

Diversity and Distribution Pattern of Hymenopteran Insects in Jorhat District, Assam, India

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Abstract: During the years 2011-2012, a survey was conducted to assess the diversity and distribution pattern of different hymenoptera insect species under the Department of Entomology, Assam Agricultural University in Jorhat district of Assam. Collections of various hymenoptera insects were made from different locations of Jorhat district viz. Kakilamukh, Titabor, Cinamora and Nimati. The areas chosen for the collection varies from farmland to forest areas with an average elevation of 116 meters (381 ft). A total of 50 surveys were conducted during the study period. The study reveals that the area under the survey has hymenopteran insects belonging to 21 families, 42 genera, and 50 species and their ecological roles span from predator to crop pollinator and parasitoids. The distribution pattern of hymenoptera insects is concerned 14 species abundant, 28 species occasional and 8 species were rare in the study site. The order of most dominant families in the district was Apidae followed by Formicidae and Vespidae.

Keywords: Hymenoptera, Diversity, Distribution, Ecological Role, Jorhat, Assam

1. Introduction

In terrestrial ecosystems, insects play a vital function as herbivores, pollinators, predators and parasites (Weisser and Seimann, 2004). Insects are considered to pollinate nearly 70% of crop plants worldwide and over 98% of trees (Klein *et al.*, 2006). The loss of these pollination services would have adverse effect on food production and no doubt for the maintenance of biodiversity (Klein *et al.*, 2006). The order Hymenoptera includes more than 100,000 described species which contains some of the most advanced and highly specialized insects. In the 'Fauna of British India' series Bingham (1903) has given a good coverage of various hymenopterans. The order is important to the balancing and functioning of most ecosystems in the planet and most beneficial for the human economy. Not only does the bee pollinate many crops but also they produce wax and honey. Mass release of parasitic wasps as bio-control agent has a prominent rule in insect pests management without using chemical insecticides. In medium elevation wet evergreen forest of the Western Ghats, bees contributed to the pollination of 18% of 86 species of trees and 22% of the understory shrubs (Devy and Davidar, 2003). Many workers have made valuable contribution in knowledge of Hymenopteran groups (Sudheendrakumar, 1994; Narendran and Sheela, 1995; and Hayat *et al.*; 2003).

Biodiversity of hymenopteran insect shows various patterns in space and time due to the difference in climatic conditions, interaction between species, geography, local history and many other factors. The patterns of biodiversity in space consist of area, latitude and altitude etc. that consist of season and life history.

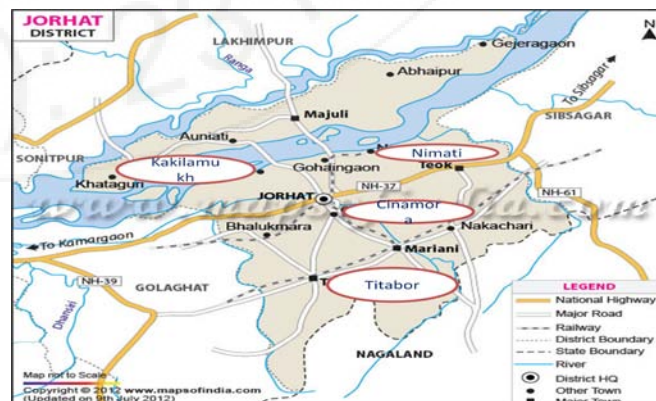
The area of the Jorhat district is 2851 Sq. Km. with a population of 1,091,295, on the north of the district, the river Brahmaputra forms the largest riverine island of the world,

Majuli, spreading over 924.6 sq. Km. In spite of significance of hymenoptera insect in biodiversity studies no effort has been made so far to study and document the prevalent this insect order. This survey work of the present study was to assess the diversity and distribution pattern of important Hymenoptera insects in the Jorhat district of Assam.

2. Material and Methods

2.1. Location, Constitution and Area

The district Jorhat of Assam is located at 26.75°N and 94.22°E and has an average elevation of 116 Meters (381 ft). Jorhat is surrounded by Sivasagar in the east, Lakhimpur in the north, Golaghat in the west and Wokha district (Nagaland) in the south. The district comes under semi-arid region with summer temperature 25°–35°C and winter temperature 22°–10°C. In case of vegetation structure of Jorhat is concerned, the district comprises of wide types of agricultural land to forest areas. The district is spreading over 2851 sq. km. with mean annual rainfall is 2029 mm.



Source: www.Jorhat.nic.in

2.2. Methods adopted for the study

2.2.1. Collection

Collections of various insects were made from different locations of varying habitats of Jorhat district viz. Kakilamukh, Titabor, Cinamora and Nimati. The areas chosen for the collection of hymenoptera insect comprises agricultural land and forest areas with an average elevation of 116 meters (381 ft). Details of distribution pattern of the surveyed undertaken in different area are presented in Table 2 for that a total of 50 surveys were carried out. The insect collections were made in the early hours of the day because hymenoptera insect are usually active at early hours of the day.

2.2.2. Methods of collection

- Hand picking:** Barks from tree were collected by hand picking for insects like leaf-miner.
- Insect collecting net:** Insect collecting net was used to collect active flier dipteran insects. Insects trapped in the insect collecting net were first killed by the vapour of killing agent to facilitate collection.
- Light trap:** Positively phototaxis hymenopteran were collected from near various light sources, Locations of four intensive study sites selected in different areas are shown in the map.

2.2.3. Equipment

The insects were collected with the help varied collecting equipments depending upon their habitat (Fenemore, 2005)

- Killing bottle:** Killing bottles were used to kill and preserve insect without affecting its colour. Chloroform (CHCl₃) was used as the killing agent. The liquid was poured over a layer of cotton and one or two filter papers or blotting papers were used to soak the cotton and also to prevent the specimen from coming in direct contact with cotton. Insects were handled carefully while they were put inside the bottle or taken out to prevent any morphological damage.
- Collection vials:** Small specimens were killed and preserved for further studies. Such specimens were kept in small plastic or glass vials.

2.2.4. Preservation for Taxonomic Study

The insects were preserved according to standard methods (Singh and Sachan, 2006-07; Srivastava, 2004).

a) Pinning of Insects

Hard bodied hymenoptera insects were pinned directly by piercing entomological pin through the body and care was taken to choose the correct size and number of pin to avoid damage to the internal part. Usually 0-3 size pins were used, although longer pins of 37-39 mm. in length were used for large bodied insects.

b) Location of pinning

The standard method viz. through right of middle line of thorax of pinning hymenoptera insects was followed.

c) Spreading

It is a process to arrange the wings for taxonomic study, with the help of spreading board which consists of two flat parallel pieces of soft wood with an inner groove lined by cork. A properly relaxed specimen, with a pin thrust vertically, was inserted inside the groove so that the wing bases remained at level with the edge of top

part. Two narrow paper strips were used to hold and spread the wings, and after adjustment of the wings at a desirable position the collected specimen was pinned using an entomological pin.

d) Mounting

Small delicate specimens were pinned with a minute, fine pin on a piece of pith, through other end of which a longer pin is inserted. The collection date and other details on a paper label were attached to this long pin. The mounted specimens were kept in insect cabinet. Naphthalene balls and Para dichlorobenzene were used in cabinet for safe preservation against any pest or fungal attack.

2.2.5. Identification

The purpose of a taxonomic key is to facilitate identification of a specimen. The goal was achieved by presenting subsequent appropriate diagnostic characters in a series of alternative choices with the help of published keys (Srivastava, 2004; Hook, 2008; Atwal and Dhaliwal, 2010) and available literature (Bolton, 1994). Some of the specimens were identified and confirmed by comparing with the specimens in Department of Entomology, Assam Agricultural University, Assam, India and identified specimens were arranged in systematic order.

2.2.6. Statistical Analysis

Collected data was analysed using PASW statistics 18 and per cent distribution of different species in the survey area was calculated by the following formula:

Per cent Distribution = (Number of Species/Total number of Species Collected) X 100

3. Results and Discussion

In the present study, hymenopteran insects belonging to 21 families, 42 genera, and 50 species (Table 1.) were tabulated and documented. On the basis of field observations and specimens collected, insects were divided into three broad categories viz. abundant (commonly distributed in the area), occasional (distributed in some of the pockets) and rare (few in numbers). Out of the 50 species recorded in Jorhat district, 14 numbers were abundant, 28 numbers occasional and 8 species were rare showed in the Table 2 and Figure 1.

Table 1: Diversity of Hymenoptera insects in Jorhat district of Assam

Family	Species Identified	English Name
Vespidae	<i>Vespa cincta</i>	Oriental Hornet
	<i>Vespa orientalis</i>	Yellow jacket
	<i>Vespa magnifica</i>	wasp
	<i>Ropalidia spp.</i>	Paper wasps
	<i>Polistes fuscatus</i>	Paper Wasps
	<i>Polistes hebraeus</i>	
Halictidae	<i>Halictus sp.</i>	Sweat bee
	<i>Sphecodes sp.</i>	
	<i>Thrinchostoma sp.</i>	Halictid bees
	<i>Homalictus sp.</i>	
Apidae	<i>Apis dorsata</i>	Rock bee
	<i>Apis cerana</i>	Indian bee
	<i>Apis florae</i>	Little bee
	<i>Tetragonula iridipennis</i>	Dammer bee
	<i>Ceratina sp.</i>	

	<i>Thyreus sp.</i> <i>Amegilla sp.</i> <i>Anthophora sp.</i>	Cuckoo bee
Pompilidae	<i>Thrincohalictus prognathus</i>	Spider wasp
Chrysididae	<i>Chrysis species</i>	Cuckoo Wasp
Megachilidae	<i>Megachile species</i> <i>Lithurgus sp.</i> <i>Anthidiellum sp.</i> <i>Coelioxys sp.</i> <i>Chelostoma sp.</i>	Leaf cutter bee
Formicidae	<i>Dorylus molestus</i> <i>Solenopsis sp.</i> <i>Myrmecaria brunnea</i> <i>Oecophylla suaragdina</i> <i>Tetraponera rufonigra</i> <i>Atta spp</i>	Ants Fire ants Weaver ants Slender ants Red ant
Aphidinae	<i>Aphidius spp</i>	Aphid parasite
Trichogrammatidae	<i>Trichogamma chilonis</i> <i>T. Japonicum</i>	Egg parasitoid
Ichneumonidae,	<i>Isotima javensis</i>	Ichneumonid wasp
Xylocopidae	<i>Xylocopidae fenestrata</i> <i>X. leucothorax</i>	Carpenter bee
Tenthredinidae	<i>Athalia lugens</i>	Mustard Sawflies
Cephalidae	<i>Cephus species</i>	Stem Sawflies
Pteromalidae	<i>Ptero spp.</i>	Pteromalid wasp
Tanaostigmatidae	<i>Tanaostigmodes cajaninae</i>	Pigeonpea pod wasp
Scelionidae	<i>Telenomum remus</i>	Parasitoid
Tiphiidae	<i>Tiphid femorata</i> <i>Agriomyia spp.</i>	Tiphiid Wasps
Eulophidae	<i>Ceratoneura indi</i> <i>Tetrastichus schoenobii</i> <i>Tetrastichus ayari</i>	Eulophid parasite
Eumenidae	<i>Eumenes petiolatus</i> <i>Eumenes sp.</i>	Potter wasp
Aphelinidae	<i>Aphelinus mali</i>	Woolly aphid parasite
Melittidae	<i>Melitta spp.</i>	

The family Apidae was dominant with 8 species followed by Formicidae and Vespidae with 6 species each. Biodiversity in most of the areas of this district of Assam remain unexplored even today. Order hymenoptera, being a group of agriculturally important insects including its role in bio-control agent in this region, demands biodiversity studies for understanding it's biodiversity as well as distribution pattern, as formerly considered by Elpino-Campos *et al.*, (2007) encountered 29 species of social wasps species distributed in 10 genera likewise in the present study a total of 6 species of wasps were enlisted. Banaszak (2010) also reported bee species diversity in various habitats of Wolin National Park in correlation with the present study 8 species of bees were enlisted. Bharati (2008) studied altitudinal diversity of ants in Himalayan regions and recorded 199 species. Sabu *et al.*, (2008) made efforts on diversity of forest litter-inhabiting ants along elevations in the Wayanad region of the Western Ghats and reported 29 ant species belonging to 18 genera under 6 subfamilies whereas in the present study in all 6 species of ants were encountered. This might be due to healthy climatic conditions and availability of natural resources necessary for their life processes and existence.

Table 2: Distribution pattern of Hymenoptera insects in Jorhat district

Family	Species distribution in the district		
	Abundant	Occasional	Rare (few in numbers)
Vespidae	√		√
Halictidae		√	
Apidae	√		
Pompilidae		√	
Chrysididae	√		
Megachilidae	√	√	√
Formicidae	√	√	
Aphidiidea	√	√	√
Anthophoridae		√	
Trichogrammatidae	√	√	
Ichneumonidae,	√	√	
Xylocopidae		√	√
Tenthredinidae	√	√	
Cephalidae		√	
Pteromalidae	√	√	√
Tanaostigmatidae	√	√	√
Scelionidae	√	√	
Tiphiidae	√	√	√
Eulophidae		√	√
Eumenidae	√	√	
Total	14 Species	28 Species	8 Species

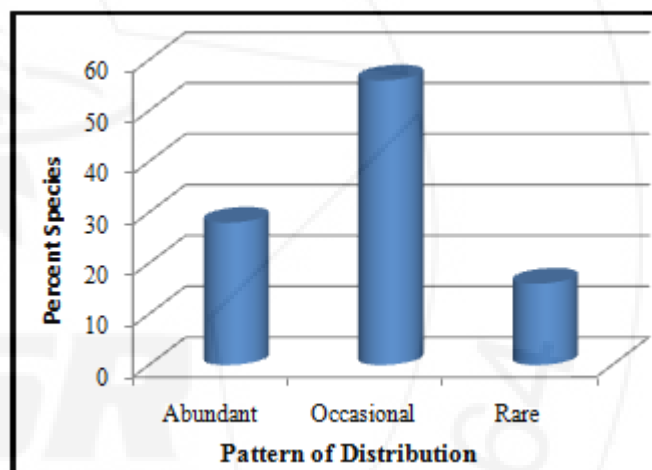


Figure 1: Percent Species distribution of Hymenoptera insect in Jorhat, Assam

Thus detailed biodiversity information is indispensable not only to conservation but also to environment impact and assessment. The high species diversity (relative to the area of the Jorhat district) and the presence of many rare species indicate that the study area is a real paradise for hymenoptera.

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