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## *Bombus cryptarum* (Fabricius, 1775), a rare bumblebee species (Hymenoptera, Apidae) new to India

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**ABSTRACT.** This paper reports a new addition to the national bumblebee fauna of the Indian Himalayas. The newly recorded species viz., *Bombus cryptarum* (Fabricius, 1775) (Hymenoptera, Apidae) is fully described from the Gurez Valley (Jammu and Kashmir) and Panamik (Ladakh) in the Western Himalayan range. Males of the *B. cryptarum* have thoracic dorsum and T2 lemon yellow without black hairs. Gonostylus with the anterior apical process with long hairs and penis valve greatly broadened and flared outwards. With the addition of a new record, the Indian Himalayan region is now represented by 57 species of bumblebees. The species diagnosis, current distributional range, and host plants of this species are also provided.

**Key words:** Conservation, fauna, highlands, Himalayas, pollination

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## INTRODUCTION

Bumblebees are the most key pollinators of the different food crops around the globe (Cameron & Sadd, 2020). There are 265 known species of bumblebee reported worldwide (Michener, 2007; Williams, 2022). The Indian Himalayan region harbours 56 species of these bees under 10 subgenera (Ascher & Pickering, 2020; Williams, 2022). These bees actively forage on the nectar of various angiosperm plants existing in the highland ecosystem of the Indian Himalayan region (Saini et al., 2012, 2015). These bees are different from other bees in body size and colour patterns and show mimicry in terms of colour variations (Cameron et al., 2007). Bingham (1897) contributed taxonomic studies of this group and compiled 23 species of bumblebee as mentioned earlier. The only commendable work by Williams

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(1991, 2004; Williams et al., 2008) by exploring 78 sites from different elevations of the Himalayan region made this figure clear with the phylogenetic analysis and revised 62 species of these bees from the Himalayan ecosystems. Saini et al. (2015) reported 48 species of bumblebee under 10 subgenera from the Indian Himalayan region. Later on, 56 species of bumblebees are represented from the Indian Himalayan region (Williams, 2022). The study was designed to streamline the native bumblebee fauna which is now represented by 57 species under 10 subgenera from the Himalayan belt of the Indian subcontinent. The distribution status of the species can be extended to the entire North West Himalayan belt associated with different angiosperm host plants and can prove a key pollinator at high land ecosystems where other species of the same genus are very limited.

## MATERIAL AND METHODS

During the year 2021–2022, extensive surveys were conducted in the targeted habitats of the Union territory of Jammu and Kashmir, and Ladakh with elevation gradients ranging from 1500–4500 m AMSL in the western Himalaya region. Bumblebee sample collection was made with sweep hand nets while they were foraging near the flowering plants. These specimens were collected and immediately killed using ethyl acetate. These specimens were pinned, and stretched, on the field to keep the pubescence colour which holds a key role in species identification. Later on, these specimens were shifted to the wooden box to process them for identification.

Bumblebees are easily identified by their morphological features, especially the colour of their pubescence. After collecting the specimens, proper care was taken to keep their pubescence visible. Later on, these collected specimens were well stretched with the help of entomological pins and dried up in the dry chamber, then shifted to the Insect wooden sterilised box with naphthalene balls to prevent fungus and microbial growth before putting labels with full information regarding the registration number, latitude, longitude, elevation, collection date, and collected by. The identification of the species has been confirmed after accessing the available literature and the identification keys (Williams, 2022, 1998; Saini et al., 2011). The distribution data and collection dates were taken with the help of Garmin® GPSMAP 64 SC (Garmin Ltd, Switzerland) with the degree to decimal points. The current distributional patterns of the species are provided in (Fig. 1). The specimens were analysed under the Nikon® SMZ25 (Nikon Co Ltd, Tokyo, Japan) motorized Stereo zoom microscope to confirm their identity (Figs 2, 3). The identification of the host plants has been confirmed from the identification features and available literature (Singh et al., 2019). Live photos of the host plants and the bumblebees were taken using a Nikon® Coolpix1000 camera (Nikon Co Ltd, Tokyo, Japan) Photographs of the bumblebees, landscape, identification key, host plants, and male genitalia are also provided. The identified specimens are now deposited in the National Zoological Collection, Zoological Survey of India, Desert Regional Centre, Jodhpur, Rajasthan for future reference.

## RESULTS

### *Taxonomic hierarchy*

**Order Hymenoptera Linnaeus, 1758**

**Superfamily Apoidea Latreille, 1802**

**Family Apidae Latreille, 1802**

**Subfamily Apinae Latreille, 1802**

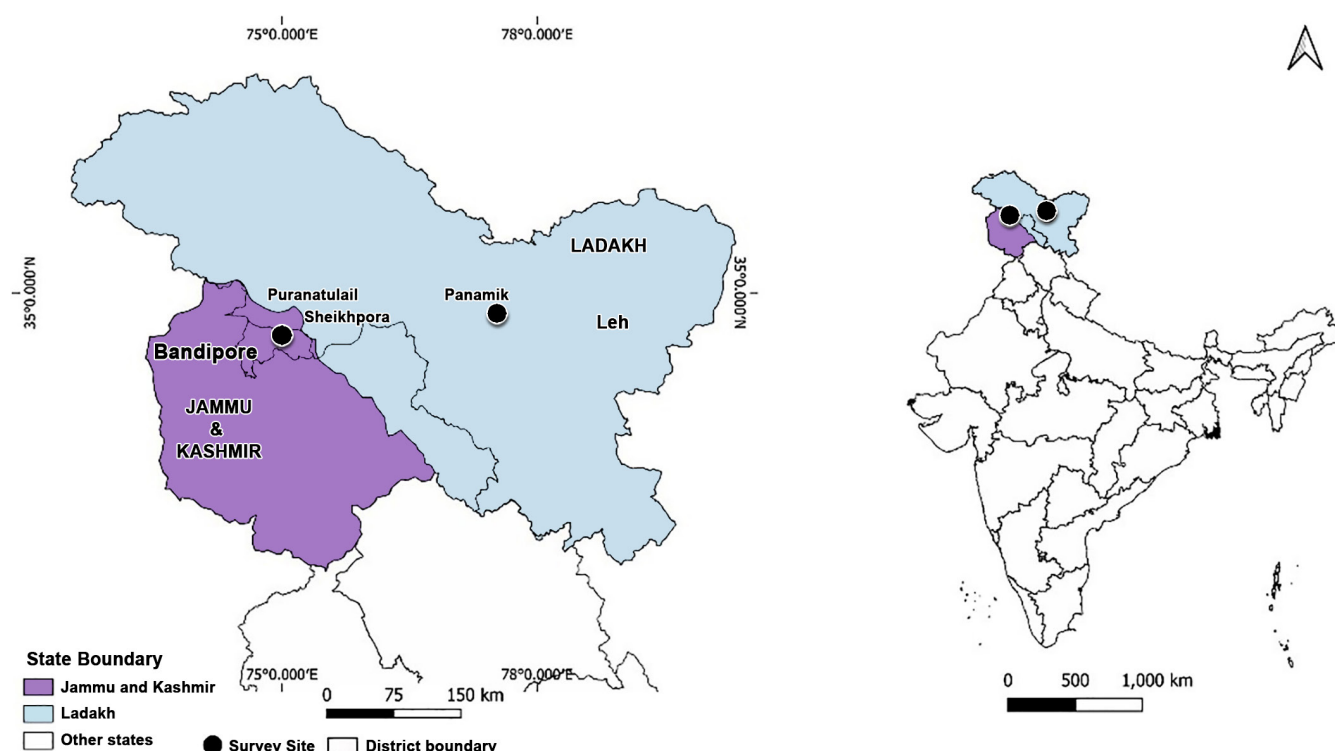
**Tribe Bombini Latreille, 1802**

**Genus *Bombus* Latreille, 1802**

**Subgenus *Bombus* Latreille s.str.**

***Bombus cryptarum* (Fabricius, 1775)**

*Apis cryptarum* Fabricius, 1775:379; *Bombus albocinctus* Smith, 1854:397; *Bombus florilegus* Panfilov, 1956:1334; *Bombus reinigianus* Rasmont, 1984:137; *Bombus armeniensis* Rasmont, 1984:138



**Figure 1.** Distribution map of the *Bombus cryptarum* (Fabricius, 1775) based on the specimens collected from the study area (India).

**Material examined.** 1 ♂, INDIA: Jammu and Kashmir: Bandipora: Gurez Valley: Sheikhpora, 07-ix-2022, 34°35'06.37" N, 75°00'03.11" E, Alt. 2634 m, Coll. Rifat Raina & party, NZC Regd. No. 13286/A.; 5 ♂♂, INDIA: Jammu and Kashmir: Bandipora: Gurez Valley: Purana Tualil, 04-ix-2022, 34°35'14.97"N, 75°00'06.84" E, Alt. 2678 m, Coll. Rifat Raina & party, NZC Regd. No. 13287/A.; 4 ♂♂, INDIA: Ladakh: Leh: Panamik, 19-ix-2022, 34°47'33.83" N, 77°31'58.51" E, Alt. 3256 m, Coll. Rifat Raina & party, NZC Regd. No. 13288/A.; *Altitudinal range*: 2600–3500 m AMSL.

**Diagnosis** (Male). Size of the bumblebee ranges from 13–14 mm in length. Thoracic dorsum and T2 lemon yellow without black hairs (Fig. 2C). T3 completely black and colour of scutellar hairs yellow. The black band between the wing bases with some yellow hairs intermixed (Fig. 3A). Genitalia with penis valve greatly broadened and flared outward to form half of a funnel (Fig. 3C). Volsella shows strongly sclerotised and forms an anterior apical corner (Fig. 3D). Gonostylus with the anterior apical process with long hairs.

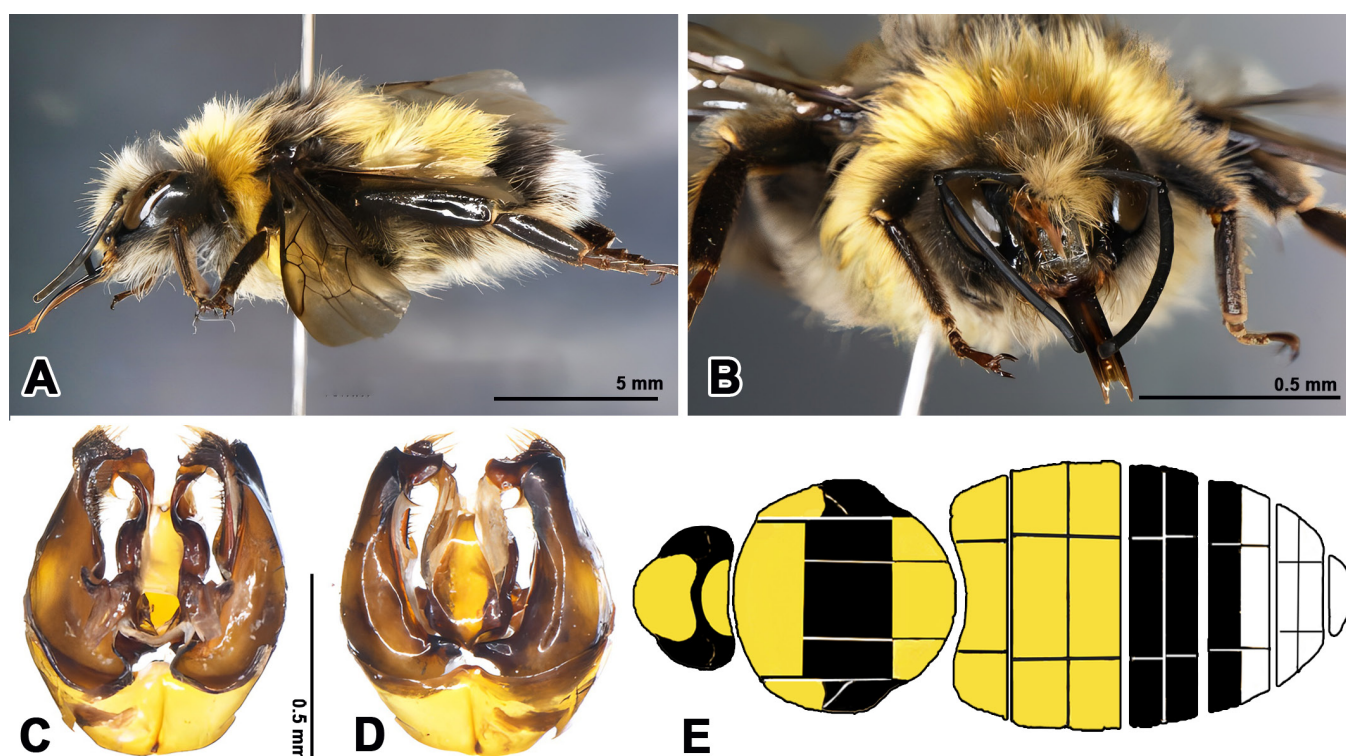
**Distribution.** **Worldwide:** Northern Pakistan, Afghanistan, Central Asia, Mongolia, northern Palaearctic, and Nearctic regions (Williams, 2022); **India:** Kashmir and Ladakh (First record from this region).

**Remarks.** The addition of *Bombus cryptarum* to the genus subgenus *Bombus s.str.* completes the full distribution of all five species *B. tunicatus* Smith, 1852, *B. longipennis* Friese, 1918, *B. reinigi* Tkalcu, 1974, *B. jacobsoni* Skorikov, 1912 (Williams, 2022) represented by this subgenus in the Indian Himalayan region. This species was recorded in Northern Pakistan, Afghanistan, Central Asia, Mongolia, and northern Palaearctic and Nearctic regions. In India, the first record of this species is recorded from Kashmir and Ladakh with an elevation ranging from 2600–3500 m AMSL. The registration numbers are similar for *B. cryptarum* as the specimens were collected from a single locality. The colour pattern and the identification keys are matched by using the literature (Williams et al., 2011; Williams, 2022). This species was observed to feed on the flowers of *Thymus linearis* Benth (Himalayan thyme) and *Cirsium arvense* (L.) Scop. (creeping thistle) in the Himalayan landscape and are the efficient pollinators of various medicinal plants, especially the Lamiaceae and Asteraceae families at high land ecosystems.





**Figure 2.** Collection Sites. **A.** Gurez Valley, 2678 m AMSL; **B.** Panamik, 3256 m AMSL; **C.** *Bombus cryptarum* on *Thymus linearis* Benth (Himalayan thyme); **D.** *Bombus cryptarum* (Fabricius, 1775) on *Cirsium arvense* (L.) Scop. (Creeping thistle).



**Figure 3.** *Bombus cryptarum* (Fabricius, 1775) male. **A.** Habitus, lateral view; **B.** Head, frontal view and mouth parts (Regd. No. 13288/A); **C.** Genitalia, dorsal view; **D.** Genitalia, ventral view; **E.** Scheme of the colour pattern.

## DISCUSSION

The present study reveals the new record of the *Bombus cryptarum* (Fabricius, 1775) of the subgenus *Bombus s.str.* from the highland mountainous ecosystem of Jammu and Kashmir, and Ladakh. The species show high foraging profoundly during the noon and limited during the dusk and dawn. Bumblebees are useful in maintaining floral diversity at high altitudes. Therefore, conserving them will help in pollination of various agricultural, and well as wild plants. The other species from the subgenus *Bombus s.str.* like *B. tunicatus* were also found in the study area. The trans-Himalayan region provides ample suitable habitat for the growth and development of this species (Streinzer, 2019; Raina et al., 2013, 2019). The status of *B. cryptarum* has been recorded in the flower-rich subalpine meadows of the Himalayan region for the first time under this study. Males of this species were recorded from the Sheikhpora and Purana Tulail (Bandipora: Gurez) and Panamik (Leh: Ladakh) were observed foraging on the flowers of *Thymus linearis* (Himalayan thyme) and *Cirsium arvense* (L.) Scop. (creeping thistle) (Figs 2C, 2D). The sampling of bees was made at the end of the season when males were only found active during the survey period. *Bombus cryptarum* is an eusocial species having large queens that establish their colonies in the Himalayan ecosystem during the spring season (April–June) and further rear their workers (females) and males and a new generation of the young queens before the colonies die out before the winter season approaches in the entire Himalayan ecosystem (September–November). The colonies of these bees exist only for several months and play a significant role in the conservation of fabulous tapestry of high land vegetation germplasm in the entire Himalayan mountainous region. The other common bumblebee species found in the study area, including, *B. tunicatus*, *B. jacobsoni*, *B. rufofasciatus* Smith 1852, *B. semenovianus* (Skorikov, 1914), and *B. simillimus* Smith, 1852. This species is an efficient pollinator of various medicinal plants, especially the Lamiaceae and Asteraceae plant families in the Himalayan region. The other cast of the species viz., queens and workers can be found during the spring and summer seasons (May–July) when the newly emerged queens establish their nest for sucking nectar and pollen on the high altitude flora and in turn help in pollination. The species is expected to be found in other parts of the western Himalayas if the area is to be surveyed extensively.

## AUTHOR'S CONTRIBUTION

The authors confirm the Contribution to the paper as follows: R.H.R.: Field studies, identification, reviewing. K.K.: Fieldwork, collection of specimens, and preparation of the manuscript; A.H.P: Fieldwork, collection of specimens; I.S.: Preparation of the manuscript, validation, V.P.U: Methodology, preparation of the manuscript, M.S.S.: Review and editing the manuscript, identification, and validation. All authors in this paper approve the final version of the manuscript.

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## AVAILABILITY OF DATA AND MATERIAL

The specimens listed in this study are deposited in the National Zoological Collection, Zoological Survey of India, Desert Regional Centre, Jodhpur, Rajasthan and are available from the curator, upon request.

## ETHICS APPROVAL AND CONSENT TO PARTICIPATE

Not applicable.

## CONSENT FOR PUBLICATION

Not applicable.

## CONFLICT OF INTERESTS

The authors declare that there is no conflict of interest regarding the publication of this paper.



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## اولین گزارش زنبور مخملی (*Bombus cryptarum* (Fabricius, 1775) (Hymenoptera, Apidae) یک گونه کمیاب از هند

رفعت حسین راینا<sup>۱</sup>، کشاور کومار<sup>۱</sup>، عجاز حسین پاری<sup>۲</sup>، ایندو شارما<sup>۱</sup>، ویرندرا پراساد اونیال<sup>۳</sup>، ملکیت سینگ ساینی<sup>۴</sup>

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**چکیده:** در این تحقیق، یک گزارش جدید گونه به فون زنبورهای مخملی هند از منطقه هیمالیا افزوده شد. گونه مذکور با نام *Bombus cryptarum* (Fabricius, 1775) (Hymenoptera, Apidae) از دره گورز (جامو و کشمیر) و پانامیک (لداخ) در رشته کوه‌های هیمالیای غربی گزارش و خصوصیات مرفولوژیک آن توصیف گردید. در نمونه‌های نر زنبور *B. cryptarum* بندهای پشتی قفس سینه و ترزیت دوم شکم به رنگ زرد لیمویی و بدون موهای سیاه هستند. گونوستیلوس دارای زواید انتهایی واجد موهای بلند بوده و دریچه اندام تناسلی نر عریض و به خارج گسترش یافته است. با اضافه شدن این گزارش جدید، در حال حاضر ۵۷ گونه زنبور مخملی در منطقه هیمالیای هند شناخته شده‌اند. جزییاتی از نحوه تشخیص گونه، محدوده انتشار کنونی و گیاهان میزبان این گونه نیز ارائه شد.

**واژگان کلیدی:** حفاظت، فون، مناطق مرتفع، هیمالیا، گرده‌افشانی