



ISSN 2320-7078

JEZS 2014; 2 (4): 324-327

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Received: 19-06-2014

Accepted: 20-07-2014

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Biodiversity and relative abundance of different honeybee species (Hymenoptera: Apidae) in Murree-Punjab, Pakistan.

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Abstract

Field investigations were carried out to determine the diversity and relative abundance of various honeybee species during 2011 and 2012. Total 184 samples were collected from 10 different localities in Murree and its vicinity. The majority of specimens (n=156, 84.78%) were from *Apis cerana* F. The ratio of *Apis mellifera* L. was 13.04% (n=24) and only 2.17% (n=4) honeybees belonged to *Apis dorsata* F. Although *Apis florea* F. is found in most parts of Pakistan but no specimen was observed in the study area.

Keywords: *Apis fauna*, Biodiversity, Relative abundance

1. Introduction

Biodiversity studies of an area provide the basic data compulsory to measure the anthropogenic impacts like habitat loss, introduction of invasive species, climate change, and pollution on biological communities [1-3].

Biodiversity has become a leading research idea in recent years and also a popular field for audience attraction in the media [4]. Honeybees belong to the Apoidea group and are consistent flower visitors and major plant pollinators, both in natural as well as agricultural ecosystems [5, 6]. The study on biodiversity of honeybees and other flower visitor insects is assisted by the observation and capture of many individuals which exploit different and measurable resources [7].

Many researchers have addressed in detail the aspects of pollination [8, 9], trophic resources partitioning [10] and spatial and temporal distribution of honeybees [11-13].

Honeybees in Pakistan were traditionally kept for honey production for the last two centuries and they have also contributed significantly in increasing crops productivity, fruit bearing and seed set in forest plants [14]. Four honeybee species i.e. *Apis cerana* Fabricius, 1793; *Apis florea* Fabricius, 1787; *Apis dorsata* Fabricius, 1793 and *Apis mellifera* Linnaeus, 1758 are found in Pakistan. *A. cerana* F. and *A. mellifera* L. are mostly found in the north western hills and foothills of Punjab, Khyber Pukhton Khawah, Gigit Baltistan, FATA (Federally administered tribal areas), some parts of Baluchistan, Sindh and Azad Jammu and Kashmir while *A. dorsata* F. prefers foothills, plains, forests and semi-desert areas up to an altitude of 1100 meters in all provinces and *A. florea* F. is mostly found up to an altitude of 600 meter and rarely found above 1500 m [15]. *A. florea* F. is absent north of the Himalayas [16] and found in all provinces in plains, coastal and sub-coastal areas and foothills throughout the year [17].

In the past, annual honey production in Pakistan was very low but the beekeeping industry flourished after the importation of *A. mellifera* L. in 1977-78 [15]. There are more than 400,000 bee colonies with an average annual honey production of 21 kg per colony. The bee flora present in the country can support up to 3,500,000 bee colonies. Total annual honey production of the country is approximately 10,000 metric ton [18].

Murree is located on southern slopes of the Western Himalayan foothills and has potential for commercial beekeeping. It has very pleasant summers and cold, snowy winter, lot of stone fruits thriving locally and has an approximate altitude of 2291 meters with annual precipitation of 1,789 mm [19]. It has rich biodiversity with more than 700 plant species [20].

It is obvious that Murree is blessed with a remarkable vegetation but was not explored earlier to determine the exact honeybee species. Therefore, present study was planned to measure the

diversity and relative abundance of honeybees in Murree and its vicinity.

2. Materials and Methods

2.1. Study site

This study was conducted at Beekeeping and Hill Fruit Pests Research sub-station sunny bank -Murree during 2011 and 2012. Murree is located in Western Himalayan foothills with very pleasant summers and cold, snowy winter. Its mean annual precipitation is 1,789 mm (70.4 inches) and has approximate altitude of 2,291 meters above sea level. It came into existence by a rapid uplift in early Eocene era by the collision of Eurasian plate with Indian plate [21]. Murree is quite rich in species diversity, with over 700 plant species [20]. In blooming season (February, March and April) the maximum average monthly temperature of Murree remains 19.78 °C, 24.72 °C, and 30.61 °C while the minimum remains 6.72 °C, 11.11 °C and 15.89 °C respectively. Ten different locations (Fig. 1) were selected for the survey of *Apis* fauna. These were Phagwari, Osia, Bhurban, Aliyot, Barian, Rawat, Jhika Gali, Lower Topa, Sunny Bank and Chitta More within the radius of about 15 kilometer from the research station.

2.2. Sampling methods

The honeybee specimens from wild flowering vegetation were collected by sweeping the 15 inch diameter insect net. The net sweeping was done once fortnightly between mid-February to the end of April 2011 and 2012 during 1000 to 1600 following the methods used by MacKay and Knerer [22]. While the

honeybee species visiting stone fruit trees in orchards were collected through four aerial sweeps on the blossom by using a 15 inches diameter insect net attached to 3 meter pole [23].

All the ten selected sites were sampled on each collecting day. The field staff deputed at Beekeeping and Hill Fruit Pest Research Substation Sunny Bank Murree was allotted different sites independently to collect the honeybee specimens. The honeybee specimens were brought in the lab and identified accordingly.

Relative abundance of different honeybee species was calculated and expressed in percentage by using the following formula after combining all the data.

Relative abundance of Species (A)

$$= \frac{\text{Number of individuals of species (A)}}{\text{Total number of all honeybees}} \times 100$$

3. Results

Diversity. Three honeybee species were identified from the study area i.e. *Apis cerana* F., *Apis mellifera* L. and *Apis dorsata* F. A total of 184 specimens of different honeybees were collected during the study. *Apis cerana* F. (n=156) remained the most dominant species followed by *A. mellifera* L. (n=24) and *A. dorsata* F. (n=4). No specimen of *Apis florea* F. was found during the study (Table.1).

In our study the relative abundance of *Apis cerana* F., *A. mellifera* L. and *A. dorsata* F. was observed 84.78%, 13.04%, 2.17% respectively (Fig.2).

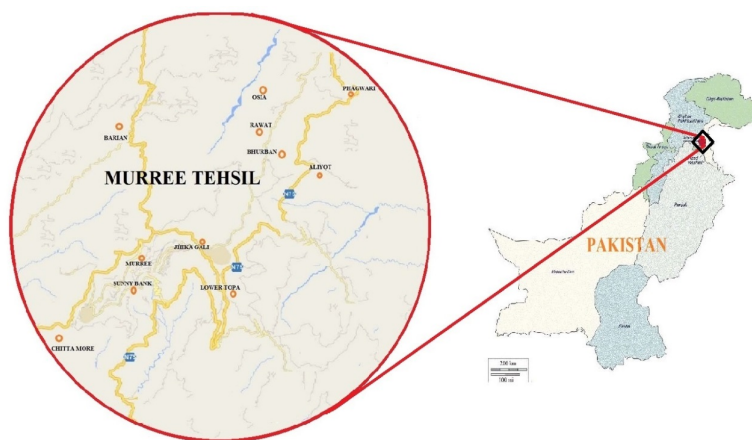


Fig 1: Map showing the study area, Murree and its vicinity.

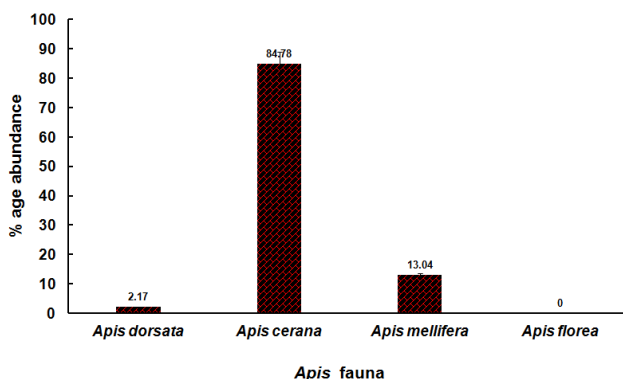


Fig 2: Graph showing relative abundance of different honeybees in Murree and its vicinity.

Table 1: Showing the number of different honeybee species at selected study areas.

Region <i>Apis</i> species	Phagwari	Osia	Bhurban	Aliyot	Barian	Rewat	Jhika Gali	Lower Topa	Sunny Bank	Chitta More	Total
<i>A. cerana</i>	15	13	23	5	17	9	24	15	21	14	156
<i>A. mellifera</i>	0	2	2	2	0	0	4	2	6	6	24
<i>A. dorsata</i>	0	0	0	0	0	0	1	0	1	2	4
<i>A. florea</i>	0	0	0	0	0	0	0	0	0	0	0

4. Discussions

Koeniger ^[24] reported that *Apis cerana* F. is found in tropical or subtropical areas of Asia, colder areas like Siberia, Northern China, and high mountain areas of Himalayan. Murree is located in Himalayan foot hills and the most dominant species found in our study was *Apis cerana* F. therefore the results are in accordance with Koeniger. It is also obvious from our study that this bee was available at more than 2000 meters height which is also in accordance with Rahman ^[25], who mentioned that *Apis cerana* F. was found up to an altitude of 3333 meters from sea level.

Few samples of *Apis dorsata* F. were found in our study area which were located at more than 2000 m altitude. These findings are not in accordance with Ahmad and Muzaffar ^[15]. According to them *A. dorsata* F. is found up to an altitude of 1100 meters. The possible reasons for the divergence of this species in high altitude may be habitat loss, climate change, and pollution in foothills, plains, forests, semi-desert and urban areas. It is possible that due to the effect of climate change and pollution the average temperature of study area may have increased and this may be the reason of availability of some specimens of *A. dorsata* F. which are mostly inhabitant of tropical or warm climate.

Muzaffar and Ahmad ^[17], reported that the *Apis florea* F. is found up to an altitude of 600 meter and Akrotanukul ^[16], proposed the distribution of this bee up to an altitude of 1500 meters. Our findings about *Apis florea* F. are in accordance with them because we did not find any specimen of this honeybee in the study area.

Before the import of *Apis mellifera* L. in Pakistan, this bee was not present in Murree hills. But now we found 13.04 % specimens of this bee in our study which is in accordance with Seeley ^[26], who stated that *Apis mellifera* L. has much adaptability with many climates in addition to temperate climate of Europe. There are more than two-thirds of the natural distribution area of this bee falls within tropical and subtropical Africa where it inhabits the diverse settings as lowland rain forest, semi-arid savannahs and forest, steamy coastal swamps, and cool mountain ranges. The main reason for their presence is that the commercial beekeepers mostly migrate their *Apis mellifera* L. colonies from low land to highland in search of flora during summer and some swarms may have escaped and started their colonies. In wild, *Apis mellifera* L. share some biological attributes with *Apis cerana* F. like their similar nesting sites (caves, rock cavities and hollow trees), multiple combs, parallel to each other, nest with single entrance.

5. Acknowledgments

Authors are thankful to the Entomologist, Beekeeping and Hill Fruit Pests Research Station Rawalpindi- Pakistan for the

facilities extended during the conduct of this research work.

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