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RESEARCH ARTICLE
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Biodiversity Survey and Distribution Trends of the Bumblebees (*Hymenoptera: Apidae*) in District, Bajur Tehsil Arang, Khyber Pakhtunkhwa:

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ABSTRACT

This paper deals with the distribution of *Bombicidae* specimens across various localities of District Bajur, Tehsil Arang, Khyber Pakhtunkhwa. All in all, seven areas have been prospected for collection: ARANGI, MAZDAKK, NARANJ, GHAZI BABA, TAWHEED ABAD, SERAY TOP, and PIKET. The results reflect an apparent difference in the abundance of the specimens, out of which ARANGI turned out to be the most productive site, contributing 43.8% toward the overall specimens, followed by MAZDAKK, which also attained a contribution rate significantly high but lower at 21.7%. If NARANJ and GHAZI BABA add moderate percentages, the minor ones are TAWHEED ABAD, SERAY TOP, and PIKET-environments probably poorer or due to poor research effort. This variation emphasizes how highly productive ARANGI and MAZDAKK are, supporting the implication of research that is necessary for understanding the factors controlling the specimen distribution and for reinforcing efforts of collecting in those less represented localities. The collected specimens were brought to the laboratory where the specimen was pinned and labeled. All the specimens were relaxed in a relaxing jar for 24 hours, after which the legs and wings of the specimens were spread. Identification of the specimens was completed with the help of a microscope identified and preserved in the lab for further identification.

INTRODUCTION

The genus Bombus, from the tribe *Bombini*, is the home of the bumble bee. This is the only surviving group within the genus Bombus, which has some 250 identified species worldwide. Originally, bumble bees are cold-adapted species, which enabled them to live in some of the highest latitude and elevation ecosystems and to attain high diversity levels in both arctic and boreal regions. Species found in the highest latitudes include many conspicuous and endemic species found under some of the most extreme conditions on the planet.

Evidence has been found that, in recent years, the bumblebee species have declined, especially within the developed regions such as Western Europe and North America. Most of the bumblebees have suffered in abundance because of agricultural wasteland using the loss of their natural habitat.

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Bombini is one of the 4 groups of corbiculate bees *Apidae* which includes *Meliponini* or stingless bees, *Euglossini* or orchid bees and the *Apini*, or honey bees (Cardinal *et al.*, 2011). There are about 22 species together with 6 true species of bumblebees belonging to the subgenus *Psithyrus* in Britain, Benton, 2006. They are mainly found in high altitudes in the region of the Northern Hemisphere, also distributed in South America where little low land tropical species have been identified. They are 9-27 mm in size, with fuzzy hairs covering the body, typically yellow and black veined with an apparent wing. The female bumblebee possesses a broad hind leg with a cupped-shaped area for collection. The number of tergites-seven in males, and six in females the segments of the antennae-twelve in females, and thirteen in males differentiate sex in the bumble bees. They are social insects in nature having a single queen within the colony.

The colonies of the bumblebee often are often smaller than the honey bees, with almost up to fifty individuals in the nest.

Female bumble bees do sting frequently; while generally ignored by other living organisms .

Cuckoo bumble bees do not make nests; queens of these bumble bees attack the nests of other species of bumble bees, kill the resident queens, and then lay their eggs into the nest after that they are looked after by resident workers of the previous queen (Williams, 1998). More than 2/3rd of crop species are those which require insect pollination to reach their full yield and are pollinated by bumblebees. A few cases, bumble bees give higher pollination services as compared to Apis mellifera for example, in blossoms *Vaccinium corymbosum* (blueberry) bumble bees were capable of pollinating more than three times per minute as compared to honeybees (Daly et al., 2013 In), also; *Trifolium pratense* (clover), alfalfa (*Medicago sativa*), broad beans (*Vicia faba*) tomato (Lycopersicon esculentum) (Corbet *et al*., 1991) and raspberry (*Rubus idaeus*), (Willmer *et al*., 1994). Several of the family Fabaceae are highly specific food plants for bumblebees, Pywell et al 2005. Bumblebees are in decline both in their range and in population and at least nine species are of conservation concern and one, the short-haired bumblebee *Bombus subterraneus* has not been seen since 1989 and is presumed extinct. Anonymous. Among them, the genus Bombus, the only one extant genus in the tribe *Bombini* comprises more than 250 species; Williams et al. proposed a simplified subgeneric classification of the genus Bombus and reduced the number of subgenera from 38 to 15 using new strongly supported estimate of phylogeny for almost all bumblebee species. They have recognized 10 new subgeneric synonyms as well (Williams 2008).

Psithyrus was treated separately as a genus while are now believed into the family Bombus, (Williams, 2008). Fifteen subgenera have been identified in the genus Bombus that often to be seen as monophyletic e.g., *Bombus rupestris*, *Bombus lapidaries*, *Bombus dahlbomii*, *Bombus fervidus*, *Bombus ruderatus*, and *Bombus atratus*., (Williams, 2008).

There are declining due to intensive agricultural farming collateral pesticide damage and insensitive

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development. The construction of thousands of new homes is taking place on agricultural sites and threatens to destroy large areas of flower-rich sites which bumblebees and other invertebrates depend on worldwide. Slaughtering by so-called organic pesticides has reduced their population. Geographically, different areas of Bajur Arang have not yet been studied for the bumblebee's taxonomy. This is a unique area that comprises microclimatic zones and many undistributed areas. The resources of bumblebee were rich here, due to alpine, subalpine, and mountainous areas. No special attention has yet been given to the Bombus species of District Bajur. A taxonomic study is going on, keeping in view the importance of the Bombus species.

MATERIALS AND METHODS

Study area Arang Bajur

The proposed Study entitled "Taxonomy and Distribution of Bumblebees (*Hymenoptera: Apidae*) of Different Areas of District Bajur " was conducted in the diverse ecological zone of district swat, i.e., ARANGI, MAZDAKK, NARANJ: GHAZI BABA, TAWHEED ABAD, SERAY TOP, PIKET.

Collection of Bumblebee

Bumblebees are the range from 9mm-27mm in size. So sweeping of hand net was used in their habitat. On flowers, sweeping was utilized as well.

Killing

Dry killing jar was used for killing of bumblebees. Cyanide was used as a killing agent because it is the most quick and effective chemical for killing of insects.

Pins, Pinning, and Labeling

Three-number size insect pins were used for pinning. Collected insect specimens were pinned at the right side of the thorax. Field label was inserted below the specimen in pins incorporating necessary information.

Relaxing and Spreading

Specimens were kept in the relaxing jar for 24-48 hrs. Antennae, mouthparts, wings and legs were spread properly.

Storage of specimens

The relaxed specimens were pinned in a wooden box and naphthalene balls were kept in the boxes to save the specimens from the attack of the museum pests. Silica gel small pouches were also kept for absorbing the moisture of boxes to save the specimens from fungus attack.

Identification

All bumblebee specimens collected were studied using a Nikon microscope with up to 400X magnification. Identifications were

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done using the available literature and identification keys: Williams (1991); Williams *et al*., (2008); Williams, P. 2009, Williams *et al*., 2010. Specimens were identified up to the species level.

Description

The descriptions are made from the most obvious and observable characters. In this present work, all collected specimens were described using the terminologies of Williams, 1991.

Repository

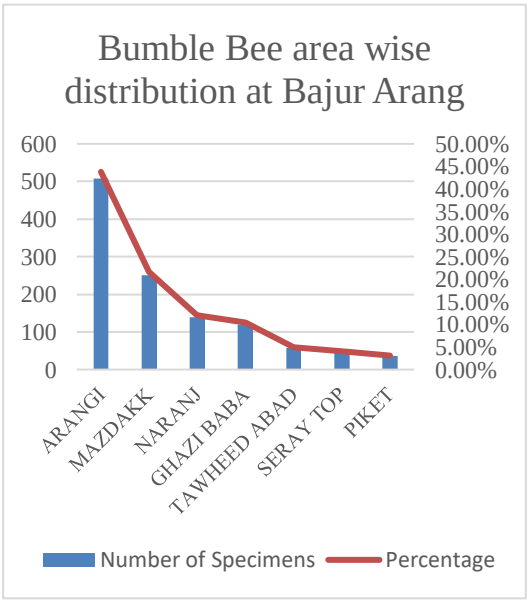
Collected specimens were submitted to the Insect Museum, Department of Entomology, Abdul Wali Khan University Mardan.

RESULTS

Collection of the specimens of family Bombicidae was carried out in the present study at different localities of District Bajur tehsil Arang, Khyber Pakhtunkhwa. ARANGI: 507, MAZDAKK: 251, NARANJ: 139, GHAZI BABA: 120, TAWHEED ABAD: 58, SERAY TOP: 47, PIKET: 36 The above information shows that the distribution of the specimens is not even within the site. Therefore, ARANGI, with 43.8%, has the most of all the available specimens, thus, being very productive. MAZDAKK has a contribution of 21.7%, which, although significant, is lesser, making it important but not as high as ARANGI. While NARANJ and GHAZI BABA show reasonable contributions, they appear to perform a somewhat leading but balanced role in the general distribution. The contribution is the least probably due to lesser favorable conditions or less collection in areas where the specimen count was relatively lesser, such as TAWHEED ABAD, SERAY TOP, and PIKET. This distribution underlines the variability in the availability of specimens and indicates that further research should be directed to sites ARANGI and MAZDAKK, while other locations may benefit from an increased focus with a view to understanding and improving their specimen yields.

Table 1. The percentage of Bumblebees recorded from district Bajur Arang Utman Khail.

Location	Number of Specimens	Percentage
ARANGI	507	43.8%
MAZDAKK	251	21.7%
NARANJ	139	12.0%
GHAZI BABA	120	10.4%
TAWHEED ABAD	58	5.0%
SERAY TOP	47	4.1%
PIKET	36	3.1%



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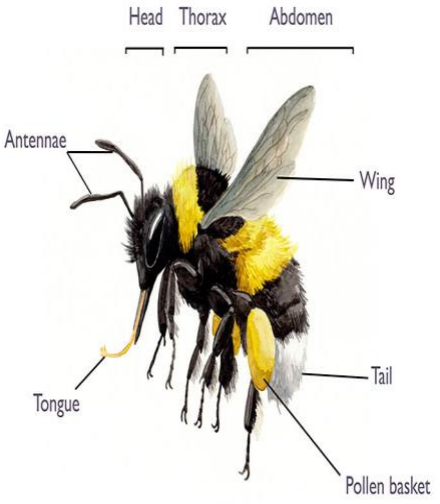


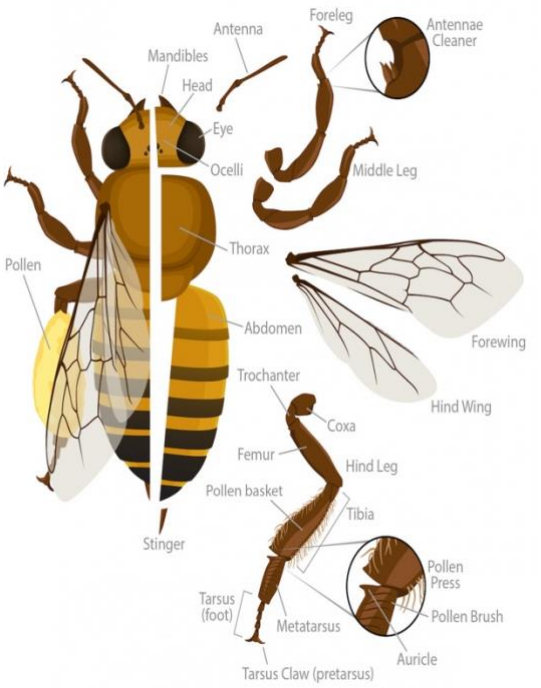
Bumblebees, genus *Bombus*, are among the most conspicuous bees besides European honey bees - chiefly because of their larger size. Over 250 species are known worldwide; many can be recognized by their black hair that is marked with various patterns of yellow, orange or white stripes. At least six species of bumblebees can be seen in the Santa Barbara area. However, one of those Crotch's bumblebee - *Bombus crotchii* is considered Endangered. Bumblebees are social insects and they form colonies having one queen.

Shape of Body:

The body of Bumblebee is large and robust. Their bodies measure 7mm to 27mm in body length. Most are thinly hairy, usually with dense hairs but bear long plumose hairs. The ventral surface of the gaster, propodeum, anterior face of gasteral tergum I and head bear little or no hair. Distal parts of the limbs are usually black or light brown and never bear bright yellow, red or metallic colours. The general appearance is similar to bumble bees although there are several morphological characters useful for identification of different subgenera as well as species under a stereomicroscope.

Antennae:

Bumblebees possess geniculate antennae. Females: 12 segments; 1 scape, 1 pedicel and 10 flagellomeres. Males: 13 segments; 1 scape, 1 pedicel, and 11 flagellomeres.



Head:

General Description: The head of the bumblebee is hypognathous. It bears 2 compound eyes and 3 ocelli. The face is densely hairy or smooth, depending upon the species. Identification: Shape and puncture distribution of clypeus and oculo- malar area is important.

Mouthparts:

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Mouthparts represent various appendages like the tongue, palp, maxilla, and mandible. Number and shape of mandibular teeth is very crucial for the identification of species that including keels, sulcus obliques, basal teeth, intercalary teeth, apical teeth, and incisora.

Legs

The legs of the bumblebee include coxa, trochanter, femur, tibia, basitarus and tarsus. Mesobasitarsus and hind tibia are very useful for identifying a number of species. Females have pollen-collecting structures corbicula and rastellum.

Wings:

Bumblebees have two pairs of wings transparent or hyaline, in some cases with darkened or metallic reflections. Colour patterns on the wings furnish diagnostic characters for several species.

Abdomen:

In females, there are 6 visible gastral terga and sterna [TI-VI, SI-VI], while in males, there are 7 visible, gastral terga and sterna [TI-VII, VI-VII]. Another important character in species identification is the ventrolateral keel on the gastral sternum [hypopygium] VI.

Taxonomic Characters:

Bumblebees can be identified on the basis of different morphological characters like color of the pubescence, sculpturing of labrum, number of mandibular teeth and 7th tergum and sternum in females, shape of mesobasitarsus and corbicular area of metabasitarsus.

Distribution:

They generally occur at elevations ranging from 1650 to 5500 meters above sea level. Their distribution is recorded from Afghanistan, India, Nepal, and Pakistan (Williams, 2004; Williams et al., 2010). For this survey, they were gathered from Skardu, Kharmang Olding, and Shigar areas and are very frequent around the lower mountain coniferous forests.

Host-Plants:

It feeds on the following plants: Artemisia absinthium L., A. spp., Cirsium falconeri (Hook.f.) Petrak, Cirsium arvense (L.) Scop., Helianthus annuus L., Chenopodium botrys L. (Chenopodiaceae); Convolvulus arvensis L. (Convolvulaceae); and Prunella vulgaris L. (Williams 1991; Rifat 2010).

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