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New records of genus *Bombus* Latreille, 1802 (Hymenoptera: Apidae) from the Himalayan range of Pakistan

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Abstract
This study was conducted during 2017-18 to explore the genus *Bombus* Latreille, 1802 from the Himalayan region of Pakistan. As a result, we found 771 specimens of bumblebees, among them nine species *viz*. *Bombus asiaticus* Morawitz, 1875, *B. lucorum* subsp. *jacobsoni* Skorikov, 1912, *B. rufofasciatus* Smith, 1852, *B. tunicatus* Smith, 1852, *B. kashmirensis* Friese, 1909, *B. semenovianus* Skorikov, 1914, *B. melanurus* Lepeleitier, 1836, *B. lepidus* Skorikov, 1912 and *B. ferganicus* Radoszkowski, 1893. Of these, *B. semenovianus* Skorikov, 1914, *B. ferganicus* Radoszkowski, 1893, *B. kashmirensis* Friese, 1909 and *B. lepidus* Skorikov, 1912 are new records for Gilgit-Baltistan. Most of the bumblebees were collected in altitudinal ranges of 6000ft-9000ft. Diagrams of each bumblebee cast have been listed with distribution.

Keywords: New records, *Bombus*, Himalayan range, Gilgit-Baltistan, Pakistan

1. Introduction

1.1 Location and Administration

Gilgit Baltistan is positioned in the Northern Areas of Pakistan between 34.60-37.40 N and 740–77.50 E with total area of 45224 sq. km. The altitude varies from ± 1400 m to 8611 m (K-2). Bordering China on the eastern side connected through high Khunjerab pass (±4634 m), having Central Asian states on its northern frontiers, Afghanistan on northwestern border while western and southern sides are delimited by means of Ghaizer, Astore and the valleys of occupied Jamu and Kashmir.

Bumblebees are measured the most important pollinators world widely [1, 2]. During cool weather and rainy season, the activity of honey bees become inadequate but bumblebees forages [3]. They have even been observed foraging during snowfall, under a full moon [4], during the night, above the tree line [5, 6] and in temperatures as cold as -3.6°C [7]. Native bees, such as bumblebees, are responsible for the pollination of over $3 billion US dollars worth of fruits and vegetables produced in the US [8].

Despite the ecological importance of bumblebees, there are no published estimates on the value of bumblebee pollination and from the Himalayan regions are available. Furthermore, there is no consensus on the total number of *Bombus* species present in Gilgit-Baltistan with estimates ranging from 10-13 species [9, 10]. These estimates suggest the *Bombus* fauna of Gilgit-Baltistan. The most recent and authoritative publication on Northern areas *Bombus*, listed 13 species from Himalayan region of Pakistan.

Nosema is a genus of obligate microsporidian intracellular parasites that has been known to affect economically important insects such as the silkworm moth, honey bees, and bumblebees [11, 12]. *Nosema bombi* infestation has been related to declining bumblebee populations and reduced genetic diversity of North American bumblebees [13, 14, 15, 16].

There is little information on bumblebee species and geographical distribution, factors affecting bumblebee species richness associated with agricultural and pasture land areas in the region. The objectives of this study were to provide baseline data on species composition and distribution, of the genus *Bombus* at three agricultural locations within Sadpara valley, Kharmang Olding, and Shigar Hashupi.

2. Materials and Methods

2.1 Survey area

Sabir *et al*. [9] have reported 13 native species from Northern areas of Pakistan an altitude range from 2291m-5344m. The proposed study entitled "New records of genus *Bombus* Latreille, 1802 (Hymenoptera: Apidae) from the Himalayan range of Pakistan" was conducted in the Himalayan region of Gilgit Baltistan i.e. Kharmang, Skardu and Shigar district of Baltistan division. The detail as; Kharmang Olding valley including Xundur (pasture land) Latitude 34° 45' 14.4" (34.754°) N Longitude 76° 4' 45.9" (76.0794°) E Elevation 3,486 m (11437 feet), Skardu; Sadpara valley (pastureland) (35°.11′88″) N, 75°.58′24″) E and Shigar; Shigar Hashopi (Agricultural land) (35°25′25″N, 75°44′20″E). The subsequent methods were followed. Collection were done with hand method and sweeping of hand net as well from their habitation mostly from medicinal plants. Bees were killed through potassium cyanide. Pinning and labeling were done with the help of scientific pins size (No.3) with coordination. All the collected specimens' confirmed by the help of Williams [1].

3. Results

The current studies reveal that nine species *viz*. *Bombus asiaticus* Morawitz, 1875, *B. lucorum* subsp. *jacobsoni* Skorikov, 1912, *B. rufofasciatus* Smith, 1852, *B. tunicatus* Smith, 1852, *B. kashmirensis* Friese, 1909, *B. semenovianus* Skorikov, 1914, *B. melanurus* Lepeleitier, 1836, *B. lepidus* Skorikov, 1912 and *B. ferganicus* Radoszkowski, 1893. Of these, *B. semenovianus* Skorikov, 1914, *B. ferganicus* Radoszkowski, 1893, *B. kashmirensis* Friese, 1909 and *B. lepidus* Skorikov, 1912 are new records for Gilgit-Baltistan.

Order Hymenoptera
Family Apidae
Subfamily Apinae
Tribe Bombini

3.1 Genus *Bombus* Latreille, 1802

1. *Bombus tunicatus* Smith, 1852. (Figs. **1-3**)
Material Examined (237 ex.): Baltistan: Kharmang: Kharmang Olding, 8986 ft, 7.vii.2017, 95♂, 80♀; Shigar: Shigar Hashupi, 8100 ft, 5.vi.2018, 60♂, 80♀,7713 ft, 30♂, 20♀, 5.vi.2018; Skardu: Sadpara valley, 12379 ft, 5.vi.2018, 6♂, 6♀.

3.2 Distribution

Gilgit-Baltistan: Kharmang: Tarkati, Tolti, Gohari, Mehdiabad, Mayourdo [10].

2. *B. lucorum* subsp. *jacobsoni* Skorikov, 1912. (Figs. 4-6)
Material Examined (76 ex.): Baltistan: Kharmang: Kharmang Olding, 8986 ft, 7.vii.2017, 15♂, 10♀, Xundur, 11375 ft, 5.vii.2017, 10♂, 8♀, 8.v.2017, 5♂, 3♀, 5.vi.2018; Skardu: Sadpara valley, 12379 ft, 5.v.2017, 10♂, 5♀; Shigar: Shigar Hashupi; 7713 ft, 5.vi.2018, 5♂, 5♀.

Distribution

Gilgit-Baltistan: Kharmang: Gohari, Mehdiabad, Mayourdo, Tarkati [10].

3. *Bombus kashmirensis* Friese, 1909. (Figs.**7-9**)
Material Examined (50 ex.): Baltistan: Skardu: Sadpara valley, 12379 ft, 6.ix.2017, 10♂, 15♀; Kharmang: Kharmang Olding, 8986 ft, 29.vii.2017, 12♂, 10♀, Xundur, 11375 ft, 5.v.2017, Upper Memosh, 10375 ft, 6.v.ii2018, 13♂, 15♀; Shigar: Shigar Hashupi, 8100 ft, 10.vii.2017, 5♂, 3♀,7713 ft, 5.vii.2018, 6♂, 9♀.

Distribution: New record to Gilgit-Baltistan.

4. *Bombus lepidus* Skorikov, 1912. (Figs.**10-11**)
Material Examined (70 ex.): Baltistan: Kharmang: Kharmang Olding, 8986 ft, 20.vi.2017, 10♂, 11♀, Xundur 11375 ft, 5.v.2017, 5♂, 5♀, 8.v.2017; Skardu: Sadpara valley, 12379 ft, 6.ix.2017, 10♂, 13♀; Shigar: Shigar Hashupi, 8100 ft, 9.ix.2017, 3♂, 2♀, 7713 ft, 5.viii.2018, 4♂, 2♀.

Distribution: New record to Gilgit-Baltistan.

5. *Bombus asiaticus* Morawitz, 1875. (Figs. **12-14**)
Material Examined (60 ex.): Baltistan: Skardu: Sadpara valley, 12379 ft, 6.ix.2017, 20♂, 15♀; Kharmang: Kharmang Olding, 8986 ft, 20.vi.2017, 18♂, 10♀; Shigar: Shigar Hashupi, 8100 ft, 9.ix.2017, 5♂ 3♀,7713 ft, 5.viii.2018, 6♂, 9♀.

Distribution: Gilgit-Baltistan: Kharmang: Tarkati, Tolti, Gohari, Mehdiabad [10].

6. *Bombus melanurus* Lepeleitier, 1836. (Figs. 15-17)
Material Examined (100 ex.): Baltistan: Skardu: Sadpara valley, 12379 ft, 6.ix.2017, 10♂, 15♀; Kharmang: Kharmang Olding**,** 8986 ft, 29.vii.2017, 12♂, 10♀; Shigar: Shigar Hashupi, 8100 ft, 10.ix.2017, 5♂ 3♀, 7713 ft, 5.vi.2018, 6♂, 9♀.

Distribution: Gilgit-Baltistan: Kharmang: Kendrik [10].

7. *Bombus ferganicus* Radoszkowski, 1893 (Figs. 18-19)
Material Examined (45 ex.): Baltistan: Kharmang: Kharmang Olding, 8986 ft, 20.vi.2017, 9♂, 5♀, Xundur, 11375 ft, 5.v. 2017, 5♂, 6♀, 8.v.2017; Skardu: Sadpara valley, 12379 ft, 6.ix.2017, 5♂, 8♀; Shigar: Shigar Hashupi, 8100 ft, 9.ix.2017, 1♂, 1♀, 7713 ft, 5.viii.2018, 3♂, 2♀.

Distribution: New record to Gilgit-Baltistan.

8. *Bombus semenovianus* Skorikov, 1914. (Figs. 20-22)
Material Examined (30 ex.): Baltistan: Kharmang: Kharmang Olding, 8986 ft, 15.v.2017, 9♂, 10♀; Skardu: Sadpara valley**,** 12379 ft, 8.vii.2017, 5♂, 8♀; Shigar: Shigar Hashupi, 8100 ft, 9.ix.2017, 5♂, 3♀,7713 ft, 5.viii.2018, 4♂, 2♀.

Distribution: New record to Gilgit-Baltistan.

9. *Bombus rufofasciatus* Smith, 1852. (Figs. 23-25)
Material Examined (103 ex.): Baltistan: Kharmang: Kharmang Olding, 8986 ft, 5.vi.2017, 10♂, 15♀; Skardu: Sadpara valley, 12379 ft, 7.vii.2017, 20♂, 30♀; Shigar: Shigar Hashupi**,** 8100 ft, 5.vi.2018, 8♂, 10♀, 7713 ft, 5.vi.2018, 5♂, 5♀.

Distribution: Gilgit-Baltistan: Kharmang: Kendrik [10].



Fig 1 **Fig 2** **Fig 3**

Fig 1-3: *Bombus tunicatus.* 1. Queen; 2. Worker; 3. Male



Fig 4 **Fig 5** **Fig 6**

Fig 4-6: *Bombus lucorum*. subsp. *jacobsoni* 4. Queen; 5. Worker; 6. Male



Fig 7 **Fig 8** **Fig 9**

Fig 7-9: *Bombus kashmirensis.* 7. Queen; 8. Worker; 9. Male


Fig 10 **Fig 11**

Fig 10-11: *Bombus lepidus.* 10. Worker; 11. Male

Fig 12 **Fig 13** **Fig 14**

Fig 12-14: *Bombus asiaticus*. 12. Queen; 13. Worker; 14. Male

Fig 15 **Fig 16** **Fig 17**

Fig 15-17: *Bombus melanurus*. 15. Queen; 16. Worker; 17. Male

Fig 18 **Fig 19**

Fig 18-19: *Bombus ferganicus*. 18. Worker; 19. Male

Fig 20 **Fig 21** **Fig 22**

Fig 20-22: *Bombus semenovianus.* 20. Queen; 21. Worker; 22. Male

Fig 23 **Fig 24** **Fig 25**

Fig 23-25: *Bombus rufofasciatus*. 23. Queen; 24. Worker; 25. Male

4. Conclusion

A total of 973 bumblebees representing 9 species were collected from pasture settings near Sadpara valley, Kharmang Olding, Shigar Hashupi (agriculture land) in 2017 and 2018. Of the 973 specimens, 17% were queens, 32% were workers, and 51% were males. The species composition and relative abundances varied among sites and years. Kharmang Olding had the highest relative abundance of bumblebees, representing 45% of the specimens collected; the other two locations, Sadpara valley; Shigar Hashupi represented 23.74% and 31% of the overall catch respectively.

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