Research Article

Studies Of Hymenopteran Insect Pollinators In District Baramulla Of Jammu & Kashmir

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ABSTRACT
Studies were undertaken on hymenopterans insect pollinators, visiting the crops of agricultural and horticultural importance in the Baramulla district of Jammu & Kashmir. A total of 12 species of insects belonging to order Hymenoptera comprising of 5 families i.e., Apidae (*Apis cerana indica*, *Apis mellifera*, *Apis dorsata*, *Bombus haemorrhoidalis*, *Bombus lepidus, Ceratina hieroglyphica*); Vaspidae (*Vespa velutina, Vespa affinis, Polister wetti*.); Formicidae (*Camponotus* sp.); Halictidae (*Halictus* sp.) and Xylocopidae (*Xylocopa violacea*) are recorded. The diagnostic features of these pollinating species are also incorporated.

KEYWORDS: Hymenoptera; Pollination; Apidae; Baramulla; Kashmir.

1. INTRODUCTION

Pollination is the process of transfer of pollen from one flower to the stigma of another flower or the same flower, later enabling fertilization and the production of seeds. Pollination is a pre-requisite for fertilization: the fusion of nuclei from the pollen grain with nuclei in the ovule, which allows the flower to develop seeds. It is the most important component of biodiversity and without which it is impossible to protect and maintain our rich biodiversity. Pollination also benefits society by increasing food security and improving livelihoods [1].

The order Hymenoptera is one of the four largest insect orders (Coleoptera, Diptera, Lepidoptera, Hymenoptera) containing more than one lac described species [2]. Increasing our understanding of the contribution of pollinators for production and their high economic importance a reason for concern worldwide. Therefore, the present study was undertaken to explore the diversity of Hymenopteran pollinators in the district Baramulla. During the present study 12 species, 8 genera and 5 families of hymenopterans pollinators have been recorded.

2. MATERIALS AND METHODS

2.1. STUDY AREA

The surveys were conducted between October 20, 2018, to August 20, 2019, in different locations of district Baramulla. Baramulla, a district of Kashmir region in the Indian state of Jammu and Kashmir is rich in flora and fauna than other regions. During this observation pollinating insects at different periods, viz. 8–10 am, 12–1 pm, 3–5 pm were observed and collected from various crops.

2.2. COLLECTION AND PRESERVATION OF POLLINATORS

Hymenopterans insects were collected by using different collection methods such as handpicking, sweeping net, and pan traps. Collected hymenopterans insect pollinators were killed by exposure to Ethyl Acetate in insect killing bottle. The collected pollinators stretched, pinned with a proper label including the date and location [3]. For the correct determination of species, various taxonomic books and journals were consulted. Identification of different insect specimens was done by the taxonomic section of Entomology.

The acronym used for depository: SASGU = School of Agricultural Sciences, Glocal University, Saharanpur, India.

3. RESULTS AND DISCUSSION

The present study includes the record of 12 species of hymenopterans pollinators belonging to 8 genera under 5 families from different locations of district Baramulla. The study also incorporates the taxonomy and diagnostic features of these pollinating species. The details of the pollinators are given in Table 1:

Table 1. Insect pollinators of different families of order Hymenoptera.

Order	Family	Genus	Species
Hymenoptera	Apidae	*Apis*	*1. Apis cerana* 2. *Apis mellifera* 3. *Apis dorsata*
		Bombus	4. *Bombus haemorrhoidalis* 5. *Bombus lepidus*
		Ceratina	6. *Ceratina hieroglyphica*
	Vespidae	*Vespa*	7.*Vespa velutina* 8. *Vespa affinis*
		Polistes	9. *Polistes wetti*
	Formicidae	*Camponotus*	10. *Camponotus* sp.
	Halictidae	*Halictus*	11. *Halictus* sp.
	Xylocopidae	*Xylocopa*	12. *Xylocopa violacea*

3.1. FAMILY: APIDAE

Members of the family Apidae are the most important agents of pollination. Honeybees along with bumblebees and solitary bees form the largest groups of insect pollinators [4].

1. INDIAN HONEY BEE (*Apis cerana indica* Fabricius)

(Figure 1)

Diagnostic Features: Body length, 11–14 mm. Head dark brown to black with three ocelli on frons; antennae black and geniculate. Thorax yellow with brownish reflection. Abdomen anteriorly with two yellow bands, posteriorly black. Pubescence. All legs black, hind legs with pollen basket, and basitarsus with antenna cleaner. Workers, queens, and drones can be distinguished easily by their physical appearance.

Material Examined: INDIA: JAMMU & KASHMIR, Baramulla, Sopore, 25.x.2018; Hygam, 27.x.2018; Seelu, 02.xi.2018; Palhalan, 15.ii.2019; Pattan, Shirpora, 24.ii.2019; Gulmarg, 29.xi.2019; Coll. S.J. Mir. (SASGU).

Distribution: India, Pakistan, Nepal, Myanmar, Bangladesh, Sri Lanka, Thailand [5].

2. EUROPEAN HONEY BEE (*Apis mallifera* Linnaeus)

(Figure 2)

Diagnostic Features: Body length 9–18 mm. Head black, body brown, or black with yellowish patches. Head with a pair of compound eyes and antennae. Legs mostly dark brown to black. Worker's hind legs with pollen baskets designed such way to carry large quantities of pollen and abdomen pointed at the end. Queens with head and thorax are similar in size to that of the worker but abdomen longer and rounded tip. Male with head and thorax are larger in comparison to female and abdomen is thick and blunt at the end.

Material Examined: INDIA: JAMMU & KASHMIR, Baramulla, Sopore, 25.x.2018; Chhoora, 20.x.2018; Kreeri, Wagura, 22.xi.2018; Boniyar, 11.ii.2019; Gulmarg, 29.vii.2019, Coll. S.J. Mir. (SASGU).

Distribution: Worldwide (except Antarctica) [5].

3. GIANT HONEY BEE (*Apis dorsata* Fabricius)

(Figure 3)

Diagnostic Features: Body length 18–25 mm, almost twice the length of *Apis mallifera*. Body-color similar to the European honey bee with golden, black, and pale bands on the abdomen and with a hairy thorax. *A. dorsata* is highly variable in coloration depending on the race, which is also associated with the distribution.

Material Examined: INDIA: JAMMU & KASHMIR, Baramulla, Sopore, 25.x.2018; Hygam, 27.x.2018; Seelu, 02.xi.2018, Coll. S.J. Mir. (SASGU).

Distribution: China, Pakistan, Sri Lanka, Philippines, Nepal, India, Malaysia, Indonesia [5].

4. BUMBLEBEE (*Bombus haemorrhoidalis* Smith)

(Figure 4)

Diagnostic Features: Body length 22–24 mm. Body covered with soft dense orange and black pubescence. Head with a pair of compound eyes and three ocelli; antennae black and geniculate. Pubescence on thorax dark grey and thick; wings large; legs hairy, modified for transporting pollens; tibia with a spine. Abdomen with two bands, first band yellowish and second band orange.

Material Examined: INDIA: JAMMU & KASHMIR, Baramulla, Boniyar, 11.ii.2019; Gulmarg, 29.vii.2019; Singhpora, Hanjiwera, 29.x.2018, Coll. S.J. Mir. (SASGU).

Distribution: India, Pakistan, Bhutan, Myanmar, Nepal, Tibet, South Western China, Thailand, Vietnam [6].

5. BUMBLEBEE (*Bombus lepidus* Skorikov)

(Figure 5)

Diagnostic Features: Body length 20-24 mm. Pubescence on head, pronotum, metanotum. Labrum with basal transverse depression extending apically as deep median furrow between pronounced lateral tubercules. Mesonotum is black with lateral aspects white. First abdominal tergum white, second tergum yellow, 3-5 tergites reddish brown.

Material Examined: INDIA: JAMMU & KASHMIR, Baramulla, Chhoora, 20.x.2018; Kreeri, Wagura, 22.xi.2018; Tangmarg, 12.vii.2019; Coll. S.J. Mir. (SASGU).

Distribution: India, Pakistan, Nepal, Bhutan, China, Tibet [6].

6. SMALL CARPENTER BEE (*Ceratina hieroglyphica* Smith)

(Figure 6)

Diagnostic Features: Body length, 3–5 mm. Body color mostly black with bluish-green or blue with yellowish reflection. Head with clypeus quite flat, labrum fully exposed by closed mandibles. Thorax is gradually declivous posteriorly. Female with abdomen obtusely angulate at the apex, while in the male the sixth tergum may bear a low median tuft of hairs.

Material Examined: INDIA: JAMMU & KASHMIR, Baramulla, Singhpora, Hanjiwera, 29.x.2018, Coll. S.J. Mir. (SASGU).

Distribution: India, China, Malaysia, Burma [7].

3.2. FAMILY: VESPIDAE

Family Vespidae includes velvet ants, hornets, scoliid wasps, and cuckoo wasps. Their body is large hairy and well adapted for pollination.

7. YELLOW-LEGGED HORNET (*Vespa velutina* Lepeletier)

(Figure 7)

Diagnostic Features: Body length, 20–30 mm. Head black in dorsal view and bright orange in frontal view. Thorax velvety brown or black with a brown abdomen. Abdominal tergites with a thin yellowish narrow posterior line except for the fourth tergum. Workers resemble queens but the queens can be differentiated by having a heavy body. Males can be differentiated easily with long antennae and the absence of sting.

Material Examined: INDIA: JAMMU & KASHMIR, Baramulla, Chhoora, 20.x.2018; Gulmarg, 29.vii.2019; Singhpora, Hanjiwera, 29.x.2018; Tangmarg, 12.vii.2019; Pattan, 18.vii.2019, Coll. S.J. Mir. (SASGU).

Distribution: Indonesia, India, Pakistan, Afghanistan, Bhutan, China, Taiwan, Burma, Thailand, Laos, Vietnam, Malaysia [8].

8. BANDED HORNET (*Vespa affinis* Linnaeus)

(Figure 8)

Diagnostic Features: Body length 18–30 mm. Head reddish brown or black with pubescent; antenna dark brown except scape pale brown. Thorax dark brown to black with several punctures and some erected hairs; mesoscutum, scutellum, metapleuron and propodeum small and crowded. All legs dark brown. Abdomen dark brown except first and second terga pale yellow.

Material Examined: INDIA: JAMMU & KASHMIR, Baramulla, Hygam, 27.x.2018; Pattan, 18.vii.2019, Coll. S.J. Mir. (SASGU).

Distribution: Sri Lanka, Hong Kong, Taiwan, India, Burma, Thailand, Laos, Vietnam, Sumatra, Philippines and Malaysia [9].

9. PAPER WASP (*Polistes wattii* Cameron)

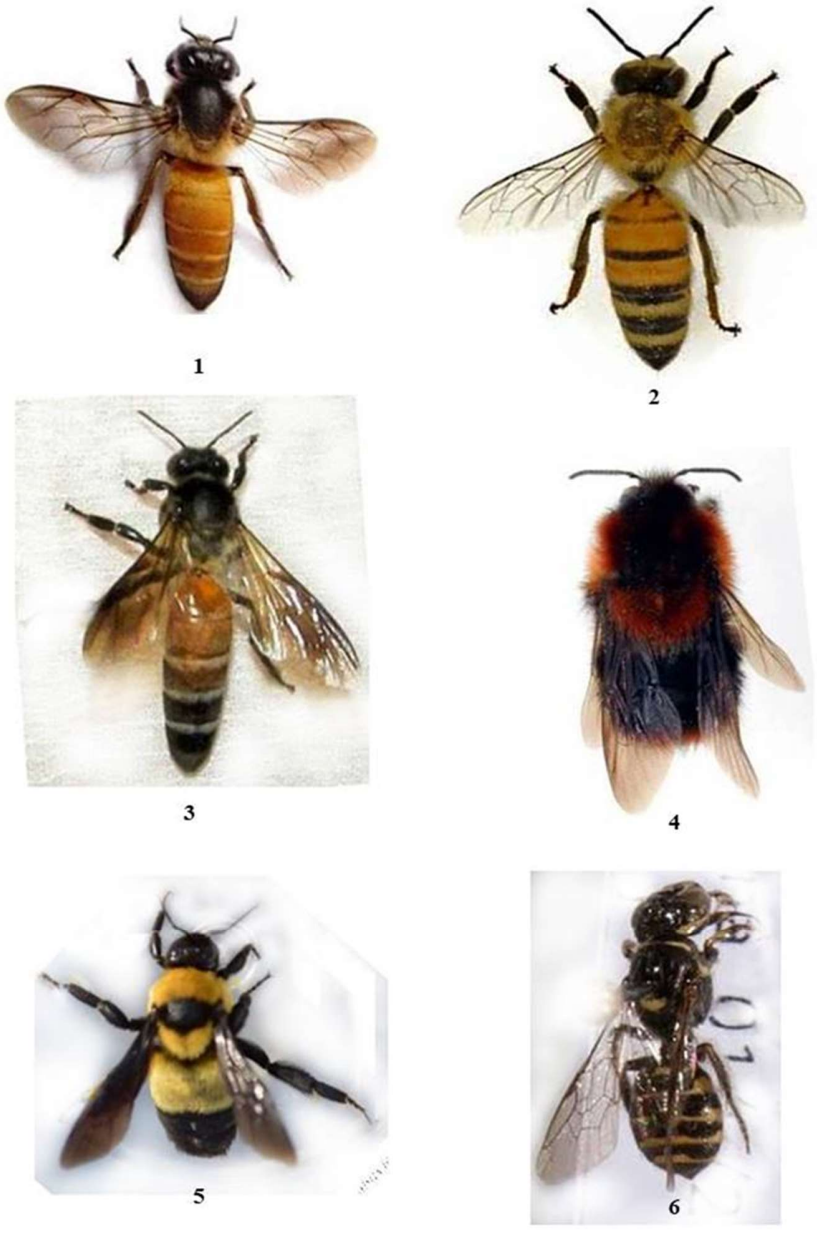
(Figure 9)

Diagnostic Features: Body length 10–20 mm. Body slender and elongated. Head and thorax yellowish, gaster brown with yellowish reflection; gastral tergites second to fifth with a narrow transverse

reddish-brown line. Forewings with three submarginal cells and absence of intersection between sub-discoidal and medial cells.
Material Examined: INDIA: JAMMU & KASHMIR, Baramulla, Chhoora, 20.x.2018; Tangmarg, 12.vii.2019; Coll. S.J. Mir. (SASGU).

Distribution: India, Afghanistan, China, Iran, Iraq, Mauritius, Oman, Pakistan, Saudi Arabia, UAE [10].

Figures 1-6. 1. *Apis cerana indica*, 2. *Apis mallifera*, 3. *Apis dorsata*, 4. *Bombus haemorrhoidalis*, 5. *Bombus lepidus*, 6. *Ceratina hieroglyphica.*



3.3. FAMILY: FORMICIDAE
Ants are frequent visitors of angiosperms, probably the most important hymenopterans from an ecology point of are the ants, workers of many ant species can be observed to visit flowering plants and collect nectar. Thus, it seems surprising that the pollination of flowers by this visitor group has rarely been reported [11].

10. **CARPENTER ANTS (*Camponotus* sp.)**
(Figure 10)
Diagnostic Features: Members of the genus *Camponotus* can be distinguished from other carpenter ant species by having a black body and the presence of whitish or yellowish hairs on the abdomen. Body length, 1–2 cm. Antennae with 6–13 segments.

Material Examined: INDIA: JAMMU & KASHMIR, Baramulla, Kreeri, Wagura, 22.xi.2018; Tangmarg, 12.vii.2019; Coll. S.J. Mir. (SASGU).
Distribution: Cosmopolitan [12].

3.4. FAMILY: HALICTIDAE

This is the largest family of short-tongued bees in the Indian Region distributed in all the zones. Because of their extensive range of adaptation to different climatic conditions, the halictine bees are the major pollinators of a wide range of flowering plants. Halictid bees, sometimes also called sweat bees to play a vital role in the pollination ecology of a region.

11. HALICTID BEE (*Halictus* sp.)
(Figure 11)
Diagnostic Features: Body length, 6–8 mm. Body slender and dark brown to black. Antennae black and geniculate. Wings hyaline, with all veins. Legs pale white to pale brown. Abdomen with hairy whitish bands. Male with longer antenna and more slender body.
Material Examined: INDIA: JAMMU & KASHMIR, Baramulla, Hygam, 27.x.2018; Zangam, 16.vii.2019; Coll. S.J. Mir. (SASGU).
Distribution: America, Northern Oriental, Mediterranean, and Central Asia [13].

3.5. FAMILY: XYLOCOPIDAE

Family comprises hairy stout usually large chiefly tropical bees which make their nest galleries in dry wood or pithy stems. Carpenter bees can pollinate several crops and fruit.

12. CARPENTER BEE (*Xylocopa violacea* Linnaeus)
(Figure 12)
Diagnostic Features: Body length, 20–23 mm. Body black with dense pubescence and hairy legs. Head with compound eyes; frons with three ocelli; antennae geniculate. Thorax shiny and creamish; fore wings with humuli at the lower margin which fits into the hind wing. *X. violacea* resembles bumblebees in size and shape but differs by shiny abdomen and absence of hairs.
Material Examined: INDIA: JAMMU & KASHMIR, Baramulla, Hygam, 27.x.2018; Boniyar, 11.ii.2019; Pattan, 18.vii.2019; Coll. S.J. Mir. (SASGU).
Distribution: India, Iran, Turkmenistan, Tajikistan, Israel, Europe [14].

Figures 7-12. 7. *Vespa velutina*, 8. *Vespa affinis*, 9. *Polistes wattii*, 10. *Camponotus* sp., 11. *Halicutus* sp., 12. *Xylocopa violacea.*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4. CONCLUSION

The present study is based on specimens collected from fourteen different locations. A total of twelve species of pollinators belonging to five families and eight genera were found visiting the foraging plants. Family Apidae was the dominant group of pollinators and among the species *Apis indica* was dominant over other pollinators. Moreover, during the entire study, *Ceratina hieroglyphica* was reported only from Hanjiwera. The results obtained from the present study can provide baseline biodiversity information of pollinators and can help to know the local species of insects and their advantageous and harmful effect.

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AUTHOR CONTRIBUTIONS

This study was carried out with the collaboration of all authors. Majid Jamali and Mahjoora Majeed identified the specimens and prepared the manuscript. Shafqat Mir collected the specimens and stretched them. All authors read and approved the final manuscript.

CONFLICT OF INTEREST

There is no conflict of interest.

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