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## Diversity of apoidea (Hymenoptera) from Grassland ecosystem of Jammu (UT of Jammu and Kashmir)

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### Abstract

Grasslands are a dynamic ecosystem which is extremely important worldwide as they support variety of flora, fauna and in turn humans. They have been origin point of many cultivated food grains, provide forage for livestock, biogeochemical cycling, provide ideal habitat for variety of species for breeding, migrating and flourishing. Hymenoptera play an important role in pollination. They are a diverse and species rich group abundantly found in grasslands. Hymenoptera plays a pivotal role in grasslands ecosystem as they aid in pollination of various wild flora. They prey upon various insect pest species and are themselves preyed upon by insectivorous animals hence helping in completing the food chain. Grasslands of Jammu (in the union territory of Jammu and Kashmir) were surveyed for a period of two years and a total of 13 species of Apoidea under 6 genera and 9 subgenera have been identified. Their distribution records along with their material examined are provided. Two species are recorded as new records from Union territory of Jammu and Kashmir.

**Keywords:** Apoidea, Grasslands, biodiversity, identification

### Introduction

According to Ecological Society of America (1952) Grasslands are defined as a terrestrial ecosystem dominated by grasses or grasses like plants consisting of mainly herbs and shrubs. Various factors like fire, precipitation, draught, grazing, and temperature play crucial role in maintenance of grasslands. Moule <sup>[1]</sup> empathised upon the importance of grasslands. Grasslands cover approximately 45 million square areas in the temperate, alpine and tropical regions throughout the world (Shantz <sup>[2]</sup>). According to Rawat and Adhikari <sup>[3]</sup> approximately 24% of geographical land is under grassland cover in India. The Indian Council of Agricultural Research classified the grasslands of India into five major types after conducting grasslands surveys between 1954 to 1962. The five categories included (Dibadghao & Shankarnarayan <sup>[4]</sup>)

- Sehima-Dichanthium* type covering Central India plateau between 300-1200m
- Dichanthium-Cenchrus-Lasiurus* type covering Delhi, Punjab, Aravalli, Gujarat, Rajasthan between 150-300m.
- Phragmites-Saccharum-Imperata* type covering Punjab, Haryana, Gangetic plains, Brahmaputra valley between 300- 500 m.
- Themeda-Arundinella* type covering Assam, J&K, Manipur, W. Bengal between 350-1200m.
- Temperate and alpine cover covering cold and temperate deserts of J&K, Himachal Pradesh, north east, Uttar Pradesh between 2100m and higher altitude.

Jammu and Kashmir was given the status of Union territory in October 2019. It lies to the north of Himachal Pradesh, Punjab and west of Ladakh. Grasslands of Jammu and Kashmir varies from tropical to subtropical to temperate and alpine, cover between 2100m and higher altitude. Singh *et al.* <sup>[5]</sup> reported that a total of 9595 km<sup>2</sup> area accounting for 4.32% of total geographical area is under protective grasslands in Jammu & Kashmir. The main physical regions of the union territory (33°17' - 37°20' N; 73°25' - 80°30' E) are the outer Himalayas in which prevails the intermediate and sub-tropical climate representing Jammu region, lesser Himalayas where temperate climate prevails representing Kashmir region (Wani and Wani <sup>[6]</sup>). Climate and rainfall of this union territory varies with altitude. As elevation increases, rainfall and temperature decreases resulting in variation of climate from sub-tropical to temperate to sub-arctic (Wani *et al.* <sup>[7]</sup>).

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In Union territory of Jammu and Kashmir, grassland density is maximum between 1500m to 4500m (Singh *et al.* [5]). The total share of alpine grasslands of Union territory of Jammu and Kashmir is 77% of total Himalayan alpine grasslands, however the state of grasslands is not very good as they are continuously diminishing due to human interference, habitat fragmentation, over grazing and economic exploitation. Researchers (Karl-Olof *et al.* [8]) at Linköping University and the Swedish University of Agricultural Sciences (SLU) in Uppsala reported that grasslands present in close association with forests have more species diversity as compared to grassland present close to agricultural fields. They found that surrounding landscape plays important role for species diversity of fauna.

## Materials and Methods

**Study area:** The present study was undertaken at various spots marked as the grasslands of Jammu and Kashmir for a period of two years from 2017 to 2019. Survey tours were organised by ZSI, Solan official collection teams headed by Dr. A.K.Sidhu and Dr.T. Kubendran. As the grasslands are dominated by grasses with many agrestals, the fauna present in these landscapes are typical and rare. Hymenoptera play an important role in pollination in these grasslands. During present studies various areas in grasslands of Union territory of Jammu and Kashmir were surveys and diversity of Hymenoptera in them. The areas covered were Katra, Raesi (32°59'30.01" N, 74°55'55.02" E); Birma Nala, Udhampur (32°54'59.52"N, 75°7'57.3852"E); Hiranagar, Kathua (32°27'0.00" N 75°16'12.00" E); Malahar, Udhampur (32.69° 56"N, 75.66° 88"E); Tatlinala, Udhampur (32°49'55"N 75°19'52"E); Jasrota, Kathua (32°22'9.88" N 75°31'31.40" E). 13 species of Apoidea under 6 genera and 9 subgenera have been identified. Two species are recorded as new records from Union territory of Jammu and Kashmir.

**Methodology:** Collections of group Apoidea was done with the help of collection nets when the examples were foraging on the flora during warm summer days. Collected examples are killed with ethyl acetate vapours in charged bottle and then kept in labelled envelopes. These previously collected examples were then relaxed in desiccator charged with phenol vapours. Relaxed examples were stretched and properly preserved in fumigated insect boxes. Keys given by Saini *et al.* [9], Bingham [10], Michener [11, 12] were used to identify the bees.

## Results and Discussions

### Systematic List

#### Family Apidae

Subfamily Apinae

Tribe Apini Latreille

Genus *Apis* Linnaeus

Subgenus *Apis* Linnaeus

#### 1. *Apis cerana* Fabricius, 1793

*Apis cerana* Fabricius 1793, *Ent. Syst. Suppl.*, p.274.

*Apis indica* Fabricius 1798: 274.

*Apis socialis* Latreille 1804a: 390.

*Apis peroni* Latreille 1804b: 173.

*Apis gronovii* Guillou 1841: 323.

*Apis perrottetii* Guerin-Meneville 1844:461.

*Apis nigrocincta* Smith 1861: 93.

*Apis indica* Skorikov 1929b: 251.

*Apis cerana himalaya* Smith 1991b: 154.

*Apis cerana* Wills, Winston and Honda 1992: 169.

**Material Examined:** Katra, Raesi, (J&K), 5ex, 16.xi.2018; Katra, Raesi, (J&K), 9ex, 18.xi.2018; Birma Nala, Udhampur, 2ex, 27.xi.2018; Birma Nala, Udhampur, 1ex, 16.ix.2018

**Distribution in India:** Himachal Pradesh, Punjab, Haryana, Jammu & Kashmir, Sikkim, Central India

**Distribution Elsewhere:** China, Indonesia, Sri Lanka, Nepal

**Remarks:** This species is abundant in its distribution in Southeast Asia.

#### 2. *Apis dorsata* Fabricius, 1793

*Apis dorsata* Fabricius 1793, *Fabr. Ent. Syst.*, Vol. II, p. 415.

*Apis bicolor* Klug 1807: 264

*Apis nigripennis* Lepel. Hym. i., 1807: 403

*Apis testacea* Smith 1858: 49.

*Apis zonata* Smith 1859: 8

**Material Examined:** Hiranagar, Kathua, (J&K), 2ex, 31.iii.2019

**Distribution in India:** Throughout India

**Distribution Elsewhere:** Nepal, China, Java, Pakistan, Sri Lanka

**Remarks:** This species is a ferocious bee with open bee hives made far above the ground. It is the largest honey bee commonly found in plains of India and South east Asia.

#### 3. *Apis mellifera* Linnaeus, 1761

*Apis mellifera* Linnaeus 1761, *Sys. Nat.*, Vol. I, p. 953.

*Apis gregaria* Geoffroy, 1762

*Apis cerifera* Scopoli, 1770

*Apis daurica* Fischer von Waldheim, 1843

*Apis mellifica germanica* Pollmann, 1879

*Apis mellifica nigrita* Lucas, 1882

*Apis mellifica mellifica lehzeni* Buttel-Reepen, 1906 (Unav.)

*Apis mellifica mellifica silvarum* Goetze, 1964 (Unav.)

**Material Examined:** Katra, Raesi, (J&K), 2ex, 18.xi.2018

**Distribution in India:** Throughout India

**Distribution Elsewhere:** throughout world except Antarctica

**Remarks:** This bee was introduced in India and is abundant throughout world.

Tribe Bombini Latreille

Genus *Bombus* Linnaeus

Subgenus *Megabombus* Dalla Torre

#### 4. *Bombus trifasciatus* Smith, 1852

*Bombus trifasciatus* Smith 1852, *Trans. Ent. Soc. N.s.* Vol. II, p.43

*Bombus trifasciatus* Smith 1878: 168.

*Bombus montivagus* Smith 1878: 168.

*Bombus wilemani* Cockerell 1911b:100.

*Bombus maxwelli* Cockerell 1911b: 100.

*Bombus mimeticus* Richards 1931: 529.

*Bombus malaise* Skorikov 1938a:2.

**Material Examined:** Katra, Raesi, J&K, 2 ex, 17.xi.2018.

**Distribution in India:** Himachal Pradesh, Kashmir, Uttarakhand, Arunachal Pradesh, Sikkim, Manipur, West Bengal.

**Distribution Elsewhere:** Myanmar, Thailand, South China, Taiwan, Pakistan, Nepal

**Remarks:** It is an Oriental species commonly found in the

north west Himalayan belt. It is found only between 1700-2400m.

Subgenus *Orientalibombus* Richards

### 5. *Bombus haemorrhoidalis* Smith, 1852

*Bombus haemorrhoidalis* Smith 1852, *Trans. Ent. Soc. n. s.*, Vol. II, p.43.

*Bombus orientalis* Smith 1879: 132.

*Bombus buccinatoris* Smith 1879: 132.

*Bombus assamensis* Bingham 1897: 550.

*Bombus cinnameus* Tkalcu 1989: 47.

*Bombus montivolans* Richards 1929: 382.

*Bombus orientalis* Richards 1929a: 384.

*Orientalibombus montivolans* Tkalcu 1968:10.

*Orientalibombus haemorrhoidalis* Tkalcu 1989:47.

**Material Examined:** Birma Nala, Udhampur, 1ex, 16.xi.2018;

**Distribution in India:** Himachal Pradesh, Kashmir, Sikkim, Meghalaya, Uttarakhand, West Bengal.

**Distribution Elsewhere:** Pakistan, Nepal, Bhutan, Myanmar, Thailand, Vietnam

**Remarks:** It is a large sized Himalayan bee species distributed between 1000 to 2700 m.

Subgenus *Sibiricobombus* Vogt

### 6. *Bombus mirus* Tkalcu, 1968

*Bombus mirus* Tkalcu 1968, *Sborn'ik Ento. Oddel. N'aro. Muse.*, Vol. 52, p.31

*B. tibetanus* Friese, 1913: 86

**Material Examined:** Katra, Reasi, 3 ex. 18.xi.2019

**Distribution in India:** Sikkim.

**Distribution Elsewhere:** Nepal, Pakistan, Afghanistan, Southwest China, Kazakhstan

**Remarks:** This species was recorded for the first time from the studied area. Its previous records are from Sikkim.

## Family Apidae

### Subfamily Xylocopinae

#### Genus *Xylocopa* Latreille

Type species: *Xylocopa Latreille*, 1802

#### Subgenus *Copoxyla* Maa, 1954

### 7. *Xylocopa cyanescens* Brulle, 1832

*Xylocopa Latr. 1802, Hist. Nat. Ins.*, Vol. III, p. 379.

*Xylocopa minuta* Lepeletier, 1841, Syn.

*Xylocopa taurica* Erichson, 1841, Syn.

*Xylocopa virescens* Gistel, 1857, Homo. (*nec* Lepeletier, 1841)

*Xylocopa canuta* Rondani, 1874, Syn.

*Xylocopa virescentis* Strand, 1917, Syn., replacement for *virescens* Gistel.

**Material Examined:** Malhar, Udhampur, 3 ex, 30.iii.2019

**Distribution in India:** Jammu Kashmir, Himachal Pradesh, Punjab

**Distribution Elsewhere:** Western Africa, Burma, Ceylon, Malaysia

**Remarks:**

Subgenus *Koptortosoma* Gribodo, 1894

### 8. *Xylocopa aestuans aestuans* (Linnaeus)

*Apis aestuans* Linnaeus 1758, *Syst. Nat.*, Vol. I, ed. X, p. 579.

*Apis leucothorax* DeGeer, 1773

*Xylocopa confusa* Perez, 1901

**Material Examined:** Tatlinala, Udhampur, 2ex, 16.xi.2018

**Distribution in India:** Punjab, Himachal Pradesh, Kashmir, Orrisa, Assam, Gujarat, Maharashtra

**Distribution Elsewhere:** Sri Lanka, Nepal, Africa

**Remarks:** This is a large bee species widely distributed in South east Asia.

Subgenus *Mesotrichia* Westwood, 1838

### 9. *Xylocopa latipes* (Drury)

*Apis latipes* Drury 1773, *Exot. Ins.*, Vol. II, p. 48.

*Apis gigas* DeGeer, 1773, Syn.

*Mesotrichia (Platynopoda) latipes basilopectera* Cockerell 1917

**Material Examined:** Birma Nala, Udhampur, 1ex, 16.ix.2018

**Distribution in India:** Jammu Kashmir, Himachal Pradesh, Uttarakhand

**Distribution Elsewhere:** China, Malaysia, Myanmar

**Remarks:** This bee species are commonly found in warm tropical climates where the bees make nests burrowing in wood.

Subgenus *Zonamegilla*

### 10. *Amegilla zonata* Brooks, 1988

*Apis zonata* Linnaeus 1758, *Syst. Nat.*, ed. X, Vol. I, p. 576.

*Anthophora zonata* (Bingham, 1897; Friese, 1918)

*Anthophora zonata* var. *puttalama* (Strand, 1913)

*Amegilla (Zonamegilla) zonata* (Brooks, 1988)

**Material Examined:** Jasrota, Kathua, 1 ex, 12.xi.2018

**Distribution in India:** Jammu Kashmir, Himachal Pradesh, Uttarakhand,

**Distribution Elsewhere:** Throughout India, Nepal, Sri Lanka, Myanmar, Australia, China, Taiwan

**Remarks:** This species is widely distributed in South East Asia.

## Family Vespidae

### Subfamily Vespinae

#### Genus *Vespa* Linnaeus, 1758

### 11. *Vespa velutina* Lepeletier, 1836

*Vespa velutina* Lepeletier 1836, *Hym.*, Vol. I, p. 507.

*Vespa auraria* Smith, 1852

*Vespa fruhstorferi* Stadelmann, 1894

*Vespa immaculata* Morawitz, 1889

**Material Examined:** Tatlinala, Udhampur, 2ex, 16.xi.2018; Birma Nala, Udhampur, 11 ex, 16.xi.2018; Katra, Raesi, 3ex, 18.xi.2018;Katra, Raesi, 1 ex, 18.xi.2018; Katra, Raesi, 3 ex, 22.xi.2018

**Distribution in India:** Himachal Pradesh, Punjab, Haryana, Uttarakhand, West Bengal, Assam, Sikkim, Jammu.

**Distribution Elsewhere:** Bhutan, China, Pakistan, Afghanistan, Taiwan, Burma, Thailand

**Remarks:** This species predates upon other bee species and is widespread in Asia.

**Family:** Scoliididae

**Subfamily:** Campsomerinae

**Genus:** *Campsomeris*

### 12. *Campsomeris trifasciata* (Saussure)

*Dielis trifasciata* (Fabricius, 1793), *Mel. Hym.*, p. 46.

**Material Examined:** Katra, Raesi, 3 ex., 22.xi.2018

**Distribution in India:** Punjab, Himachal Pradesh, Maharashtra, Gujarat, West Bengal

**Distribution Elsewhere:** Greater Antilles, Bahama Islands, Florida, Iran, Sri Lanka

**Remarks:** This species was recorded for the first time in studied area.

**Family:** Megachiliidae

**Subfamily:** Megachiliinae

**Genus:** *Megachile* Latrielle

Subgenus *Eutricharaea* Thomson

### 13. *Megachile femorata* Smith

*Megachile femorata* Smith 1879, *New Sp. Hym. B. M.*, p. 68

*Megachile femorata* Dalla Torre 1894a

*Megachile femorata* Bingham 1897

**Material Examined:** Hiranagar, Kathua, (J&K), 2ex., 31.iii.2019

**Distribution in India:** Punjab, Jammu Kashmir, West Bengal, Gujarat, Madhya Pradesh

**Distribution Elsewhere:** China, Nepal, Central Asia, Sri Lanka

**Remarks:** This species belongs to solitary bees group so are not as abundant as social bees.

### Conclusion

It is important to properly map and study the grassland ecosystems to understand the patterns and dynamics of endemic and introduced species of flora and fauna. Two species i.e. *Bombus mirus* (Tkalcu, 1968) and *Campsomeris trifasciata* (Saussure) are new records for the studied area. These species are being recorded for the first time from the studied areas.

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