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Diversity of insects with special reference to order hymenoptera in Amba reserved forest of Kolhapur district, Western ghats, Maharashtra, India

S.R. Aland, A.B. Mamlayya, S.M. Gaikwad,* D.L. Bharmal** and G.P. Bhawane

Department of Zoology, Shivaji University, Kolhapur (MS)

** Department of Zololgy, Bhogawati Mahavidyalaya, Kurukali, Kolhapur (MS)*

*** Department of Zoology, Sri Pancham Khemraj Mahavidyalaya, Sawantwadi, Sindhudurga (MS)*

ABSTRACT : During the years 2007-2009 emphasis was made to study diversity of insects with special reference to order Hymenoptera in Amba Reserved Forest of Kolhapur District, Maharashtra. The region selected for study is part of Western Ghats of Maharashtra State which is one of the Biodiversity hot spots of the world. The study revealed 82 species distributed over 47 genera and belonging to 17 families. The families Formicidae and Eumenidae were dominant with 39 and 11 species respectively. The registered Shannon-Weiner and Simpson diversity indices were 1.97 and 0.74 respectively indicating diversity and abundance of hymneopterans in Amba Reserved Forest.

Keywords : Diversity, Hymenoptera, Amba Reserved Forest, Western Ghats, Maharashtra

INTRODUCTION

Modest estimate indicate that insects represents 56% of the 1.7 million animal species described (Heywood, 1995), but the wordl total is estimated at 3.6 to 10 million (Gaston and Husdon, 1994; Novotny *et al*., 2002; Odegaard, 2006). If these figures are considered and the estimation of non insect is added then the Class Insecta will constitute the dominant group of animal kingdom representing 80-92% of the entire animal Kingdom. Insects play vital functional role in terrestrial ecosystems as herbivores, pollinators, decomposers, predators and parasites (Weisser and Seiman, 2004. According to Gillot (1982) the order Hymenoptera includes more than 100,000 described species which contains some of the most advanced and highly specialized insects.

Biodiversity 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 a rea, latitude and altitude etc while those in times consist of season, life history and others. Efficient examples of organisms whose diversity varies seasonally are birds and insects. Insects have very different life history and thus, if an area is decided for studying their biodiversity, the time when sampling is made may strictly affect the diversity estimates. The most commonly used index of biodiversity is the number of species i.e. species diversity (Magurran, 1988).

Animals, particularly insects are considered to pollinate nearly 70% of crop plants worldwide and over 98% of trees in lowland tropical rain forest (Bawa, 1990; 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 (Allan Wardell *et al*., Klein *et al*., 2006). According to Devy and Davidar (2003) in medium elevation wet evergreen forest of the Western Ghats, apid bees contributed to the pollination of 18% of 86 species of trees and 22% of the understorey shrubs.

According to Allan *et al*., (1973) the presence of insects at a particular habitat depends on a wide range of factors of which the availability of food and climatic conditions suitable for egg laying and suitable flowers for feeding of adults govern the distribution of insects.

The quick and widespread loss of bioligical diversity is a matter of considerable concern. The destruction of tropical rain forests is a major factor responsible for the high rates of species extinction in recent years (Myers, 1998). Globally, tropical rain forests are disappearing at a rate of 12 million hectares a year (Cyranoski. 2007). Therefore, developing policies to manage tropical rain forests to prevent biodiversity loss is urgently needed. Nevertheless, mechanisms and processes causing diversity loss with reference to forest utilization are still almost unknown, although such knowledge is necessary for developing sustainable forest management policies (Szara and Johnson, 1996). The Western Ghats, known as one of the 25 biodiverstiy 'hotspot' of the world and occupies a critical position in the global biodiverstiy scene (Myers *et al*., 2000).

Several estimates have been made from time to time on isect fauna. According to an estimate by Menon (1965), there could be about 50,000 insect species in India. As percent estimate by Varshney (1997) 59,353 species of

insects belonging to 619 families constituting nearly 6.83% of the world insect fauna have been reported from India.

A series of revisionary studies have been subsequently been carried out from different geographical regions, no exhaustive survey has so far been carried out specifically from the various forests. This is particularly true with regard to Western Ghats region which is noted for its richeness in biodiversity (Mathew and Rahamathulla, 1995). Incidentally, the region selected for present investigatioin lies in Western Ghats of Maharashtra State, India.

In the 'Fauna of British Indai' series Bingham (1903) has given good coverage of various hymenopterans. Many workers have made valuable contribution to our knowledge of Hymenopteran groups (Abdurahiman and Joseph, 1967 a & b, 1975 a ; Joseph *et al*., 1973 a & b, 1979; Narendran, 1986, 1992; Narendran and Sureshan, 1989; Narendran and Sheela, 1995; Sudheendrakumar, 1990, 19993, 1994; Anderson, 1991 and Wiebes, 1980; Hayat *et al*; 2003). As far as insect fauna with special reference to order Hymenoptera of the study region is concerned, it si attempted of the first time.

MATERIAL AND METHODS

The present study was carried out in Amba Reserved Forest (15° 43' to 17° 10' north and longitude 73°40' to 74°42' east) of Kilhapur District of Maharashtra State in the years of 2007-2009. Monthly field visits were organized so as to surveys and collection. The Hymenopterans were collected with the help of sweep net method. Some opportunistic collections were also made. The ants were collected with the help of pit fall trap. All specimens were killed in insect killing bottle, brought to the laboratory in the Department of Zoology, Shivaji University, Kolhapur maharashtra, India and preserved with dry as well as wet preservation methods, Identification was done with available standard literature (Bingham, 1903; 1975a; 1975b; Morley, 1913; Holldobles and Wilson, 1990; Bolton, 1994).

Study Region

Kolhapur District

Kolhapur District (15° 43' to 17° 17' North latitude and 73° 40' to 74° 42' East longitude at 500 m MSL) is part of South Maharashtra. The geographical area is 7865 km^2. Total forest coverage of the District is about 1672 km^2. Out of which563 km^2 is reserved forest and 417 km^2 is protected forest. The forest area is about 22% of the total geographical area of the District.

Amba Reserved Forest

Amba Reserved Forest (15°43' to 17°10' north and longitude 73°40' to 74°42' east and 691.3 meters above Mean Sea Level) is situated between North-West directions of Kolhapur District. It is tropical semi evergreen forest of Western Ghats. The geogrphical area is 318.16 ha. The average annual rainfall is 6000 mm. Temperature of this region during Summer, Winter and Rainy Season ranges from 25-38°C, 10-30°C and 15-30°C respectively, Red brown soil is observed in the study region.

Data Analysis

For calculating the diversity indices Shannon-Weiner Index (Shannon and Weaver, 1949) and Simpson Index (Simpson, 1949) formulae were used.

1. Shannon-Weiner Index :

$$H = -\sum_{i=1}^{S} p_i \ln p_i$$

Where, P_i is the proportion of the 'ith' species in the community, '*S*' is the total number of species,'In' is the log with base '*e*' (Pielou, 1975).

2. Simpson Index :

$$D = \sum_{i=1}^{S} \frac{n_i(n_i - 1)}{N(N-1)}$$

Where, *n* is total number of organisms of a particular species,

N is the total number of organisms of all species

RESULTS AND DISCUSSION

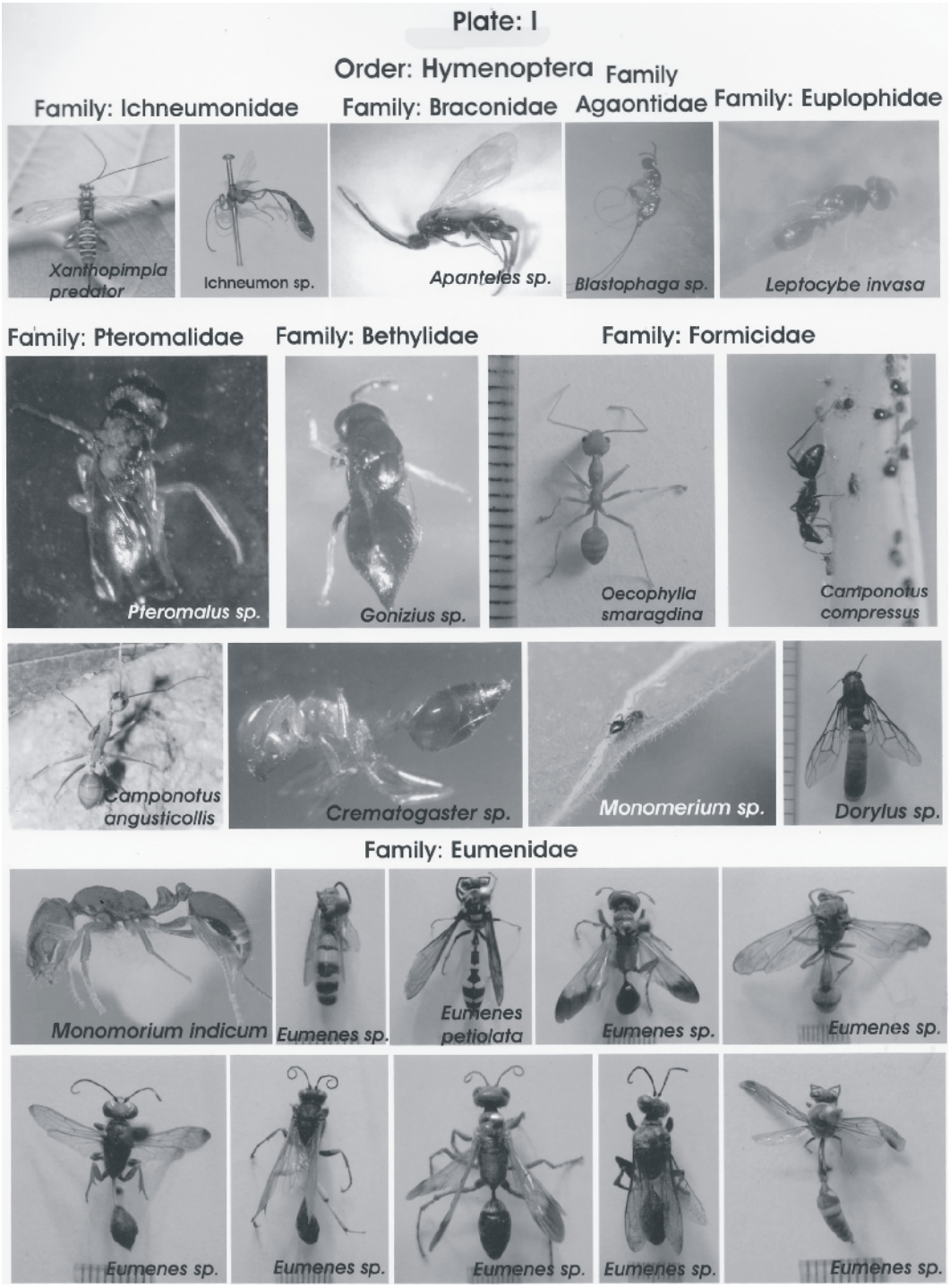
In all, 82 species distributed over 47 genera belonging to 17 families were reported in Amba Reserved Forest in the years 2007-2009. The family Formicidae was dominant with 39 species followed by family Eumenidae with 11 species. The families Vespidae, Xylocopidae and Apidae contained 4 species respectively. Whereas families namely Ichneumonidae, Braconidae and Bethylidae contained 3 species respectively. The family Evaniidae represented by 2 species and remaining families' *viz*. Platygasteridae, Agaontidae, Ghalcididae, Eulophidae, Trichogramatidae, Pteromalidae, Scolidae and Megachilidae contained 1 species respectively. The registered Shannon-Weiner and Simpson Diversity Indices values were 1.97 and 0.74 respectively revealed diversity and abundance of hymenopteran insects in the study region.

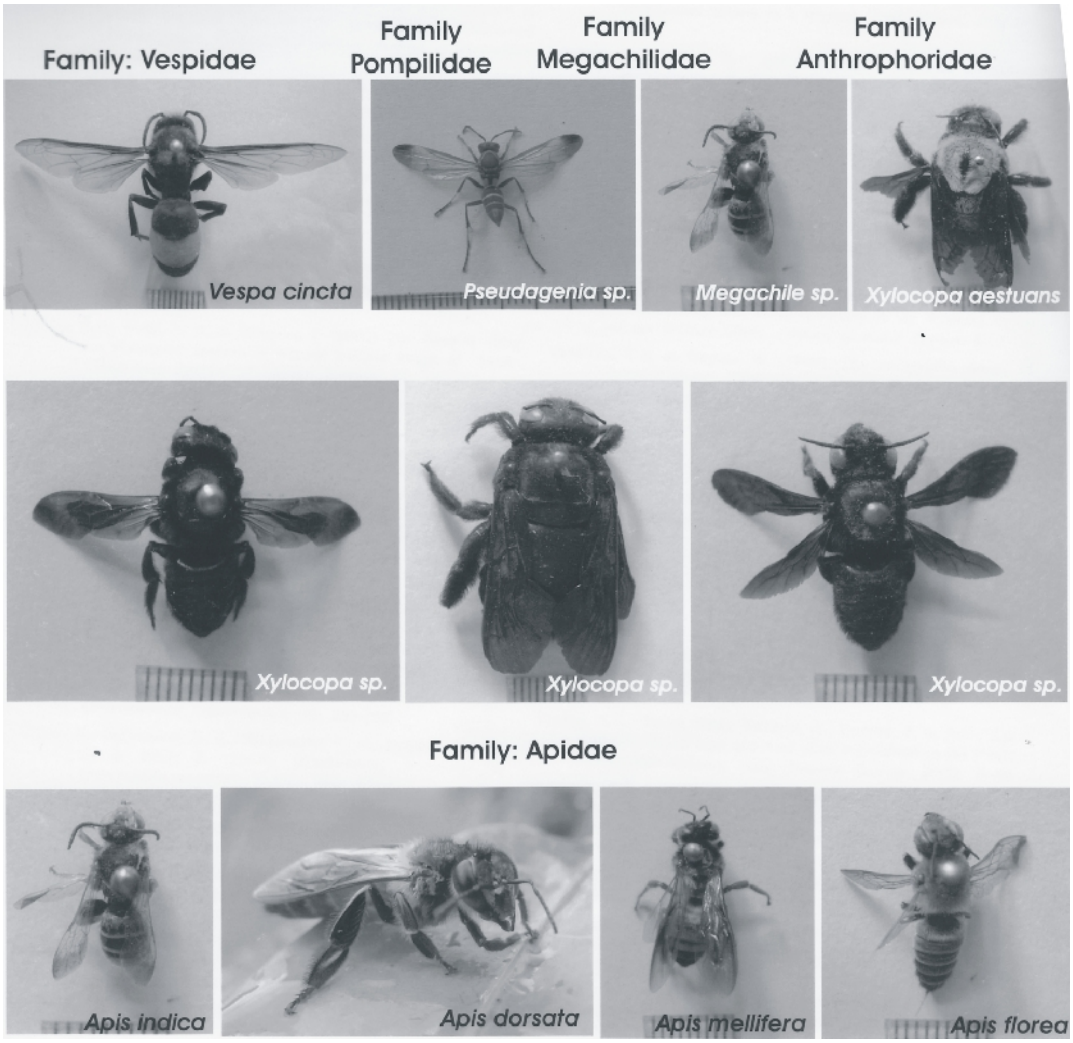
Gadagkar *et al.*, (1993) have made addition to the knowledge of ant species richness and diversity in some selected localities in Western Ghats of India and reported 140 species of ants 32 gemera amd 6 subfamilies. Bharati (2008) studied altitudinal diversity of ants in Himalayan regions and recorded 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. Pai *et al*., (2009) reported 38 species of ants in Chorao Island, Goa, India. Whereas in the present study in all 39 species of ants were encountered.

Wolda and Roubik (1986) analyzed nocturnal bee

abundance and seasonal bee activity in a Panamaniam Forest and recorded 50 species from 17 genera and 5 families. Thomas *et al*., (2009) made an attempt on social bees and food plant association in the Nilgiri Biosphere reserve, India and recorded 4 species of bees. Banaszak (2010) reported 133 bee species in various habitats of Wolin National Park. In the present study 9 species of bees were enlisted.

Elpino-Campos *et al*., (2007) encountered 29 species of social wasps species distributed in 10 genera. In the present study a total of 16 species of wasps were enlisted. Ghanhari *et al*., (2010) reported 11 species of Ichneumonidae from the forests of Northern Iran. In the present study 3 species of Ichneumonids were reported. Rashitsyn (2003) studied diversity of hymenoptera and reported one hundred eight species at Orapa, Botswana whereas in the present study in all eighty-two species of Hymenopterans were recorded.





Liow *et al*., (2001) recorded fourty-five species of bees with reference to families Anthophoridae, Apidae, Colletidae, Halictidae and Megachilidae in tropical lowland forests of South-East Asia. While in the present study four species of Anthophoridae/Xylocopidae, four species of Apidae and one species of Megachilidae were recorded. Dawale (1991) enlisted twenty-four species of hymenopteran parasites of econimically important crop pests from Kolhapur District. During the present study fourteen species of parasites were reported.

The present study revealed that the order hymenoptera is highly diverse and abundant (1.97 & 0.74) in Amba Reserved Forest. This might be due to healthy climatic conditions and availability of natural resources necessary for their life processes and existence.

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