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Taxonomic characterization of *Bombus haemorrhoidalis* from different regions of Western Himalaya

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Abstract
Bumblebees play a vital role as pollinators in agricultural food production and natural ecosystems across the globe. Their significance lies not only in their role as pollinators but also in the diverse social structures they exhibit, ranging from eusocial colonies to solitary life-cycle stages, along. Their complex social evolution, behavior, and ecology make them intriguing subjects for scientific study. In the present investigation, the samples of *Bombus haemorrhoidalis* were identified on the basis of morphological traits, wing venation and external genitalia. A comprehensive study on the diversity of pollinators and their interactions with various plant species is essential in the Western Himalayan region to protect and conserve its native vegetation.

Keywords: *Bombus haemorrhoidalis*, taxonomic characterization, Western Himalaya, wing venation, genitalia

Introduction
Bumble bees (*Bombus*) are very important pollinators of many agricultural and horticultural crops. Hobbs *et al*. (1961) [1] found that the bumble bees are the suitable pollinator species to pollinate flowers with deep corolla. These insects play a crucial role in preserving the genetic diversity of high-altitude vegetation in the Indian Himalayan region. Indigenous bumblebees present a practical approach for pollination in diverse agricultural settings such as greenhouses and polyhouses. These insects hold significant importance as highly efficient pollinators, exhibiting remarkable resilience by foraging even in harsh and unfavorable conditions (Abak *et al*. 2000; Semida and Elbanna, 2006) [2, 3]. Thomson (2001) [4] conducted a survey on bumblebee population and stated that the bumblebees population present at different altitudinal level starting from 1000m and up to 5500 m ASL. Different species of bumblebees like *Bombus terrestris*, *B. impatiens*, *B. occidentalis* and a number of other are used for commercial pollination of various crops across the world. These species are compete for nesting locations, food and other resources with native pollinator species. In terms of shape, color patterning, food preference, disease incidence and life histories and ecologies, bumblebees exhibit significant interspecific variation. In recent years, Bumblebee species are experiencing significant declines globally, posing a threat to their populations worldwide (Williams and Osborne, 2009) [5]. The causes of this decline are not fully understood, but they are believed to involve factors such as pathogen spill-over from commercial breeding operations and shifts in agricultural practices and land use (Cameron *et al*., 2011; Jacobson *et al*., 2018) [6-7]. Climate change also pose threat to many bumble bee species due to decline of suitable habitats (Hoiss *et al*., 2012; Kerr *et al*., 2015; Rasmont *et al*., 2015) [8-10]. The diverse ecological conditions and rich flora of the Western Himalaya region have created favorable habitats for various bumblebee species. A systematic investigation on the diversity of pollinators and their associations with native plants is crucial for the protection and preservation of indigenous vegetation in the Western Himalayan region.

Materials and Methods
The specimens of *Bombus haemorrhoidalis* were collected from ten different localities of Himachal Pradesh i.e. Mashobra, Summer hill, Naldehra, Jatoli, Kandaghat, Jaladi, Hamirpur,

Gheori, Bathra and Bilaspur. The collected specimens were killed with the help of benzene vapors and then mounted with the help of entomological pins. For the examination of genitalia, the abdomen of *Bombus haemorrhoidalis* was detached and then dipped in 10% KOH solution. The material was then cleaned with distilled water and dissected in 10% alcohol. Genitalia were extracted carefully with the help of fine needles and analyzed under NIS elements imaging software with the help of a digital camera (Nikon SMZ1270). For wing venation, wings were removed from the thorax of the insect specimens and soaked in higher grades of ethyl alcohol for 5 to 10 minutes, followed by staining in alcohol eosin. After proper dehydration in alcohol, the wings were mounted on the glass slide in Canada balsam. The wing veins were named according to Comstock and Needham scheme (Comstock and Needham, 1899; Wootton, 1979) [11, 12].

Results and Discussion

Material Examined: 2ex., 22.ii.19**,** Gheori; 1ex., 25.ii.19, Bathra; 2ex., 27.ii.19, Jaladi; 1ex., 1.iii.19, Hamirpur; 2 ex., 4.iii.19, Bilaspur; 1ex., 7.iii.19, Rajgarh; 2ex., 9.iii.19, Jatoli; 2ex., 13.iii.19, Kandaghat; 3ex., 16.iii.19, Mashobra; 1ex., 20.iii.19, Summer Hill; 2ex., 24.iii.19, Naldera; 2ex., 20.ii.21**,** Gheori; 2ex., 23.ii.21, Bathra; 2ex., 25.ii.21, Jaladi; 3ex., 3.iii.21, Hamirpur; 2 ex., 6.iii.21, Bilaspur; 3ex., 9.iii.21, Rajgarh; 2ex., 12.iii.21., Jatoli; 2ex., 15.iii.21, Kandaghat; 3ex., 19.iii.21, Mashobra; 2ex., 21.iii.21, Summer Hill; 3ex., 26.iii.21, Naldera (Collector: Poonam Dhiman).

Diagnostic Features: Worker: Head wider than the thorax and covered inpubescent; face elongated, geniculate antennae, convex clypeus. First, second and third abdominal tergites yellow, fourth and fifth tergites red in color, legs black with pale yellow hair; two dark fuscous forewing and hindwing attached to thorax. Queen: Black head and thorax, first and second tergites white in color, third tergum black and forth and tergites red in color.

Fig 1: *Bombus haemorrhoidalis* Smith

Forewing: Wings dark brown fuscous with dark veins. Costa (C), dark first longitudinal vein, arises near the axillary area. Below the costa, subcosta fused with the radius (Sc+R) and moved forward, subcosta runs upto costal margin. Radius vein bifurcated near the middle part and made marginal cell. Radius vein (R) connected to media vein (M) by two cross veins i.e. 1rs-m and 2rs-m. A thick vein, M+Cu emerges from middle of the wing and after short distance separated into individual veins i.e. media (M) and cubitus (Cu). Two cross veins i.e. 1m-cu and 2m-cu connected the media (M) with the cubitus (Cu) and formed two medial cell. A thick, convex, unbranched anal vein (A) arises from anal margin and connected to cubitus by 1cu-a and 2cu-a cross veins (Fig. A).

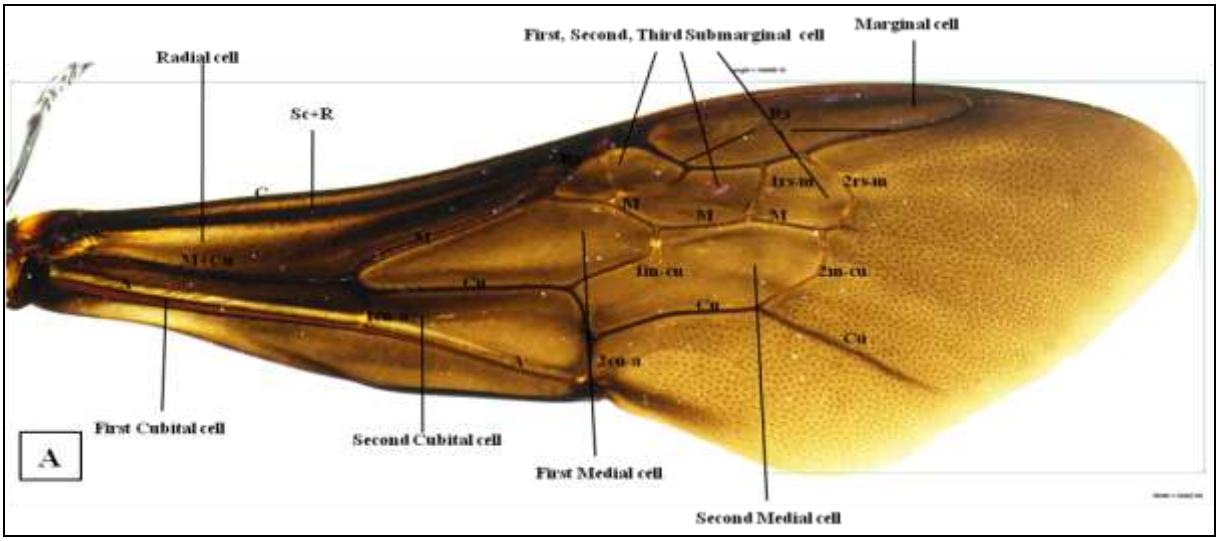

Fig 2: Forewing: *Bombus haemorrhoidalis*

Hindwings: Hamuli present at the edge of the hindwings. Sc+R, first longitudinal vein, slightly arched and moved forward upto the middle. Radius vein moving forward upto the apical margin. M+Cu emerges from the middle of the wings, moved forward and separated into individual veins media (M) and cubitus (Cu) after short distance. A cross vein rs-m connected radius and media. Anal vein arises from anal margin and connected to cubitus by cu-a cross vein (Fig. B).

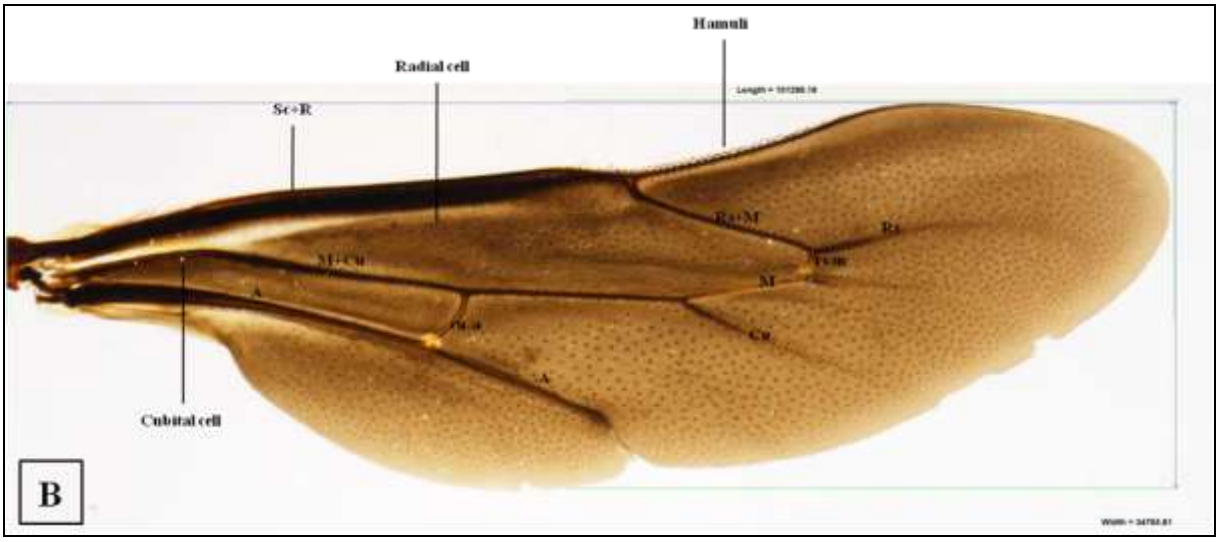

Fig 3: Hindwing: *Bombus haemorrhoidalis*

Genitalia: Workers genitalia contain large, curved and dark brown stinger; a pair of gonostylus attached to second valvifer. Large black hairs present on gonostylus. Hemitergites triangular and attached to ramus and first valvifer (Fig. C).

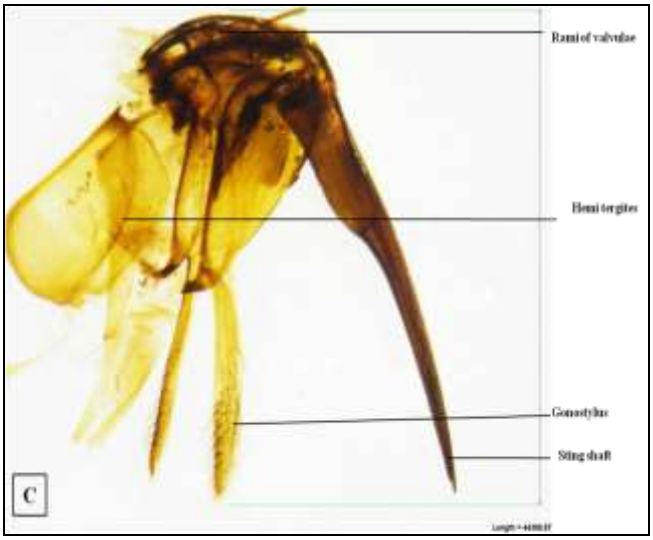

Fig 4: Genitalia: *Bombus haemorrhoidalis* Worker Bee

These results support the previous findings of Francoy *et al*. (2009) [13] studied wing venation in male and workers of stingless bees and found same pattern of wing venation in both males and workers of stingless bees. Kozmus *et al*. (2011) [14] used wing venation as a tool for identification of 250 species of bumble bees and revealed that about 97% bumblebees assigned to correct species. Nel *et al*. (2012) [15] found that wing venation used as tool for species and subspecies identification and also helpful in tracing the evolutionary relationships between groups. Chauhan *et al*. (2013) [17] conducted morphometric studies to identify the differences in different castes of *B. haemorrhoidalis*. Sheikh *et al*. (2014) [16] studied the distribution of bumblebee and its association with flora in lower Northern Pakistan.

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References

1. Hobbs GA, Nummi WO, Virostek JF. Food gathering behavior of honey bees, bumble bees and leaf-cutting bees (Hymenoptera: Apoidea) in Alberta. Can Entomol. 1961;93:409-419.
2. Abak K, Ozdogan AO, Dasgan HY, Derin K, Kaftanoglu O. Effectiveness of bumblebees as pollinators for eggplants grown in unheated greenhouses. Acta Hortic. 2000;514:197-203.
3. Semida FA, Elbanna S. Impact of introduced Honey bees on native bees at St. Katherine protectorate, South Sinai, Egypt. Int J Agric Biol. 2006;8:191-194.
4. Thomson JD, Goodell K. Pollen removal and deposition by honey bee and bumblebee visitors to apple and almond flowers. J Appl Ecol. 2001;38:1032-1044.
5. Williams PH, Osborne JL. Bumblebee vulnerability and conservation worldwide. Apidologie. 2009;40:367-387.
6. Cameron SA, Lozier JD, Strange JP, Koch JB, Cordes N, Solter LF, Griswold TL. Patterns of widespread decline in North American bumble bees. Proc Natl Acad Sci. 2011;108:662-667.
7. Jacobson MM, Tucker EM, Mathiasson ME, Rehan SM. Decline of bumble bees in northeastern North America, with a special focus on *Bombus terricola*. Biol Conserv. 2018;217:437-445.
8. Hoiss B, Krauss J, Potts SG, Roberts S, Steffan-Dewenter I. Altitude acts as an environmental filter on phylogenetic composition, traits, and diversity in bee communities. Proc R Soc B Biol Sci. 2012;279:4447-4456.
9. Kerr JT, Pindar A, Galpern P, Packer L, Potts SG, Roberts SM, *et al*. Climate change impacts on bumblebees across continents. Science. 2015;349:177-180.
10. Rasmont P, Franzén M, Lecocq T, Harpke A, Roberts SPM, Biesmeijer J, *et al*. Climatic risk and distribution atlas of European bumble bees. BioRisk. 2015;10:1-236.
11. Comstock JH, Needham JG. The wings of insects. Am Nat. 1899;33:117-126.

12. Wootton RJ. Function, homology, and terminology in insect wings. Syst Entomol. 1979;4:81-83. Doi:10.1111/j.1365-3113.1979.tb00614.x.
13. Francoy TM, Silva RAO, Nunes-Silva P, Menezes C, Imperatriz-Fonseca VL. Gender identification of five genera of stingless bees (Apidae, Meliponini) based on wing morphology. Genet Mol Res. 2009;8(1):207-214.
14. Kozmus P, Virant-Doberlet M, Meglic V, Dovc P. Identification of Bombus species based on wing venation structure. Apidologie. 2011;42(4):472-480. doi:10.1007/s13592-011-0037-5.
15. Nel A, Prokop J, Nel P, Grandcolas P, Huang DY, Roques P, *et al*. Traits and evolution of wing venation pattern in paranetopteran insects. J Morphol. 2012;273:480-506.
16. Sheikh UAA, Ahmad M, Imran M, Nasir M, Saeed S, Bodlah I. Distribution of bumble bee, Bombus haemorrhoidalis Smith, and its association with flora in lower Northern Pakistan. Pak J Zool. 2014;46:1045-1051.
17. Chauhan A, Katna S, Rana BS. Ethological studies on bumble bees under subtropical conditions in India. J Med Sci Clin Res. 2013;1:125-129.