Papilio polytes* were encountered during 2015 in Akola vicinity.

Antennae clubbed without apiculus, forewing length is 4 cm and greater, hind wing with tail like projection. Arolium pad or pulvi are greatly reduced or absent.

6. Hesperidae

Hesperidae family composed of only species of skipper was encountered during 2015 in Akola vicinity.

Antennal club with terminal portion slender, often hooked shaped (apiculus) stout bodies, short winged, wings are usually well rounded with more or less sharply tipped forewing.

7. Arctiidae

Arctiidae family composed of two species of tiger moth was encountered during 2015 in Akola vicinity.

Forewing length is greater than 1.2 cm, tympanum present on last thoracic segments; antennae usually moderately uniform throughout, different color spot were present on wing.

8. Geometridae

Geometridae family was encountered during the 2015 in Akola vicinity.

Forewing length is greater than 1.2 cm, tympanum present on first abdominal segments, base of the proboscis naked, forewing usually broadly triangular. Different types of antennae are present, simple, feathery, plumose type.

9. Pterophoridae

Pterophoridae family was encountered during the 2015 in Akola vicinity. Forewing length is less than 1.2 cm, base of proboscis is scaled, forewing and hindwing divide into numerous lanceolate branches,legs are extremely long.

10. Bombycidae

Forewing length usually greater than 3 cm, forewing long and slender (greater than 3 times as long as wide), pointed apically, frenulum well developed, proboscis well developed, body usually not excessively hairy.

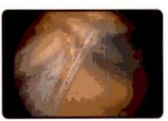
11. Lassiocampidae

Forewing length usually greater than 3 cm, forewing broadly triangular, often rounded apically, frenulum poorly well developed, proboscis reduced or absent, body usually very hairy, wing usually held tent like, hind wing usually not pattern.

Morphological characterization

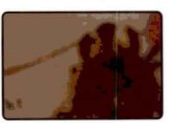
Family-Sphingidae

Wing coupling apparatus (Frenulum)



Body is not usually hairy

Forewing pointed apically



Antennae

Family-Noctuidae

Well developed frenulum

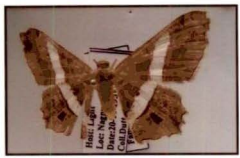
Forewing venation with M_2 almost touching M_3

Uniform antennae

Single tibial spur

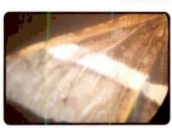
Plate 2(a)

Morphological characterization

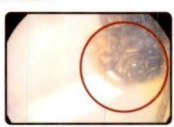


Family-Geometridae

Antennal Variation



Forewing broadly triangular



Base of proboscis naked

Family-Pyrallidae

Forewing narrow triangular

Base of proboscis scaled

Antannae

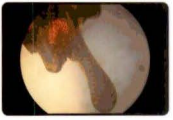
Plate 2(b)

Morphological characterization

Family-Papilionidae

Antennal club without apiculus

Forewing length 4 cm or greater



Hindwing with a tail-like projection

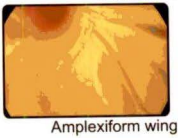
Tarsus without arolium

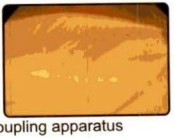
Family-Pieridae

Antennal club without apiculus

Eye not emarginate at base of antennae

Forewing length >2cm

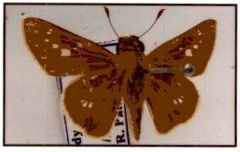




Amplexiform wing coupling apparatus

Plate 2(c)

Morphological characterization



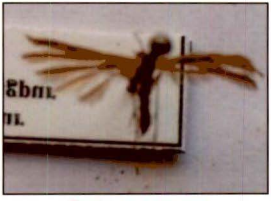
Family- Hesperidae

Antennal club with apiculus (Hook-shaped)

Short winged

Stout bodied

Family: Pterrophoridae



Exelestes atomosa

Forewing and hindwing divided into numerous lanceolate branches

Leg extremely long

Table-3: Family- wise per cent composition of lepidopteran fauna in Akola vicinity

Sr. no	Family	No. of specimen	Per cent
1	Noctuidae	93	26.57
2	Nymphallidae	76	24.28
3	Pieridae	69	19.71
4	Papillionidae	34	9.7
5	Arctiidae	17	4.8
6	Sphingidae	15	4.2
7	Lycaenidae	14	4
8	Geometridae	9	2.5
9	Pterophoridae	9	2.5
10	Hesperidae	6	1.71
11	Pyrallidae	6	1.70
12	Notondidae	2	0.57
	Total	350	100

Family wise composition of lepidopteran fauna

Noctuidae

Data in Table 3 and fig. 2 indicates that Noctuidae emerged as largest family of lepidoptera in Akola vicinity.

Noctuidae family contributing to 26.57 per cent of the total lepidopteran fauna. Among them the major contributing forms were *Helicoverpa armigera, spodoptera litura, Eudocima fullonica, Eudocima materna, Earias vitella* as the most predominant pests with economic importance.

Gurule et al. (2010) catalogued the 70 species of moths from family Noctuidae in Nashik district of Maharashtra.

Bharamal (2015) studied the faunstic records of 56 specimens of moth contributing 14 families, out of this family Noctuidae was found to be

dominant family which was represented by 13 specimens in Amboli Reserve Forest.

Sekhon and Singh (2015) reported the total 1300 representatives of 41 species referable to 24 genera belonging to family Noctuidae from western ghat, Maharashtra.

Thus, the more share of family Noctuidae was also reported by the previous researchers that strengthening the finding of present investigations particularly lepidopteran fauna in Maharashtra is concerned.

Nymphallidae

Data in Table 3 and fig. 2 revealed that 21.71 per cent of the total lepidopteran fauna was represented by this family. It is second largest family of order Lepidoptera in Akola vicinity. Within this family major form were recorded from the vicinity which was *Danais plexippus, Danais limnias, Euploea core, Précis lemonias, Hypolimnas bolina* etc. out of these most of the species were not having association with crop ecosystem and feeds on various wild plant and they are polyphagous in nature.

As per Bora and Meitei (2014), family Nymphallidae with 22 genera and 34 species was most dominant in Cachar district of Assam. Members of Nymphallidae were always dominant in tropical region because of most of the species are polyphagous in nature.

Pieridae

Data in Table 3 and fig. 2 revealed that 19.71per cent of the total represented by family pieridae. Within this family major form were recorded from the vicinity which was *Catopsilta crocale, Catopsilta pyranthe, Catopsilta pomona, Calotis danae, Belenois mesentinae, Ixias marrinae, Irias hecabe*. Out of these species *Catopsilta* species are most predominant and having economic importance as a pest of cruciferous pests.

Papillionidae

Data in Table 3 and fig.2 revealed that 9.7 per cent of the total lepidopteran fauna was represented by family Papillionidae. This family was represented by *Papilio demoleus, Papilio aristolochiae, Papilio polytes* etc. which are the most important pests of citrus in this vicinity.

Chandekar and Nimbalkar (2015) reported 56 species of butterflies belongs to 5 families namely papilionidae (4), Pieridae (12), Nymphallidae (21), Lycaenidae (15), and Hesperidae (4).

Sphingidae

Data in Table 3 and fig. 2 revealed that 4.2per cent of the total lepidopteran fauna was represented by family sphingidae. Within this family, two species were recorded from the study areas which were sphingidae moth *Acherontia styx* and Hawk moth, *Herse convulvii.* These two are the major pests of sesamum and tuber plants, respectively.

Chandra et al. (2013) collected 12 species of hawk moth belonging to 10 genera and 3 sub families. Species *Agnosia microta* is new addition to fauna of Madhy Pradesh.

As a members of Spingidae encountered during the present investigation are regular occurring pest in this vicinity and it is also found in most of the part of India. Thus, the finding of previous workers is in close confirmation to the present findings.

Arctiidae

Data in Table 3 and fig. 2 revealed that 4.8per cent of the total lepidopteran fauna was represented by family arctiidae. Within this family *Utetheisa pulchella, Amsacta lactinae* and one unidentified specimen were recorded.

Hairy caterpillar belonging to the family is being polyphagous and major pests of *Kharif* crop found active in this vicinity.

Lycaenidae

Data in Table 3 and fig. 2 revealed that 4per cent of the total lepidopteran was represented by the family lycaenidae. Most of the members of this family were collected from field crop viz; Pigeon pea, cotton and weeds.

Geometridae

Data in Table 3 and fig. 2 revealed that 2.5per cent of the total lepidopteran fauna was represented by family geometridae. This is one of the smallest families of Lepidoptera in this vicinity. Most of the members are phototropic, attracted towards light.

Pterophoridae

Data in Table 3 and fig. 2 revealed that 2.5 per cent of the total lepidopteran fauna was represented by family Pterophoridae. The member of this family is major pest of pigeon pea.

Hesperidae

Data in Table 3 and fig. 2 revealed that 1.7per cent of the total lepidopteran fauna was represented by family Hesperidae. Within this family, Skipper *Pamara Mathias* is recorded from study area. This is members of this family are minor pests of cotton and cowpea. However, these are not recorded pest in this vicinity.

Pyrallidae

Data in Table 3 and fig. 2 revealed that 1.70per cent of the total lepidopteran was represented by the family pyrallidae. Stem bore is one the most predominant pest with economic importance.

Notondidae

A minimum of only 0.57 per cent of total lepidopteran were represented by member of this family, species belonging to this family were observed during the period were, *Antheu serula*.

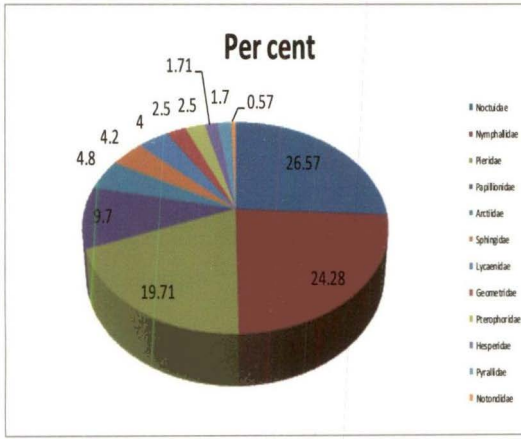


Fig: 2 Per cent share of lepidopteran fauna collected from Akola vicinity.

Notondidae was a smallest family of Lepidoptera in this vicinity collected through light trap.

Table 4: Family wise Shannon biodiversity index of lepidopteran fauna in Akola vicinity

Sr.No	Family	Pi(ln(pi))
1	Noctuidae	-0.3520
2	Nymphallidae	-0.3315
3	Pieridae	-0.3199
4	Papillionidae	-0.2264
5	Arctiidae	-0.1469
6	Lycaenidae	-0.1287
7	Sphingidae	-0.1349
8	Geometridae	-0.09421
9	Pterophoridae	-0.09421
10	Hesperidae	-0.06957
11	Pyrallidae	-0.06957
12	Notondidae	-0.0294
Shannon Diversity Index (H')	=	1.9970

Shannon Biodiversity Index

The data given Table- 4 indicates that Noctuidae family fauna showed abundance in population (-0.3520), where as Nymphallidae (-0.3315), Pieridae (-0.3199), Papillionidae (-0.2264), Arctiidae (-0.1469), Sphingidae (-0.1349) had moderate abundance of lepidopteran fauna. However family Notondidae and Pyrallidae showed the lower population of lepidopteran fauna. However, moderate to rich Shannon Biodiversity index (H'=1.9970) was noticed in terms of families of lepidopteran in Akola vicinity.

Table: 5 Species wise Shannon Diversity index of lepidopteran fauna in Akola vicinity

Sr. No	Familly	Common Name	*Species name*	Pi (ln pi)
1	Noctuidae	Tobacco leaf eating caterpillar	*Spodoptera litura*	-0.2724
2	Noctuidae	American bollworm	*Helicoperpa armigera*	-0.2186
3	Papilionidae	Lemon butterfly	*Papilio demoleu*	-0.1976
4	Nymphallidae	monarch butterfly	*Danais plexippus*	-0.1973
5	nymphallidae	Blue tiger butterfly	*Danais limniace*	-0.1633
6	Pieridae	Common emigrant	*Catopsilta pomona*	-0.1468
7	Pieridae	Lemon pancy	*Precis lemoniace*	-0.1221
8	Sphingidae	Spingid moth	*Acherontia styx*	-0.1087
9	Pterophoridae	Tur plume moth	*Exeletes atomosa*	-0.0940
10	Pieridae	White orange tip	*Ixias marinnae*	-0.0940
11	Pieridae	Common grass yellow	*Eurema hecabe*	-0.08614
12	Noctuidae	Fruit sucking moth	*Eudocima materna*	-0.0696
13	Nymphallidae	Common crow	*Euploe core*	-0.0696
14	Hesperidae	Skipper	*Pelopida s mathias*	-0.06957
15	Papilionidae	Common rose	*Papilio aristolochiae*	-0.06957
16	Noctuidae	Silver moth	*Autographa gamma*	-0.06041
17	Pieridae	Pioneer tip	*Belenois mesentinae*	-0.06041
18	Pieridae	Great egg butterfly	*Hypolimnas bolina*	-0.06041
19	Sphingidae	Hawk moth	*Herse convulvuii*	-0.0510
20	Pieridae	Mottled emigrant	*Catopsilta Pyranthe*	-0.03218
21	Pieridae	Crimpson tip	*Calotis danae*	-0.03218
22	Pyrallidae	Stem borer	*Chillo partellus*	-0.0294
23	Noctuidae	Spotted bollworm	*Earias insulana*	-0.01645
24	Papilionidae	Common mormon	*Papilio demoleus*	-0.01645
25	Pieridae	Peacock pancy	*Jumonia almanac*	-0.01645
26	Pieridae	Baronet butterfly	*Euthalia nuis*	-0.01645
27	Pterophoridae	Tur plume moth	*Exelestes atomosa*	-0.0940
28	Notondidae	Antheu serula	*Antheu serula*	-0.02945
29	Arctiidae	Hairy caterpillar	*Utetheisa pulchela*	-0.0940
		H'		2.36707

Table 5 indicates that a total 29 species have been identified based on the morphological characters by comparing it with the specimens of the respective species preserved/ deposited in the biosystematics laboratory insect museum (Heritage collection). During the course of investigation member of ten families comprised of twenty eight belongs to 24 genera Shannon's Diversity index indicates that rich species diversity (H'=2.36707) of Lepidoptera in Akola vicinity was recorded during kharif season of 2015. Tobacco leaf eating caterpillar (*spodoptera litura*) showed more abundance (-0.2724) followed by American bollworm, *Helicoverpa armigera* (-0.2186) among the moths. Whereas under butterflies, lemon butterfly, *Papilio demoleus* had -0.1976, abundance followed by Monarch butterfly, *Danais plexippus* (-0.1973), Blue tiger butterfly, *Danais limniace* (-0.1633), common emigrant, *Catopsilta pomona* (-0.1468), Lemon pancy, *Precis lemonias* (-0.1221), White orange tip, *Ixias marinnae* (-0.0940),Tur plume moth, *Exeletes atomosa* (-0.0940), Common grass yellow, *Eurema hecabe* (-0.08614), Common crow, *Euploe core* (-0.0696), Common rose, *papilio aristolochiae* and skipper, *pelopidas mathias* both had (-0.06957). Pioneer tip, *Belenois mesentinae* and great egg butterfly, *Hypolimnas bolina* both had (-0.06041) abundance. Mottled emigrant, *Catopsilta pyranthe* and Crimpson tip, *Calotis danae* both had a (-0.03218) abundance. Spotted bollworm, *Earias insulana*, common mormon, *papilio polytes*, Peacock pancy *Junonia almanac*, Baronet butterfly, *Euthali nuis* had a (-0.01645) lowest bundace in Akola vicinity.

Out of these moths viz, Spodoptera litura, Helicoverpa armigera, Exeletes atomosa, Earias insulana are some of the regular and major pests of Kharif crop. Eudocima materna and Eudocima fullonica are the pests of citrus. Among the butterflies, *Papilio demoleus* is the major pre dominant pest of citrus in this vicinity. Pierids, *Catopsilta pomona* observed to be a pest of cruciferacae family. Rest of the butterflies did not show menace to the kharif crop of Akola vicinity.

Anonymous (2016) reported the menace of kharif crop pest viz, *Spodoptera litura, Heliocoverpa armigera, Eudocima fullonica, Eudocima maternal, Papilio demoleus* in Akola vicinity.

Development of pictorial key

For the easy identification and classification of lepidopteran fauna important and typical characters of concerned family have been highlighted and depicted in pictorial form facilitates to have comparative studies so as to differentiate into family levels.

Pictorial keys for identification of lepidopteran fauna

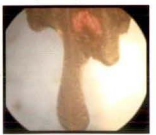
Lepidoptera

Butterflies

Family - Hesperidae

Antenanal club with terminal portion slender, often hook shaped (apiculus)

Family: Papillionidae



Hind wing with tail like projection

Macrolepidoptera

(Next Plate)

Microlepidoptera

Family: Pterophoridae

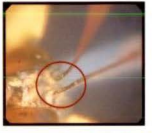
Forewing and hindwing divided into numerous lanceolate branches

Leg extremely long

Plate 3(a)

Family: Pieridae

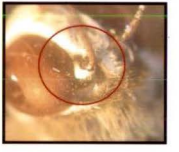
Ground color of forewing mostly white or yellow



Eye not emarginate (indented) at the base of antennae

Family: Lycaenidae

Hindwing with a hairlike tail (or triangular projection)



Eye emarginate at base of antennae

Family: Nymphallidae

Forlegs greatly reduced

Only two pairs of walking leg

Pictorial keys for identification of lepidopteran fauna

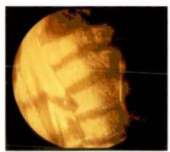
Lepidoptera

Macrolepidoptera

Family: Sphingidae

Frenulum well developed

Forewing long and slender pointed apically



Body usually not excessively hairy

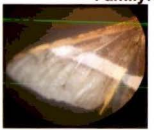
Plate 3(c)

Family: Pyrallidae

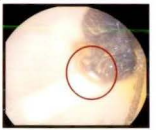
Forwing narrow triangular

Base of proboscis scaled

Family: Geometridae

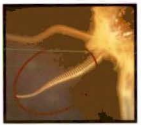


Forewing usually broadly triangular



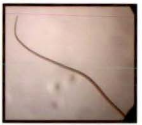
Base of proboscis is naked

Family : Notondidae



Male antennae usually plumose in basal half and simple in distal hal

Family : Noctuidae



Male antennae usually moderately uniform throughout

Family: Saturniidae

Feathery antennae

Family: Arctiidae

Pigmented wings

Family: Lymantridae

Tuft of hair at anal end

Plate 3(e)

Table 6: Per cent share of lepidopteran fauna in Insect biosystematics laboratory, Department of Entomology, Dr. P.D.K.V. Akola

Sr no.	Family	No. of specimen	Per cent
1	Noctuidae	58	40.27
2	Nymphallidae	15	10.34
3	Pyrallidae	14	9.6
4	Pieridae	14	9.6
5	Lycaenidae	10	6.89
6	Arctiidae	10	6.89
7	Papillionidae	7	4.82
8	Hesperidae	6	4.13
9	Geometridae	4	2.75
10	Lasiocampidae	2	1.37
11	Cossidae	1	0.68
12	Sphingidae	1	0.68
13	Bombycidae	1	0.68

The data given in Table 6 indicates that Noctuidae family showed the dominance in collection population (40.27 per cent) whereas Nymphallidae (10.34 per cent), Pyrallidae (9.6 per cent), Pieridae (9.6 per cent), and Lycaenidae (6.89 per cent). However family Cossidae, Sphingidae, Bombycidae, showed the lower population of lepidopteran fauna.

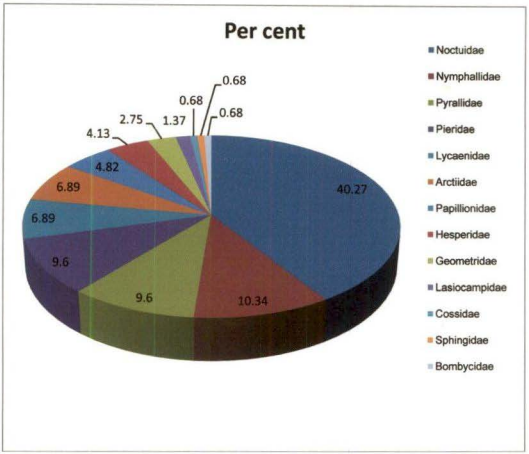


Fig. 3 Per cent share of lepidopteran fauna in Insect biosystematics laboratory, Department of Entomology, Dr. P.D.K.V. Akola

Table 7 : Heritage Collection of Lepidopteran fauna, Insect Biosytematics laboratory, Department of Entomology, PGI, Dr.P.D.K.V,Akola

Sr. No.	Species	Date	Location	Name of collectors	Cabinet No.	Box No.
1	Order : Lepidoptera S. Order : Ditrysia S.Family : Bombycidea. Family : Bombycidae *Ocinara varians* (3)	10/09/1934	Nagpur	..	N_1	N_1
2	Order : Lepitoptera S. order : Ditrysia S. Family : Bombycoidea Family : Sphingidae *Herse convulvii*	10/09/1934	Nagpur	..	N_1	N_1
3	Order : Lepidoptera. S. Order : Ditrysia S. Family : Lassiocampidae *Toregama siva*	10/09/1934	Nagpur	..	N_1	N_1
4	Order : Lepidoptera S. order : Ditrysia Family : Lassiocompidae *Trabala Vishnu*	23/11/1934	Pusa Bengal	Santakay	N_1	N_1
5	Order : Lepidoptera S. order : Ditrysia Family : Sphingidae *Nephele didyma*	07/11/1948	Maharaj Bag	--	N_1	N_1
		17/12/1949	Maharaj Bag	--	N_1	N_1
		02/11/1949	Maharaj Bag	--	N_1	N_1
6	Order : Lepidoptera S. order : Ditrysia S. family : Cossoidea Family : Cossidae	13/09/1941 18/04/1941 30/05/1941	Nagpur Nagpur Nagpur	K. R. Sontake K.R.Sontake K.R.Sontake	N_1 N1 N1	N_2 N2 N2

	Inderbella quadrinotata					
7	Order : Lepidoptera S. order : Ditrysia S. family : Geometrioidea Family : Geometridae *Ascotis selearia*	11/10/1948	Maharaj Bag Nagpur	K. R. Sontake	N_1	N_2
8	Order : Lepidoptera S. order : Ditrysia S. family : Geometrioidea *Semiothisa eleonora*	20/11/1931	Nagpur	Dutt	N_1	N_2
9	Order : Lepidoptera S. order : Ditrysia S. family : Geometrioidea Family : Geometridae *Cacochloris uvidula*	12/07/1932	Nagpur	Dutt	N_1	N_2
10	Order : Lepidoptera S. order : Ditrysia Family : Geometridae *Thalassodes immissaria*	09/08/1933	Nagpur	Dutt	N_1	N_2
11	Order : Lepidoptera S. order : Ditrysia S. family : Hesperioidae Family : Hesperiidae *Abaratha syrichthus* (2)	10/08/1935	Nagpur	Sontake	N_1	N_2
12	Order : Lepidoptera S. oder : Ditrysia S. family : Hesperioidea Family : Hesperidae *Parnara mathias*	08.09.1933 21.12.1928 23.07.1929 12.09.1933 02.19.1933	Nagpur Nagpur Pusa Bihar Nagpur Nagpur	Gopinath Gopinath Gopinath Gopinath Gopinath	N_1 N_1 N_1 N_1 N_1	N_2 N_2 N_2 N_2 N_2

		07.01.1929 02.19.1935	Pusa Bihar Nagpur	Sontakay Sontakay	N_1 N_1	N_2 N_2
13	*Spialia Galab*					
14	Order : Lepidoptera S. Order : Ditrysia *Taractrocera maevios*	11/06/1929 13/06/1929	Nagpur Nagpur	Sontakay Sontakay	N_1 N_1	N_2 N_2
15	*Telicota augias*	13/071929	Nagpur	Sontakay	N_1	N_2
16	*Telicota bambusae*	29/06/1929	Nagpur	Sontakay	N_1	N_2
17	Order : Lepidoptera S. order : Ditroysia S. family : Pyraloidea Family : Pyrallidae *Chillo partellus*	18/09/1933	Nagpur	Gopinath	N_1	N_3
18	*Euzphora Sp*	06/09/1943				
19	*Lamprosema diemenalis*	05/10/1928 09/11/1928	Pusa Bihar Pusa Bihar	K.R. Sontakay K.R. Sontakay	N_1 N_1	N_3 N_3
20	*Nomophilo noctuella*	09/04/1929 17/11/1928 08/04/1929	Pusa Bihar Pusa Bihar Pusa Bihar	K.R. Sontakay K.R. Sontakay K.R. Sontakay	N_1 N_1 N_1	N_3 N_3 N_3
21	*Ephestio Spp.*	29/01/1919	Mathurapur (Bihar)	G.D. Ojha	N_1	N_3
22	*Galleria mellonella (4)*	29/01/1919 21/02/1919 21/02/1919	Mathurapur (Bihar) Mathurapur (Bihar) Mathurapur	G.D. Ojha G.D. Ojha G.D. Ojha	N_1 N_1 N_1	N_3 N_3 N_3

		05/10/1928	(Bihar) Pusa (Bihar)	G.D. Ojha	N_1	N_3
23	*Macalla Moncusalis (2)*	-	-	-	-	-
24	*Macalla Sp.*	27/12/1949 19/10/1948 17/12/1909	- - -	Sahu Sahu Sahu	N_1 N_1 N_1	N_3 N_3 N_3
25	*Marasamia trapezalis*	17/11/1928 16/11/1928	Pusa Bihar Pusa Bihar	Sontakay Sontakay	N_1 N_1	N_3 N_3
26	*Margaronia conthosalis*	17/11/1928 17/11/1928	Pusa Bihar Pusa Bihar	Sontakay Sontakay	N_1 N_1	N_3 N_3
27	*Nymphulla feedalis*	06/12/1928 10/10/1928 06/10/1928	Pusa Bihar Pusa Bihar Pusa Bihar	K.R. Sontakay K.R. Sontakay K.R. Sontakay	N_1 N_1 N_1	N_3 N_3 N_3
28	*Nymphulla fluctrosalis*	30/08/1928 30/08/1928	Pusa Bihar Pusa Bihar	Sontakay Sontakay	N_1 N_1	N_3 N_3
29	*Nymphulla reeporsalis*	10/10/1928 06/08/1929	Pusa Bihar Pusa Bihar	K.R. Sontakay K.R. Sontakay	N_1 N_1	N_3 N_3
30	*Nymphulla offinalis*	24/01/1929 01/06/1929 01/06/1929 07/01/1928	Pusa Bihar Pusa Bihar Pusa Bihar Pusa Bihar	Sontakay Sontakay Sontakay Sontakay	N_1 N_1 N_1 N_1	N_3 N_3 N_3 N_3
31	Order : Lepidoptera S. Order : Ditrysia S. family : Noctuoidea Family : Arcdiidae *Amsacta lineola*	29/09/1928 29/09/1928 17/07/1931 08/10/1928	Pusa Bihar Pusa Bihar Nagpur Pusa Bihar	Dutt Dutt Dutt Dutt	N_1 N_1 N_1 N_1	N_4 N_4 N_4 N_4

32	*Argina Cribraria*	22.8.1934	Nagpur	Sontakay	N_1	N_4
		16.8.1934	Nagpur	Sontakay	N_1	N_4
		19.9.1935	Nagpur	Sontakay	N_1	N_4
		19.9.1935	Nagpur	Sontakay	N_1	N_4
		16.8.1934	Nagpur	Sontakay	N_1	N_4
		15.8.1934	Nagpur	Sontakay	N_1	N_4
		11.8.1934	Nagpur	Sontakay	N_1	N_4
		16.8.1934	Nagpur	Sontakay	N_1	N_4
		16.8.1934	Nagpur	Sontakay	N_1	N_4
		20.8.1934	Nagpur	Sontakay	N_1	N_4
		9.9.1935	Nagpur	Sontakay	N_1	N_4
33	*Asura Stroigipennis*	June 1928	Shilong	R.N. Singh	N_1	N_4
34	*Creatonotus gangis*	10.1.1992	Nagpur	Sontakay	N_1	N_4
35	*Diacrisia oblique*	21.9.1937	Pusa Bihar	Sontakay	N_1	N_4
		24.9.1937	Nagpur	Sontakay	N_1	N_4
		21.9.1937	Pusa Bihar	Sontakay	N_1	N_4
		24.9.1937	Nagpur	Sontakay	N_1	N_4
		27.9.1937	Nagpur	Sontakay	N_1	N_4
		24.9.1937	Nagpur	Sontakay	N_1	N_4
		21.9.1937	Pusa Bihar	Sontakay	N_1	N_4
		24.9.1937	Nagpur	Sontakay	N_1	N_4
		24.9.1937	Nagpur	Sontakay	N_1	N_4
		27.9.1937	Nagpur	Sontakay	N_1	N_4
		21.9.1937	Pusa Bihar	Sontakay	N_1	N_4
		27.9.1937	Nagpur	Sontakay	N_1	N_4
		24.9.1937	Nagpur	Sontakay	N_1	N_4
36	S.Family : Noctuidea Family : Arctiidae *Digama hearseyana*	26.4.1929 6.8.1929	Nagpur Nagpur	Sontakay Sontakay	o_1 o_1	N_5 N_5
37	*Estigmene lactinea*	9.7.1935	Nagpur	Sontakay	o_1	N_5
		9.7.1935	Nagpur	Sontakay	o_1	N_5
		9.7.1935	Nagpur	H.N. Singh	o_1	N_5

		9.7.1935	Nagpur	H.N. Singh	o_1	N_5
38	*Estigmene perrotteti*		Nagpur	Sontakay	o_1	N_5
39	*Pericalis ricini*	27.6.1930	Nagpur	Sontakay	o_1	N_5
		17.8.1936	Nagpur	Sontakay	o_1	N_5
		4.9.1935	Nagpur	Sontakay	o_1	N_5
		27.6.1935	Nagpur	Sontakay	o_1	N_5
40	*Utetheisia Pulchella*	25.10.932	Nagpur	Sontakay	o_1	N_5
		1936	Nagpur	Sontakay	o_1	N_5
		15.8.1934	Nagpur	Sontakay	o_1	N_5
		29.8.1934	Nagpur	Sontakay	o_1	N_5
		28.8.1934	Nagpur	Sontakay	o_1	N_5
		28.8.1934	Nagpur	Sontakay	o_1	N_5
41	S. Family : Noctuidea Family : Noctuidae *Achaea coronate*	July – Aug 1921	Nagpur	Dutt	O_1	N_7
		20.8.1931				
		30.81941				
		30.7.1941				
		15.8.1931	Nagpur	Dutt	O_1	N_7
		1.8.1941			O_1	N_7
42	*Achaea janata*	14.9.1933	Nagpur	Gopinath	O_1	N_7
		14.9.1934	Nagpur		O_1	N_7
		20.9.1933	Nagpur	Gopinath	O_1	N_7
		12.9.1933	Nagpur	Gopinath	O_1	N_7
		11.9.1933	Nagpur	Gopinath	O_1	N_7
		24.9.1934	Nagpur	Gopinath	O_1	N_7
43	*Achaeo tirrahea*	30.8.1931	Nagpur	Sontakay	O_1	N_8
		1935	Nagpur	Sontakay	O_1	N_8
		5.9.1934	Nagpur	Dutt	O_1	N_8
		10.8.1935	Nagpur		O_1	N_8
		24.8.1934		Sontakay	O_1	N_8
		16.10.1942		Sontakay	O_1	N_8
		15.8.1934	Nagpur	Dutt	O_1	N_8
		15.8.1934	Nagpur	Dutt	O_1	N_8

44	*Acontia intersepta*	7.8.1933	Nagpur	Gopinath	O_1	N_8
		7.8.1933	Nagpur	Gopinath	O_1	N_8
		3.8.1936	R.L.G	Gopinath	O_1	N_8
45	*Acontia Spp.*	11.7.1931	Nagpur	Dutt	O_1	N_8
46	*Adisura atkinsoni*	26.12.1936	Nagpur		O_1	N_8
47	*Agrotis ipsilon*	20.12.1930	Nagpur	Gopinath	O_1	N_8
		20.12.1930	Nagpur	Gopinath	O_1	N_8
		17.8.1933	Nagpur	Gopinath	O_1	N_8
		17.8.1933	Nagpur	Gopinath	O_1	N_8
48	*Pericyma unbrina*	1.6.1929	Pusa Bihar	Sontakay	C_1	N_{13}
49	*Perigea capensis*	7.1.1929	Pusa Bihar	Sontakay	C_1	N_{13}
		7.1.1929	Pusa Bihar	Sontakay	C_1	N_{13}
50	*Phlegetoria delatrix (2)*					
51	*Phytometro ni*	3.11.1932	Nagpur	Gopinath	C_1	N_{13}
52	*plotheia spp.*	21.5.1911	Nagpur		C_1	N_{13}
		15.9.1906	Nagpur		C_1	N_{13}
		26.7.1903	Nagpur		C_1	N_{13}
53	*plusia eriosona*	16.9.1909	Pusa Bihar	J.L. Khare	C_1	N_{13}
54	*Polydesma quenavadi*	June – Aug 1923				
55	*Polytella gloriosae*	19.10.1935	Nagpur	N.V.B	C_1	N_{13}
		19.10.1935	Nagpur	N.V.B	C_1	N_{13}
		17.8.1931	Nagpur	Gopinath	C_1	N_{13}
		19.10.1935	Nagpur	N.V.B	C_1	N_{13}
		17.8.1931	Nagpur	Sontakay	C_1	N_{13}
		17.8.1931	Nagpur	N.V.B	C_1	N_{13}
56	*Risoba obstructa*	20.7.1932	Nagpur	Gopinath	C_1	N_{13}
		20.7.1932	Nagpur	Gopinath	C_1	N_{13}
57	*Sesamia inferens*	21.3.1933	Nagpur	Sontakay	C_1	N_{13}
		17.11.1935	Nagpur	Sontakay	C_1	N_{13}
		16.11.1935	Nagpur	Sontakay	C_1	N_{13}
		20.11.1935	Nagpur	Sontakay	C_1	N_{13}
		14.4.1933	Nagpur	Sontakay	C_1	N_{13}

		17.11.1935	Nagpur	Sontakay	C_1	N_{13}
		22.11.1935	Nagpur	Sontakay	C_1	N_{13}
		14.3.1933	Nagpur	Sontakay	C_1	N_{13}
58	*Speiredonia retorta*	27.7.1934		Rao	C_1	-
		11.3.1934	Nagpur	K.S.S.C	C_1	
		27.4.1929	Pusa Bihar	Sontakay	C_1	
59	*Spingomorpha chlorea*					
60	*Tarache spp.*	11.07.1931	Nagpur	Dutt	C_1	-
61	*Timora lanceolata*	11.07.1935	Nagpur	Mujtab	C_1	-
62	*Spodoptero litura*	19.08.1933	Nagpur	Sontakay	C_1	-
		06.12.1928	Nagpur	Sontakay	C_1	-
		02.10.1935	Nagpur	Sontakay	C_1	-
		02.10.1935	Nagpur	Sontakay	C_1	-
		20.09.1933	Nagpur	Sontakay	C_1	-
		13.08.1974				
		3 (Without Dat)				
63	*Spodoptera pectin*	23.01.1929	Nagpur	Sontakay	C_1	-
		23.01.1929	Nagpur	Sontakay	C_1	-
		06.04.1935	Nagpur	Sontakay	C_1	-
		19.08.1974				
		2 Spp.				
64	*Spodoptera mauritia*	09.08.1929	Nagpur	Sontakay	C_1	-
65	Family : Notodontidae	09.10.1934	Nagpur	S.A.	C_1	-
	Antheua Serula	03.12.1931	Nagpur	Rasheed	C_1	-
				Dutt		
66	Family : Noctuidae	03.08.1934				
	Amyna octo	02.18.1948	Ento Sec.	G.A.	S_1	N_9
			Nagpur	Gongnade		
67	*Amyna Punctum*	23.05.1929	Pusa Bihar	Sontakay	S_1	N_9
		04.06.1929	Pusa Bihar	Sontakay	S_1	N_9
68	*Anomis flava*	23.07.1929	Pusa Bihar	Sontakay	S_1	N_9
69	*Anomis involuta*	31.07.1948				

		17.07.1948				
70	*Anomis sp.*	29.06.1929	Pusa Bihar	Sontakay	S_1	N_9
71	*Anticarsia irrorata*	07.08.1932	Nagpur	Gopinath	S_1	N_9
		04.08.1932	Nagpur	Gopinath	S_1	N_9
		03.08.1932	Nagpur	Gopinath	S_1	N_9
72	*Attatha spp.*	10.06.1929	Pusa Bihar	Sontakay	S_1	N_9
73	*Bombotelia simplex*	28.02.1933	Nagpur	Gopinath	S_1	N_9
74	*Calesia haemorrhoa*	13.09.1934	Nagpur	Dutt	S_1	N_9
75	*Calpe emarginata*	30.08.1930	Coimbatore		S_1	N_9
76	*Calpe minuticornis*	25.06.1929	Pusa Bihar	Sontakay	S_1	N_9
77	*Carea subtilis*	08.08.1932	Nagpur	Gopinath	S_1	N_9
		04.08.1932	Nagpur	Gopinath	S_1	N_9
		01.10.1948	Maharaj bag		S_1	N_9
		01.10.1948			S_1	N_9
78	*Cirphis unipuncta*	11.08.1932	Nagpur	Gopinath	S_1	N_{10}
		12.08.1932	Nagpur	Gopinath	S_1	N_{10}
		07.08.1932	Nagpur	Gopinath	S_1	N_{10}
		15.07.1937	Nagpur	Gopinath	S_1	N_{10}
		11.08.1932	Nagpur	Gopinath	S_1	N_{10}
		12.08.1932	Nagpur	Gopinath	S_1	N_{10}
		08.08.1932	Nagpur	Gopinath	S_1	N_{10}
		07.08.1932	Nagpur	Gopinath	S_1	N_{10}
79	*Cosmophilla erosa*	27.09.1909	Pusa Bengal	J.L.Khare	S_1	N_{10}
		10.08.1935	Nagpur	H.N.Singh	S_1	N_{10}
80	*Cosmophilla indica*	17.11.1935	Nagpur	Gopinath	S_1	N_{10}
		19.08.1931	Nagpur	Gopinath	S_1	N_{10}
81	*Cosmophila subilifera*					
82	*Cosmophilla Spp.*	06.10.1908	Pusa Bengal		S_1	N_{10}
83	*Erebus macrops*					
84	*Dinumma Placens*	17.08.1931	Nagpur	Gopinath	S_1	N_{10}
85	*Earias insulana*	1928		Dutt	S_1	N_{10}

86	*Earias fabia*	29.10.1931	Akola beraza	Dutt	S_1	N_{10}
		29.10.1931	Akola beraza	Dutt	S_1	N_{10}
		29.10.1931	Akola beraza	Dutt	S_1	N_{10}
		15.05.1933	Nagpur	Gopinath	S_1	N_{10}
		15.05.1933	Nagpur	Gopinath	S_1	N_{10}
		29.10.1931	Akola beraza	Dutt	S_1	N_{10}
87	*Euxoa Segetis*	24.04.1929	Pusa Bihar	Sontakay	S_1	N_{10}
88	*Euxoa Spinifera*	28.05.1929	Pusa Bihar	Sontakay	S_1	N_{10}
89	*Hoplotaraolle Lanana*	18.07.1931	Nagpur	Dutt	S_1	N_{10}
90	*Hypena Peruvulgaris*	18.07.1931	Nagpur	Dutt	S_1	N_{10}
		09.08.1931	Nagpur	Dutt	S_1	N_{10}
		21.07.1931	Nagpur	Dutt	S_1	N_{10}
91	*Ischyia Manlia (4)*					
92	*Lynecestis amphix*	27.07.1948			S_1	N_{11}
		17.07.1948			S_1	N_{11}
		05.06.1929	Pusa Bihar	Sontakay	S_1	N_{11}
93	*Laphigma exigue*	06.11.1936	Pawarkheda		S_1	N_{11}
		20.06.1932	Nagpur	Gopinath	S_1	N_{11}
		26.06.1932	Nagpur	Gopinath	S_1	N_{11}
		03.07.1932	Nagpur	Gopinath	S_1	N_{11}
		03.07.1932	Nagpur	Gopinath	S_1	N_{11}
94	*Mocis undata*				S_1	N_{11}
95	*Nyctipao hieroglyphica*	1918	Nagpur	N.K.M	S_1	N_{11}
		11.11.1921	Coimbatore		S_1	N_{11}
96	*Othereis fullonica*	June – Aug 1923		Sontakay	S_1	N_{12}
		08.08.1941		Bajaj	S_1	N_{12}
		08.08.1941		Bajaj	S_1	N_{12}
		08.08.1941		Bajaj	S_1	N_{12}
		08.08.1941		Bajaj	S_1	N_{12}
		08.08.1941		Bajaj	S_1	N_{12}
97	*Othereis maternal*	16.08.1942		Sontakay	S_1	N_{12}
		21.08.1937			S_1	N_{12}

		19.08.1931 24.08.1934 16.08.1942 11.02.1929 01.02.1929	Nagpur Pusa Bihar Pusa Bihar	Dutt Sontakay Sontakay	S_1 S_1 S_1 S_1	N_{12} N_{12} N_{12} N_{12}
98	Order : Lepidoptera S. Order : Ditrysia S. family : Papilionoidea Family : Nymphallidae *Precis almanac*	 28.09.1928 28.11.1928	 Pusa Bihar Pusa Bihar	 Sontakay Sontakay	 Q_1 Q_1	 N_{17} N_{17}
99	*Precis hierta*	05.09.1928	Pusa Bihar	Sontakay	Q_1	N_{17}
100	*Precis orithyia*	06.06.19299	Nagpur	Sontakay	Q_1	N_{17}
101	*Precis lemonias*	09.04.1929 07.08.1929	Pusa Bihar Pusa Bihar	Sontakay Sontakay	Q_1 Q_1	N_{17} N_{17}
102	*Sesphisa dichroa*	June 1928	Simla	CMC	Q_1	N_{17}
103	*Telchinia violae* Family : Papiliionidae	-		Sontakay	Q_1	N_{17}
104	*Papilio aristolochiae*	1909	Pusa Bihar	Sontakay	Q_1	N_{17}
105	*Papillio demoleus (3)*			Sontakay	Q_1	N_{17}
106	*Papillio glycerion*	1907	Bengal	D. Nowrojee	Q_1	N_{17}
107	*Papillio hector*	24.03.1907	Maharaj bag	D.R. Soman	Q_1	N_{17}
108	*Papillo polytes*	28.08.1934 21.10.1935 04.08.1934 13.12.1934	Nagpur Nagpur Nagpur Nagpur	D.R. Soman D.R. Soman D.R. Soman D.R. Soman	Q_1 Q_1 Q_1 Q_1	N_{18} N_{18} N_{18} N_{18}
109	*Papilio polytes* *Family – pieridae*	23.01.1929 23.01.1929	Nagpur Nagpur	Gopinath Gopinath	Q_1 Q_1	N_{18} N_{18}
110	*Anaphaeis mesentina*	17.04.1929 29.06.1929	Nagpur Nagpur	Sontakay Sontakay	Q_1 Q_1	N_{19} N_{19}
111	*Belenois meseutina*	1908 13.08.1922	Simla Nagpur	Sontakay Sontakay	Q_1 Q_1	N_{19} N_{19}

112	*Colotis amata*		Nagpur	Sontakay	Q_1	N_{19}
113	*Colotis fausta*		Nagpur	Sontakay	Q_1	N_{19}
114	*Colotis danae*	11.07.1922	Nagpur	Sontakay	Q_1	N_{19}
		11.07.1922	Nagpur	Sontakay	Q_1	N_{19}
		08.08.1922	Nagpur	Sontakay	Q_1	N_{19}
115	*Catopsilta crocale*	10.06.1929	Pusa Bihar	Sontakay	Q_1	N_{19}
		1909	Bengal	Sontakay	Q_1	N_{19}
		19.09.1928	Pusa Bihar	Sontakay	Q_1	N_{19}
116	*Catopsilta Pomona*	05.04.1929	Nagpur	Sontakay	Q_1	N_{19}
117	*Catopsilta pyranthe*	14.05.1929	Pusa Bihar	Sontakay	Q_1	N_{19}
		06.09.1928	Pusa Bihar	Sontakay	Q_1	N_{19}
		08.07.1918	Nagpur	Sontakay	Q_1	N_{19}
118	*Huphina nerissa*	14.09.1928	Pusa Bihar	Sontakay	Q_1	N_{20}
		17.04.1929	Pusa Bihar	Sontakay	Q_1	N_{20}
		04.04.1929	Pusa Bihar	Sontakay	Q_1	N_{20}
119	*Ixias marinnae*	25.08.1914	Nagpur	Sontakay	Q_1	N_{20}
		25.08.1914	Nagpur	Sontakay	Q_1	N_{20}
120	*Leptosia xiphia*	04.09.1928	Nagpur	Sontakay	Q_1	N_{20}
		14.09.1928	Nagpur	Sontakay	Q_1	N_{20}
121	*Ierias hecabe*	11.10.1928	Nagpur	Sontakay	Q_1	N_{20}
		04.12.1928	Nagpur	Sontakay	Q_1	N_{20}
122	*Pareronia hippie*	03.09.1928	Nagpur	Sontakay	Q_1	N_{20}
		05.10.1928	Nagpur	Sontakay	Q_1	N_{20}
123	*Pareronia valeria hippie*	17.04.1929	Nagpur	Sontakay	Q_1	N_{20}
124	Order : Lepidoptera S. Order : Ditrysia S. Family : Papillionoidea Family. : Nymphalidae *Argynnis children*	June – 1928	Shilong	R.N. Singh	P_1	N_{16}
125	*Ariadre (Ergolis)*	31.01.1929	Nagpur	Gopinath	P_1	N_{16}
	Merione	29.11.1933	Nagpur	Gopinath	P_1	N_{16}

126	*Danais limnias*	04.04.1929	Pusa Bihar	Sontakay	P_1	N_{16}
127	*Danais Plexippus*	05.04.1929	Pusa Bihar	Sontakay	P_1	N_{16}
128	*Danais sito*	June – 1928	Shilong	R.N. Singh	P_1	N_{16}
129	*Euploeo core*	17.04.1929	Pusa Bihar	Sontakay	P_1	N_{16}
		13.07.1929	Pusa Bihar	Sontakay	P_1	N_{16}
130	*Euthalia nais*	05.07.1929	Bihar	Sonatakay	P_1	N_{16}
131	*Hypalimna bolina*	12.08.1929	Nagpur	Sonatakay	P_1	N_{16}
132	*Lethe verma*	1928	Shilong	R.N. Singh	P_1	N_{16}
133	*Mycalesis perseus*	01.07.1929	Pusa Bihar	Sontakay	P_1	N_{16}
		1929	Pusa Bihar	Sontakay	P_1	N_{16}
134	Order : lepidoptera S.Order : Ditrysia S.Family : Papillonoidea Family : Lycaenidae *Catochrysops stroaba*	11.04.1929	Pusa Bihar	Sontakay	P_1	N_{15}
135	*Lycaenesthes emolus*	10.04.1928	Pusa Bihar	Sontakay	P_1	N_{15}
136	*Euchrysops conejus*	15.09.1928	Pusa Bihar	Sontakay	P_1	N_{15}
		31.01.1929	Pusa Bihar	Sontakay	P_1	N_{15}
		08.09.1928	Pusa Bihar	Sontakay	P_1	N_{15}
		08.11.1928	Pusa Bihar	Sontakay	P_1	N_{15}
137	*Lampideo boeticus*	22.04.1929	Pusa Bihar	Sontakay	P_1	N_{15}
		21.12.1928	Pusa Bihar	Sontakay	P_1	N_{15}
138	*Spindasis valcanus*	29.06.1929	Pusa Bihar	Sontakay	P_1	N_{15}
		25.06.1929	Pusa Bihar	Sontakay	P_1	N_{15}
		29.06.1929	Pusa Bihar	Sontakay	P_1	N_{15}
139	*Tajuria cippus*	11.04.1929	Pusa Bihar	Sontakay	P_1	N_{15}
140	*Tarucus theophastus*	25.03.1929	Nagpur	Sontakay	P_1	N_{15}
		04.07.1932	Nagpur	Sontakay	P_1	N_{15}
141	*Virachola Isocrates*	13.02.1935	Nagpur	Sontakay	P_1	N_{15}
		28.11.1933	Nagpur	Sontakay	P_1	N_{15}
		16.12.1933	Nagpur	Sontakay	P_1	N_{15}
		31.05.1929	Nagpur	Sontakay	P_1	N_{15}

		14.03.1935	Nagpur	Sontakay	P_1	N_{15}
		09.02.1935	Nagpur	Sontakay	P_1	N_{15}
142	*Zizera maha*	12.11.1929	Pusa Bihar	Sontakay	P_1	N_{15}
		29.08.1928	Pusa Bihar	Sontakay	P_1	N_{15}
		04.12.1928	Pusa Bihar	Sontakay	P_1	N_{15}
		01.12.1931	Nagpur	Sontakay	P_1	N_{15}
143	*Zizera lysine*	15.09.1928	Pusa Bihar	Sontakay	P_1	N_{15}

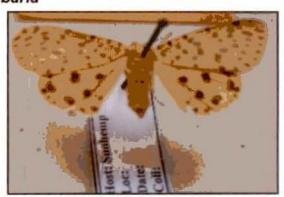
The data in Table-7 indicates that in the Heritage collection (British era)of lepidopteran fauna in Insect Biosystematics Laboratory, Department of Entomology, Post Graduate Institute, Dr.P.D.K.V, Akola, a total 143 species of the Lepidoptera have been deposited in Insect Biosytematics Laboratory, this specimens are collected from the various places in India.

These specimens are being used as voucher /type specimens. Most of the species are of agriculturally important pests.These specimens of Lepidopteran fauna have been already identified by some british entomologists before independent of India. The specimes kept in the insect museum of Department of Entomology, Dr.P.D.K.V.Akola could be used as a source of identification by comparing the collected specimens with the voucher/type specimens kept in the laboratory. In all 143 species of 102 genera belonging to 13 families of Lepidoptera have been deposited in the insect museum. In all more than 25000 specimens of diversed group of insects comprising 15 different orders have been preserved including Heritage collection. Probably it is one of the largest insect museums in central India. Researcher particulary Entomologists, Zoologists, students and farmers are being benefitted.

Family: Arctiidae

Argina cribaria

Utetheisa pulchella



Argina Spp.

Amsacta lactinea

Pericalis ricini

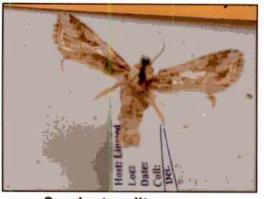
Family: Lasiocampidae

Taragama siva

Family: Notondidae

Antheu serula

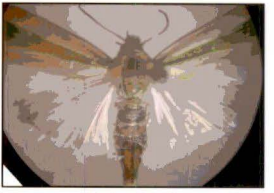
Family: Noctuidae



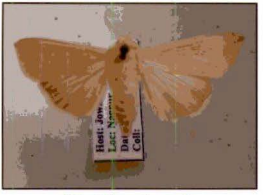
Spodoptera litura

Heliocverpa armigera

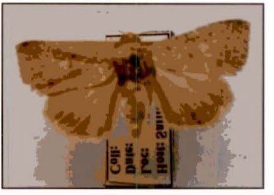
Eudocima materna



Earias insulana



Cirphis unipuncta



Celama analis

Plusia aricholea

Agrotis ipsilon

Family: Noctuidae

Cracidolomia binotalis

Speiredonia retorta

Spodoptera mauritia

Sesamia inferense

Phlegetonia delatrix

Perigea capensis

Eudocima fullonica

Family: Sphingidae

Herse convulvuii

Acherontia styx

Plate 4(c)

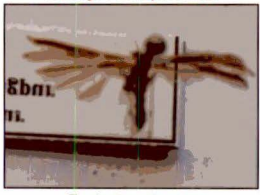
Family: Lymantridae

Euproctis subnotata

Family: Nolidae

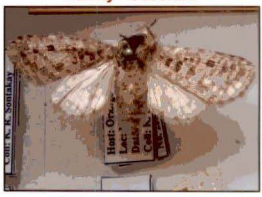
Risoba obstructa

Family: Pterrophoridae



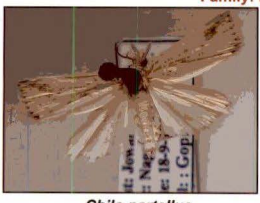
Exelestes atomosa

Family - Cossidae

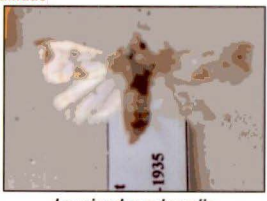


Indarbela quadrinotata

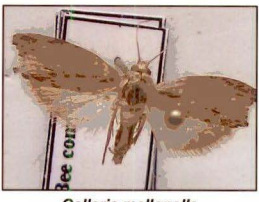
Family: Pyrallidae



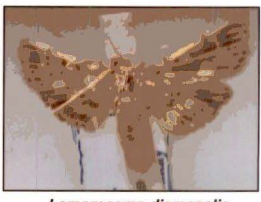
Chilo partellus



Leucinodes orbonalis



Galleria mellonella



Lamprosema diemenalis

Family: Pyrallidae

Nomophila noctuella

Family: Papilionidae

Papilio demoleus

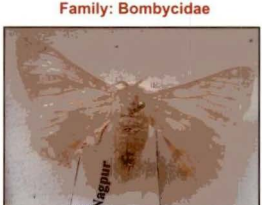
Family: Geometridae

Semiothisa eleonora

Ascotis selenaria

Cacochloris uvidula

Family: Bombycidae



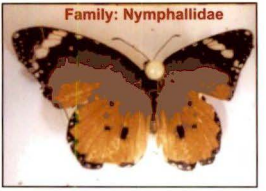
Ocinara varians

Butterfly

Family: Nymphallidae

Euploea core

Danais limniace



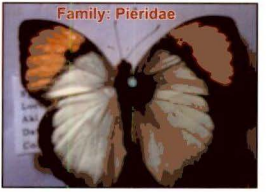
Danais plexippus

Papillio aristolochiae

Family: Pieridae

Calotis danae

Catopsilta pomona



Ixias marrinae

Parnara mathias

CHAPTER V

SUMMARY AND CONCLUSION

The Biodiversity of lepidopteran fauna was undertaken to know the activities of lepidopterans in Akola vicinity. This study was carried out during the year 2015-2016 at Department of Entomology, Post Graduate Institute, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola.

5.1 Collection of lepidopteran fauna

Lepidopterans were collected from the different field crop of Akola vicinity by using net, light traps and preserved for the further study. These fauna were sorted out and categorized up to family level based on the morphological characterizations by using appropriate taxonomic key. For studying the distinguishing morphological characters of different specimens Stereo zoom microscope (Nikon SMZ800) with attached Nikon camera was used. This taxonomical work carried out in the Insect Biosytematics Laboratory, Department of Agril. Entomology, Dr.Panjabrao Deshmukh Krishi Vidhyapeeth, Akola

5.2 Meteorological week wise lepidopteran activity

Lepidopteran faunal activity was noticed from second week of July 2015 i.e. 28th meteorological week. It is revealed from the data that peak activity was noticed in 37th meteorological week (10 Sept-16 Sept) during these periods total 59 specimens were trapped and preserved. Second peak was recorded in 36th meteorological week (48 Specimens) were trapped followed by 33rd week (44 specimens).

5.3 Lepidopteron fauna found in Akola vicinity

In Lepidoptera order twelve families were observed viz; Noctuidae, Nymphallidae, Pieridae, Papillionidae, Sphingidae, Arctiidae, Lycaenidae, Hesperidae, Geometridae, Pterophoridae, Notondidae and Pyrallidae.

5.4 Family wise per cent compositions of lepidopteran fauna in Akola vicinity

Family wise recorded data showed that family Noctuidae observed the rich fauna during the course of study and contributing about 26.57 per cent of overall collection and the family Notondidae and Pyralllidae showed the minimum fauna in Akola vicinity.

5.5 Family wise per cent share of lepidopteran fauna in Insect Biosytematicss Laboratory, PGI, Dr.P.D.K.V, Akola

Family wise recorded data showed that family Noctuidae showed the dominance in collection population i.e. (40.27 per cent), where as Nymphallidae (10.34 per cent), Pyrallidae (9.6 per cent). However, family Cossidae, Sphingidae, Bombycidae showed the lower population of lepidopteran fauna.

5.6 Shannon Biodiversity Index of family

The data given in (Table-4) indicates that Noctuidae family fauna showed abundance in population (-0.3520), Whereas Nymphallidae (-0.3315), Pieridae (-0.3199), Papillionidae (-0.2264) Arctiidae (-0.1469) and Sphingidae (-0.1349) had moderate abundance of lepidopteran fauna. However, family Notondidae and pyrallidae showed the lower population of lepidopteran fauna. Moderate to rich Shannon Biodiversity index (H'=1.9970) was noticed in terms of families of lepidopteran in Akola vicinity.

5.7 Shannon diversity index of species

The species level Shannon's biodiversity index of collected fauna indicates that, Tobacco leaf eating caterpillar, *Spodoptera litura* (-0.2724) showed abundance in population, where as American bollworm, *Helicoverpa armigera* (-0.2186), Lemon butterfly, Papilio demoleus (-0.1976), Monarch butterfly, Danais plexippus (-0.1973) had a moderate abundance. However, Spotted bollworm, Earias insulana, Baronet butterfly, Hypolimnas bolina, Peacock pancy, Junonia almanac, common mormon,Papilio polytes had a (-0.01645) lowest abundance in Akola vicinity. Rich Shannon

Biodiversity index (H'= 2.36707) was noticed in terms of species of Lepidoptera in Akola vicinity.

5.8 Pictorial key

For the easy identification and classification of lepidoteran fauna important and typical characters of concerned family have been highlighted and depicted in pictorial form facilitates to have comparatives studies so as to differentiate into family levels as given in Plate 3.

Conclusions

1. Lepidopteran fauna was found to be more active during the month of August and September in *Kharif* season of Akola vicinity.
2. 37th meteorological week was found to be peak period for the activity of lepidopteran population followed by 36th and 33rd the meteorological week.
3. Noctuidae was emerged out as the most dominant family in Kharif agro ecosystem.
4. As per Heritage collection, Noctuidae family was dominant in collection of Insect Biosytematics Laboratory, Post Graduate Institute, Dr. P.D.K.V, Akola, might be due its phototrophic nature.
5. For the characterization of lepidopteran fauna up to family level morphological characters viz; antennae, tibial spur, tympanum, wing venation, proboscis, wing coupling apparatus etc. are found to be the most distinguishing characters for identifaction up to family level.
6. Based on Shannon diversity index lepidopteran had moderate diversity index (H'=1.9970) However, noctuidae showed abundance in population.
7. Based on theShannon diversity index of lepidopteran specieshad rich diversity index (H'=2.36707). However, *Spodoptera litura* and *Helicoveroa armigera* showed abundance in population.
8. The distinguishing morphological characters with pictorial form of lepidopteran fauna differentiating the families have been used to develop pictorial key for easy identification up to family level, would be helpful to the students, amateur, researchers etc.

CHAPTER VI

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