



DIVERSITY AND DISTRIBUTION OF SCARAB BEETLES (COLEOPTERA: SCARABIDAEIDAE) IN MALAKAND DIVISION, PAKISTAN

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ABSTRACT

Dung beetles (Coleoptera: Scarabaeidae) play important roles in terrestrial ecosystems by cycling nutrients, aerating soil, dispersing seeds, and controlling parasites. In this context, we examined the diversity and distribution of dung beetles in the Malakand Division of Khyber Pakhtunkhwa, Pakistan, from 2019 to 2021. We aimed to identify species, understand their ecological roles, and determine how environmental factors affect their populations. Over three years, we identified 42 species from 27 genera and collected 2,698 beetles using baited pitfall traps, hand-picking, sweeping, and beating vegetation.

Malakand Division includes a range of habitats, such as forests, farms, and rangelands, which support dung beetle populations that rely on organic matter, especially mammal dung. Building on this, researchers conducted the study in 10 locations across the region, including Swat, Buner, Chitral, Dir Upper, Dir Lower, Shangla, and Malakand, each with different altitudes and climates. They sampled beetles during peak activity from May to September. To measure species diversity, abundance, and distribution, the researchers used the Shannon Index, Inverse Simpson Index, and Fisher Alpha Index. These tools assessed species richness, evenness, dominance, and the overall health of beetle communities.

The results revealed a high level of diversity in the Scarabaeidae populations, with 42 species identified across the study period. Notably, 17 species, including *Xylotrupes ulysses*, *Phyllognathus dionysius*, *Anomala dimidiata*, and *Oniticellus cinctus*, were recorded in Pakistan for the first time. Shannon Index values ranged from 2.89 to 3.17, showing moderate to high diversity and a stable community across all three years. Simpson Index values remained between 0.94 and 0.96 each year, meaning no single species dominated, which points to a healthy balance. The Fisher Alpha Index averaged 4.93, indicating high species richness overall. However, the Inverse Simpson Index detected notable yearly variation: in 2019, the mean was 0.96, indicating low diversity and possible species dominance; in 2020, this mean jumped to 23.50, suggesting a sudden increase in diversity or more balanced abundances; in 2021, it decreased to 3.17, indicating declining diversity from the 2020 peak but still above the 2019 baseline. These changes in the Inverse Simpson Index suggest shifts in which species were most common, potentially due to environmental changes affecting food sources or beetle movement each year. In 2020, changes in vegetation or climate may have reduced dung availability and affected mammal behavior, leading to a temporary peak in diversity. Despite fluctuations in which species were abundant, the Shannon and Fisher Alpha Indices showed that overall diversity and species richness stayed relatively stable year to year. This suggests that while the balance of dominant species shifted, the diversity and number of species remained fairly constant.

In summary, this research provides important information about dung beetle diversity and distribution in the Malakand Division and highlights their key role in maintaining ecosystem health. Although a high number of species persists and the community remains stable, shifts in dominant species indicate that dung beetles respond to environmental changes. We must continue monitoring and enact focused conservation to protect their essential ecological roles in the region.

Keywords: Dung beetles, Scarabaeidae, biodiversity, ecosystem services, conservation, Malakand Division, Shannon Index, Inverse Simpson Index, Fisher Alpha Index, environmental monitoring.

INTRODUCTION

Insects live in a wide range of habitats, including land, water, and air. They vary greatly in their roles in the ecosystem, size, life cycles, and habitat needs. Globally, insects and other invertebrates make up more than 75% of all described species. Coleoptera, or beetles, are the most successful insect order, accounting for over 38% of all insect species worldwide (Yadav et al., 2023). Arthropods are the largest and most diverse animal group. Insects play many roles, such as herbivores, pollinators, predators, parasitoids, and decomposers. Among insects, Hymenoptera, Coleoptera, and Diptera are some of the most studied groups (Noriega et al., 2018). Dung beetles are beetles that use mammalian dung or organic fertilizers in unique ways. They are often found near organic manure, especially from herbivores. There are up to 7,000 known dung beetle species (Shah et al., 2021), living both on and under the ground, particularly in farmed fields (Hussain et al., 2022).

Dung beetles belong to the class Insecta, order Coleoptera, and family Scarabaeidae. The superfamily Scarabaeoidea comprises Passalidae, Lucanidae, and Scarabaeidae, with the latter making up about 91% of scarabaeoid species (Shah et al., 2021; Shah and Shah, 2022). Dung beetles are distributed worldwide, with their presence closely tied to natural ecosystems and influenced by human activities (Hussain et al., 2021). They occur in tropical forests, savannas, and open or semi-open habitats in central Europe (Ambrozove et al., 2022). Climate, mammalian presence, vegetation, temperature, and soil pH all affect dung beetle diversity. The main factor influencing dispersal is the quality and type of manure in each location. Dung beetle distribution mirrors mammalian diversity, making them good biodiversity indicators (Shah et al., 2021). Agricultural interventions and habitat degradation further affect their populations, forcing them to adapt, migrate, or vanish (Shahabuddin, 2010). Dung beetles play key roles in nutrient recycling, helminth control, and seed dispersal, with species ranging from carnivores and omnivores to detritivores. Some are highly specialized feeders limited to the dung of certain primates (Shah and Shah, 2022). Their diversity is affected by anthropogenic disturbances such as pollution, habitat loss, and urbanization (Yadav et al., 2023).

Beetles show a wide range of colors, from shiny metallic shades to dull black or brown (Annapurneshwari et al., 2018). Dung beetles can be glossy black, metallic green, or red. They have a hard exoskeleton, and their forewings are protected by tough covers called elytra. Beetle mouthparts are rarely sectorial and may sometimes be reduced. Palps are important parts of their mouth structure (Lawrence et al., 2013; Shah et al., 2021). Male beetles usually have 11-segmented antennae, while females have up to 10. The leg bases are often set into the body, and their genitalia are small and located at the end of the abdomen (Thakare et al., 2012; Lawrence et al., 2013). Scarabaeidae are divided into two groups based on their spiracles: Laparostici (dung beetles) and Pleurostici (agricultural pests like chafers). Dung beetles feed on mammal dung, small organisms, fungi, and organic matter to support their larvae (Shah et al., 2021). Pleurostici beetles eat plants, and some do not feed as adults. Pleurostict chafers are divided into nine subfamilies. Dung beetles are found worldwide, but some species are unique to certain regions (Asha and Sinu, 2020).

Scarabaeidae is one of the largest insect families, with great diversity in shape, color, and size. Beetles have short wings and a round body, protected by hard elytra. Their forehead has a rounded clypeus that covers the mouthparts. Male beetles often have horns, which they use to compete with other males during mating. Their forelegs are strong and saw-like, useful for digging. Beetle antennae are flattened and oval, usually with 3 to 7 segments. Most beetles are black, but some are brown, red, green, or gold, and they range in size from 2 mm to 60 mm (Shah et al., 2021). In the genus

Onthophagus, males and females look different and use different strategies for reproduction. Major males with long horns protect females and help with brood care, while minor males without horns only help with mating (Hunt and Simmons, 1998, 2000). Up to 10,000 beetle species have horns, mainly in males, while females have small or no horns. Males use their horns to fight for access to females during breeding (Laini et al., 2022). Male genitalia are often the most reliable way to tell species apart, especially when external features are similar (Eberhard, 1985; Chandra and Gupta, 2012).

Dung beetles (Coleoptera: Scarabaeidae: Scarabaeinae) primarily feed on the feces of omnivorous and herbivorous vertebrates (Noriega et al., 2021). The olfactory system of dung beetles allows them to detect the scent of dung and determine the location of dung pats. The stimulus to the olfactory system is volatile organic compounds (VOCs) released by the dung. By using these VOCs, a beetle can typically determine the texture, location, and type of dung (Perera et al., 2022).

Dung beetles exhibit different nesting behaviors, such as rolling dung balls (rollers), tunnel formation (tunnelers), and digging (dwellers). Many dung beetle species burrow beneath the dung, constructing tunnels with various chambers to store one or more dung balls. These chambers also serve as shelters for developing beetles (Shah and Shah, 2022). Dung beetles (Coleoptera: Scarabaeidae; Scarabaeinae) are essential components of terrestrial ecosystems, both taxonomically and functionally. They carry out important ecological functions, such as nutrient cycling, soil aeration, seed distribution, and controlling enteric parasites and dung-breeding dipteran pests (Nasir et al., 2016). Dung beetles feed on the excreta of both small and large mammals and are also known as coprophagous beetles. Some species also consume decaying organic matter such as mushrooms, leaves, and fruits. They help maintain the sanitation of nature by recycling organic matter. Additionally, their feces contribute to soil fertility and help protect plant seeds from predation by pathogenic organisms (Jagdale et al., 2017). In natural environments, beetles respond sensitively to stimuli caused by anthropogenic pressures, such as hunting of mammals, fragmentation, burning, selective logging, and deforestation (Espinoza et al., 2018). Dung beetles can serve as vectors for both animal and human pathogens, transferring disease-causing agents found in fresh feces from one place to another (Shah and Shah, 2022).

Dung beetles are important for the biogeochemical cycle because they feed on materials like animal dung, dead animals, and decaying plants. This helps recycle soil nutrients, spread seeds, support forest growth, and control diseases. Their digging also improves soil aeration and water movement, making the soil more fertile (Carrion-Paladines et al., 2021). Because of these roles, dung beetles are often called ecosystem engineers (Pokhrel et al., 2021).

This study identifies and describes the main types of beetles found in the Malakand region of Pakistan. The central finding highlights the diversity of scarab beetles in the area, confirmed using traditional taxonomic methods.

METHODS

Malakand Division is a key administrative region in northern Khyber Pakhtunkhwa (KP). It includes the districts of Swat, Buner, Shangla, Dir (Lower and Upper), Chitral, and Malakand. The division covers about 32,007 square kilometers. It sits at roughly 34°33'56" North and 71°55'52" East (Uddin et al., 2022). Malakand shares borders with Mardan to the south and Hazara Division to the east. To the north, it meets Gilgit-Baltistan, and to the northwest, it borders Afghanistan. The area falls within the subtropical dry zone of the Hindu Kush range. It contains some of Pakistan's largest coniferous and broadleaved forests. Elevation varies from around 700 meters up to 7,708 meters. The landscape includes rugged terrain, slopes, plains, and river valleys (Gul et al., 2023).

A detailed field survey was conducted during the active season from March to September to collect beetle specimens across different elevation gradients. Sampling was performed three times during this period. Several methods were used, including baited pitfall traps, hand-picking, sweeping, and beating vegetation. Additional specimens were collected by shaking trees and using sweep nets (Pablo-Cea et al., 2022; Correa and da Silva, 2022). The study area was divided into several sampling sites. At each locality, pitfall traps were installed at 150-meter intervals. Each site was visited

repeatedly during the active beetle season (March–August). Specimens were collected in triplicate to ensure accuracy and consistency. The sweep nets used were made of thick cotton cloth. They had an opening diameter of 30 cm and a bag length of 60 cm, suitable for systematic sweeping of shrubs and grasses. To immobilize the captured beetles, a light pesticide spray was used. Afterward, beetles were transferred into killing jars containing ethyl acetate. The specimens were then carefully stretched on wooden boards for drying. Once dried, the beetles were mounted on insect pins sized to fit the specimen. All were properly labeled. The preserved samples, ranging from one to four individuals per species, were stored in labeled wooden boxes for later identification and taxonomic study.

Table:1 Geographical positions of various localities of Malakand Division

S.No	Name of Locality	Longitude	Latitude
1.	Swat	72.426°E	35.227°N
2.	Buner	72.615°E	34.3943°N
3.	Dir Upper	71.047°E	35.3356°N
4.	Dir Lower	71.8097°E	34.9161°N
5.	Chitral Upper	72.1416° E	36.1113° N
6.	Chitral Lower	71.78636°E	35.8518°N
7.	Shangla	72.7570° E	34.8872° N
8.	Malakand (dargai)	71.5310° E	34.3020° N
9.	Malakand (Batkheela)	71.9046° E	34.5030° N

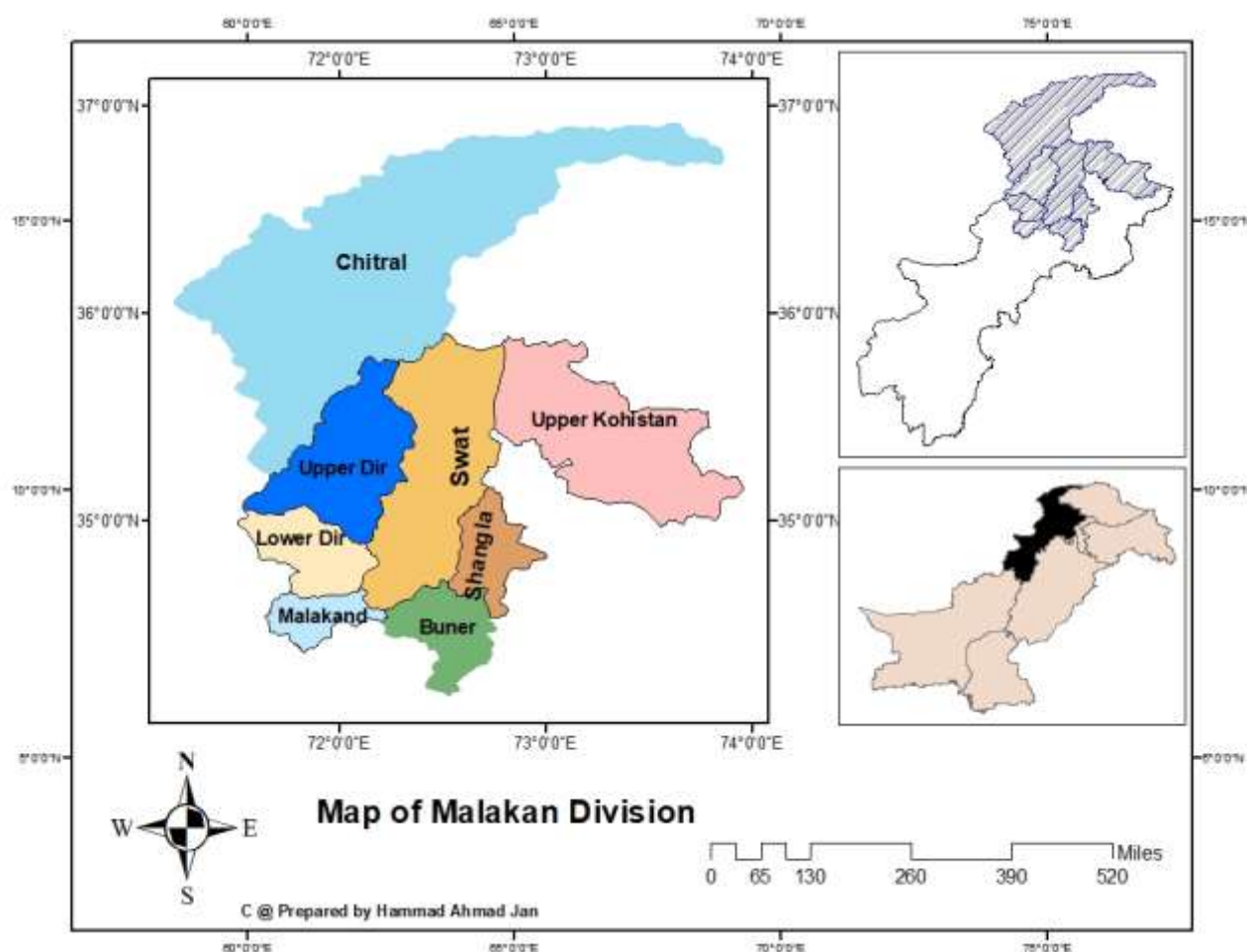


Figure:1 Map of Malakand Division showing sampling sites.

Table: 2. Different samples collection points selected in District Buner

Tehsils	Collection points
Gagra	Kulyary, dewanababa, Barkalai, Matwany, Kulyari
Daggar	Gokand, Daggar, Nawakaly, Torwarsak,
Gadezi	Pirbaba, Nansair, Legany
Chagharzi	Budal, Tangora, Pandair
Mandanr	Ambela, Nawagai, Nagrai
Khudokhail	Chinglai, Kangalai, Ghurghushto, Totalai

Table: 3. Selected point in District Swat for samples collection

Sampling sites	Sampling Points
Barikot	Landaky, Barikot, Shamozy,
Kabal	Shah Dherai, Kanju, nengolai
Matta	Sherpalam, kalakot, Gabinjaba,
Charbagh	Charbagh, Miandam, Malamjaba,
Khwazakhaila	Chaalyar, Khwazakhela Bandai, Mashkomy
Bahrain	Madayan, Bahrain,
Kalam	Kalam, Othror, Mahodand,
Mingora	Marghuzar, Saidu Sharif, Qambar, Nawai kalai

Table: 4. Selected localities for samples collection of District Shangla

Tehsils	Sampling Points
Puran	Mahozy, Aloch, Yakhtangy
Martung	Martung, Kabalgram, Dedal
Chakesar	Deroi,
Alpuri	Alpuri, Lelony, Shahpur
Besham	Maira, Tahkot, Karora

Table: 5. different sites selected in District Malakand for specimens' collection

Tehsils	Collection Points
Batkhaila	Totakan, Agra, Batkhaila
Thana Bhaizi	Palai, Thana, Aladand
Dargai	Dargai, Sarogai, Warter

Table: 6. Collection points of District Dir lower for sampling

Tehsils	Collection Points
Adenzai	Ramora, Chakdara, Gulabad
Balambat	Balambat, Koto, Hyma
Khaall	Khaall Barkaly, Sacha, Tormang
Lal Qilla	Maaidan, Bagh, Oshero dara
Munda	Munda, Gusam, Mian Kaly
Timergara	Timergara, Mian Banda, Hongy

Table: 7. Significant localities of District Dir Upper for Collection of samples.

Tehsils	Collection Points
Dir	Dirbazar, Chakyatan, Lowari Tunnel

Sheringal	Sheringal, Dogdara
Larjam	Bibyaware, Darora
Wari	Karodara, Nehagdara
Kalkot	Lamoty, Patrak, Kumrat
Barawal	Bandy, Tekarkot

Table: 8. Sampling points of District Chitral (Upper and lower)

Tehsils	Collection Points
Mestuj	Green Lasht, Booni, Kuragh, Choyinj, kojo
Chitral	Oyon, Chitral, Garam Chishma, Preyit, Bomborait
Drosh	Domel Nisar, Orsoon, Mirkhani, Soyeer, Shishi Koh, Arandu

GPS data was recorded in the field book. After collection, specimens were taken to the Department of Zoology, University of Swabi, for drying. To preserve the specimens, pins were inserted through the center of the thorax. Each specimen was labeled with its collection location, the collector's name, and the date. Both wet and dry preservation methods were used. For wet preservation, beetles were placed in jars with 70% ethanol and 5% glucose (Hussain et al., 2022). For dry preservation, specimens were stored in insect boxes with naphthalene balls. This protected them from ants and fungi (Ghazanfar et al., 2017; Gonçalves et al., 2022). Species identification relied on keys from several entomologists. These included Arrow (1931), Hayat and Khan (2013, 2014), Siddique et al. (2014), and Noureen et al. (2015). Specimens were also compared with those in various collections: the Pakistan Museum of Natural History, Islamabad (PMNH), the Entomological Museum of NIFA, Peshawar, the University of Agriculture Peshawar, and the National Agricultural and Research Centre, Islamabad (NARC Islamabad). After identification and labeling, specimens were stored in the Museum at the Department of Zoology, University of Swabi. A stereomicroscope (Olympus Model: SZX-ILLB2-100, Japan) was used to examine morphological features. Identification was based on morphological keys from Hayat and Khan (2013), Siddique et al. (2014), Hayat and Khan (2014), and Noureen et al. (2015). Literature and reference specimens from various museums were also used. Beetle photographs were taken with high-resolution digital cameras, such as Nikon and Canon, to capture details. For smaller beetles, a camera Lucida attached to the stereomicroscope was used (Chandra & Gupta, 2012). All work was conducted at the Department of Zoology, University of Swabi.

To analyze beetle diversity in the Malakand Division, Khyber Pakhtunkhwa (KPK), Pakistan, statistical methods were used. Specifically, researchers assessed species richness and evenness for 2019, 2020, and 2021. In total, 25 species from 14 genera of the family Scarabaeidae were collected from various sites (Table 1). Next, beetle counts per species for each year were analyzed for diversity, and the Shannon Index (H'), Inverse Simpson Index ($1/D$), and Fisher Alpha Index were calculated annually. These indices enabled year-to-year comparisons of diversity, abundance distribution, and species richness in the study area. The Shannon diversity index is given by the following formula:

$$H' = -\sum (p_i \cdot \ln p_i)$$

where p_i is the proportion of individuals belonging to species i .

The Inverse Simpson Index ($1/D$) gives more weight to abundant species and was defined as:

$$= D = \sum p_i^2 D(x)$$

While the inverse Simpson index was calculated as:

$$\text{Inverse simpson} = \frac{1}{D}$$

The Fisher Alpha index is used to measure species richness within an ecosystem, with higher values indicating greater species diversity. A non-parametric Wilcoxon test was applied to compare the diversity indices across different years, as the data did not follow a normal distribution. The original dataset was reorganized so that years were represented by rows and species by columns. The diversity

indices for each year were then calculated using R's vegan package. To assess the differences in diversity indices, the `compare_means()` function from the `ggpubr` package was used to perform the Wilcoxon test

Table:9 List of species collected from different localities of Malakand Division in the years 2019,2020, and 2021.

Name of Species	2019	2020	2021
<i>Xylotrupes Ulysses</i>	27	19	22
<i>Anomala dimidiata</i>	25	17	27
<i>Anomala varicolor</i>	20	19	22
<i>Anomala rugosa</i>	23	21	21
<i>Anomala bengalensis</i>	23	13	15
<i>Anomala dubia</i>	17	17	17
<i>Adoretus lasiopygus</i>	26	24	20
<i>Lepidiota munda</i>	17	16	19
<i>Maladera castanea</i>	25	23	27
<i>Clinteria confinis</i>	22	18	22
<i>Chiloloba acuta</i>	19	19	20
<i>Cetonia aurata</i>	24	23	21
<i>Torynorrhina flammea</i>	17	11	17
<i>Torynorrhina hyacinthine</i>	21	19	17
<i>Heterorrhiniola porphyretica</i>	27	25	27
<i>Oxycetonia versicolor</i>	22	20	22
<i>Onitis lama</i>	18	35	28
<i>Onitis falactus</i>	24	46	22
<i>Onitis philemon</i>	25	49	23
<i>Gymnopleurus bombayensis</i>	28	56	20
<i>Gymnopleurus cyaneus</i>	19	36	20
<i>Gymnopleurus flagellates</i>	27	52	22
<i>Gymnopleurus mopsus</i>	25	21	20
<i>Paragymnopleurus sinuatus assamensis</i>	22	43	22
<i>Digitonthaphagus gazella</i>	23	44	20
<i>Digitonthaphagus bonasus</i>	26	51	23
<i>Onthophagus ramosus</i>	17	34	9
<i>Onthophagus gazella</i>	21	41	17
<i>Onthophagus paliceps</i>	21	42	19
<i>Onthophagus nuchicornis</i>	23	46	24
<i>Helicopris midas</i>	28	53	24
<i>Copris (Paracopris) punjabensis</i>	20	40	22
<i>Copris lunaris</i>	22	43	21
<i>Sisyphus longipes</i>	21	40	15
<i>Garereta lugens</i>	24	48	19
<i>Phalops divisus</i>	24	47	22
<i>Catharsius pithecius</i>	21	39	18
<i>Catharsius molossus</i>	20	40	21
<i>Oniticellus cinctus</i>	22	42	18
<i>Tiniocellus modestus</i>	24	45	18
<i>Metacatharsius inermis</i>	27	52	21
<i>Phyllognathus dionysius</i>	17	15	19

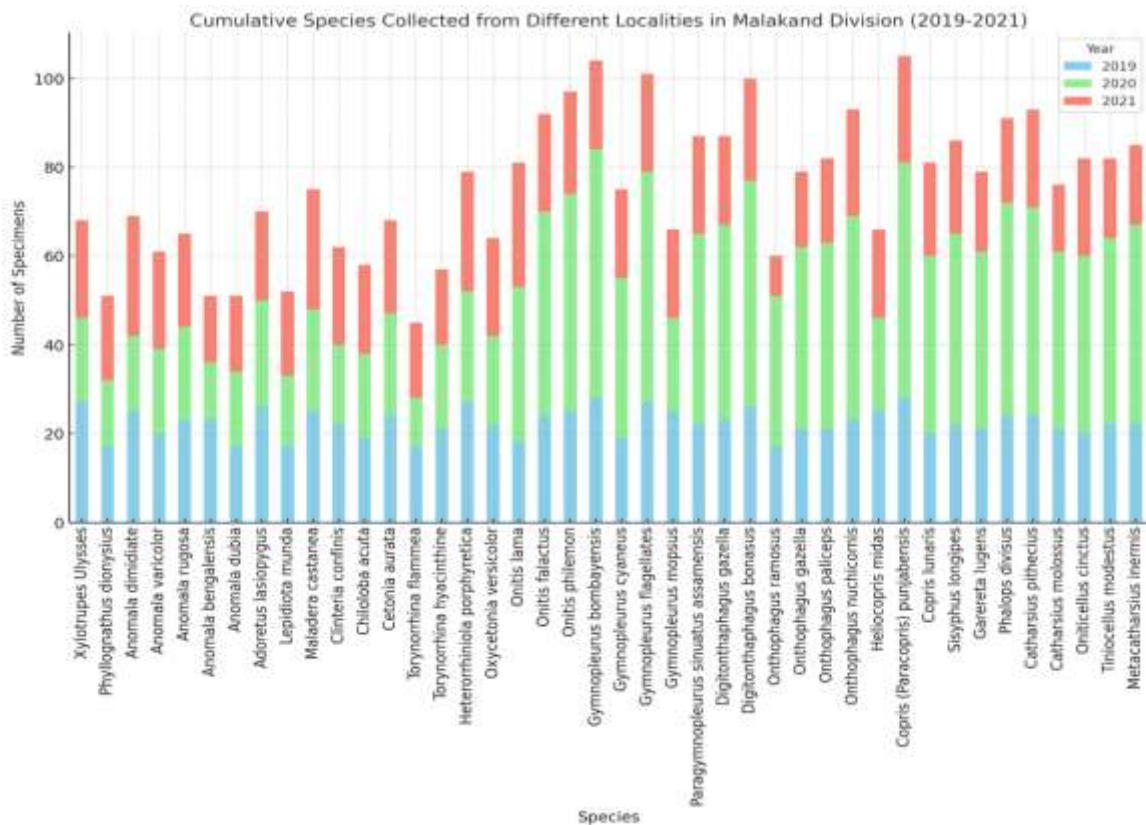


Figure:2 Cumulative species collected from different localities in Malakand Division (2019-2021)

RESULTS

The family Scarabaeidae, part of the superfamily Scarabaeoidea, is the largest and most diverse group in its category, comprising many subfamilies. For example, while dung beetles feed on dung, other species eat vegetation and flowers. Adult beetles are recognized by their large size, detailed markings, and colorful patterns. Furthermore, scarab beetles are found worldwide, with about 27,800 species in 600 genera, and display a wide range of life cycles and adaptability (Shah and Shah, 2022). In this study, 43 species from 27 genera of Scarabaeidae were identified. Key diagnostic features include a size range from 2 to 160 mm, variable body shapes (oval to elongated, usually convex), and coloration (brown, black, or dark green). Heads have eyes, frons, genae, and clypeus, with some males showing cephalic horns. Antennae have 8 to 10 segments forming a club. Thorax features a broad pronotum. Abdomen is large and segmented. Forewings are membranous; hindwings are modified into hard elytra. Legs possess toothed front tibiae, with front tarsi rarely absent.

Table: 10 Check list of the collected species belongs to Family Scarabaeidae recorded in Malakand Division.

Family Scarabaeidae

S. No	Genus	Scientific Name
1	Xylotrupes	<i>Xylotrupes Ulysses</i>
2	Pentodon	<i>Pentodon idiota</i>
3	Anomala	<i>Anomala dimidiata</i>
4		<i>Anomala varicolor</i>
5		<i>Anomala rugosa</i>
6		<i>Anomala bengalensis</i>
7		<i>Anomala dubia</i>

8	Adoretus	<i>Adoretus lasiopygus</i>
9	Lepidiota	<i>Lepidiota munda</i>
10	Maladera	<i>Maladera castanea</i>
11	Clinteria	<i>Clinteria confinis</i>
12	Chiloloba	<i>Chiloloba acuta</i>
13	Cetonia	<i>Cetonia aurata</i>
14	Torynorrhina	<i>Torynorrhina flammea</i>
15		<i>Torynorrhina hyacinthine</i>
16	Heterorrhiniola	<i>Heterorrhiniola porphyretica</i>
17	Oxycetonia	<i>Oxycetonia versicolor</i>
18	Onitis	<i>Onitis lama</i>
19		<i>Onitis falactus</i>
20		<i>Onitis philemon</i>
21	Gymnopleurus	<i>Gymnopleurus bombayensis</i>
22		<i>Gymnopleurus cyaneus</i>
23		<i>Gymnopleurus flagellates</i>
24		<i>Gymnopleurus mopsus</i>
25	Paragymnopleurus	<i>Paragymnopleurus sinuatus assamensis</i>
26	Digitonthaphagus	<i>Digitonthaphagus gazella</i>
27		<i>Digitonthaphagus bonasus</i>
28	Onthophagus	<i>Onthophagus ramosus</i>
29		<i>Onthophagus gazella</i>
30		<i>Onthophagus paliceps</i>
31		<i>Onthophagus nuchicornis</i>
32	Heliocopris	<i>Heliocopris midas</i>
33	Copris	<i>Copris (Paracopris) punjabensis</i>
34		<i>Copris lunaris</i>
35	Sisyphus	<i>Sisyphus longipes</i>
36	Garereta	<i>Garereta lugens</i>
37	Phalops	<i>Phalops divisus</i>
38	Catharsius	<i>Catharsius pithecius</i>
39		<i>Catharsius molossus</i>
40	Oniticellus	<i>Oniticellus cinctus</i>
41	Tiniocellus	<i>Tiniocellus modestus</i>
42	Metacatharsius	<i>Metacatharsius inermis</i>
43	Phyllognathus	<i>Phyllognathus dionysius</i>

Key for the identification of family Scarabaeinae:

1. Flattened Body, one terminal spur on mid tibiaeScarabaeini Latreille
- . convex Body, two terminal spurs on mid tibiae 2
2. long hind legs, filiform tarsi *Sisyphini* Mulsant
- . short or long hind legs, simple tarsi 4
3. Longitudinal groove in middle of Pronotum*Coprini* Leach
- . Longitudinal groove absents in Pronotum, impressions absent or present6
4. Elytra expanded behind the shoulder *Gymnopleurini* Lacordaire
- . Elytra not expanded behind the shoulder 3
5. Pygidium sculpted with long hairs *Oniticellini* Kolbe
- . Pygidium sculpted with short hairs or hairless..... 5
6. Lateral carina in Elytra *Onthophagini* Burmeister
- . Lateral carina absents in Elytra *Onitini* Laporte

Xylotrupes ulysses (Guérin-Méneville 1830). The Brown Rhinoceros Beetle (*Xylotrupes ulysses*), found in regions like Papua New Guinea, Britain, and parts of India, belongs to the family Scarabaeidae, subfamily Dynastinae. Males of this species, measuring 35mm in length and 20mm in width, are distinguished by two bifurcated horns, while females lack these horns. The beetle's coloration ranges from dark brown to purple, with a smooth, ridge-free elytra and spiny hind legs (**Figure:3**). Specimens were collected from various regions in Pakistan, such as Swat, Chitral, and Malakand. This species is noted as new to the study area.

Pentodon idiota (Fuessly, 1778), part of the Scarabaeidae family and Dynastinae subfamily, is an oval-shaped beetle measuring 18mm in length and 11mm in width. Its dark brown, shining, and softly elongated body is distinguished by a tiny, tapering head and punctured thorax with minute bristles. The elytra contain spots, punctures, and striae, with a mid-dorsal stripe on each. Its spiny legs and front tibia featuring three blunt denticles further characterize it (Figure:4). Specimens were collected from regions like Swat, Chitral, and Malakand in Pakistan. This species is noted as a new record for Malakand Division, though it is widely distributed across parts of South France, Spain, Egypt, and North Africa

Anomala dimidiata (Hope, 1831), part of the Scarabaeidae family and Rutelinae subfamily, is an oval, nearly convex beetle with a green dorsal side, blue-green legs, and a reddish-haired ventral surface. Measuring 22mm in length and 14mm in width, it features small, nearly concave eyes, a smooth and shiny thorax, and smooth elytra without lines. The beetle's wings have a membrane at the margins, and its narrow tibial spur is distinctive (**Figure:5**). Specimens have been collected from areas like Swat, Buner, Chitral, and Malakand in Pakistan. The species is also found in West Bengal, Nepal, Afghanistan, India, Jammu and Kashmir, and other parts of Pakistan. This species was recorded in Pakistan by Hashmi & Tashfeen in 1992.

Anomala varicolor (Gyllenhal, 1817), a member of the Scarabaeidae family and Rutelinae subfamily, has an oval and elongated shape, measuring 11mm in length and 7mm in width. It features a brown coloration, with a pronotum displaying yellowish-brown patches and large black spots. The elytra are marked with dense yellow and dark ridges, and the legs vary in color, with dark red tarsi and tibiae. The beetle's pro-tibiae have two well-developed denticles, while the middle and hind tibiae are larger in the middle (**Figure: 6**). Specimens have been collected from regions such as Swat, Chitral, and Buner in Pakistan, and the beetle is also found in China, Bhutan, Nepal, and West Bengal. It was previously recorded in Pakistan by Zahoor et al., 2013.

Anomala rugose (Arrow, 1899), a member of the Scarabaeidae family and Rutelinae subfamily, has an oval, elongated shape with a length of 14mm and a width of 8mm. The beetle's coloration is black with brown margins, and the thorax is broad without punctures or strips. The female elytra are moderately rugose, strongly punctate, and yellowish-brown with deep spots, while the male elytra are shining, rarely punctate, and completely black with a few yellow spots. Its narrow spiny legs are another characteristic feature (**Figure:7**). Specimens have been collected from Swat, Chitral, Shangla, and Lower Dir in Pakistan, with the species also found in Nepal, Bhutan, West Bengal, and India. The species shows sexual dimorphism.

Anomala bengalensis (Blanchard, 1851), a member of the Scarabaeidae family and Rutelinae subfamily, has an elongate, oval shape with a length of 13.5mm and a width of 7.5mm. Its coloration is brownish-yellow, with blackish-brown markings on the head, elytra, margins of the pronotum, hind tibiae, and tarsi. The beetle's head is short, transverse, and wrinkled, with a short rectangular clypeus and 9–10 antennal segments. The pronotum is punctured, and the elytra feature longitudinal rows of punctures. Its legs include tridentate fore tibiae with one spur, carinated mid and hind tibiae with two spurs, and tarsi with five segments (**Figure:8**). Specimens have been collected from Chitral, Malakand, and Lower Dir in Pakistan. This species is also found in Bhutan, Myanmar, West Bengal, Bangladesh, and India.

Anomala dubia (Scopoli, 1763), part of the Scarabaeidae family and Rutelinae subfamily, has an

elongate, oval shape with a length of 11mm and a width of 6.5mm. Its coloration is variable, ranging from brown to green. The head is smooth and green with convex eyes and 7–10 antennal segments. The thorax is shining and green with a smooth pronotum. The elytra are greenish-brown, with well-bent edges and strips present (**Figure:9**). The legs have asymmetrical claws. Specimens were collected from Swat, Buner, Chitral, and Lower Dir in Pakistan. This species has been reported for the first time in Pakistan, but it is widely distributed in areas such as Central America, the United States, Canada, Mexico, the Netherlands, and India.

Adoretus lasiopygus (Burmeister, 1855), a member of the Scarabaeidae family and Rutelinae subfamily, has a flat, short, oval shape, with a length of 11-13mm and a width of 4.5-5mm. Its dorsal side is dark brown, while the ventral side is light brown, with a lighter pronotum, elytra, and clypeus. The head is short and granular, and the thorax features a short, transverse pronotum. The elytra are punctured, with three pale, longitudinal elevated lines near the suture. The legs have asymmetrical claws, and the tarsi consist of 4-5 segments (**Figure: 10**). Specimens have been collected from regions such as Swat, Chitral, and Malakand in Pakistan. This species, originally found in Sri Lanka, West Bengal, and India, is new to Pakistan.

Lepidiota munda (Sharp, 1876), part of the Scarabaeidae family and Melolonthinae subfamily, has a large, elongated, convex, and oval shape with a length of 41mm and a width of 21mm. Its elytra are dark red, while the pronotum and clypeus are dark brown, and the ventral side is brown. The head is semicircular, and the thorax is black and convex. The abdomen tapers at the apex, protruding from the elytra. The wings are moderately punctured, and the legs are narrow and elongated (**Figure: 11**). Specimens were collected from Swat, Chitral, and Lower Dir in Pakistan. This species, which is found in Malaysia and tropical Asia, is new to Pakistan.

Maladera castanea (Arrow 1933), a member of the Scarabaeidae family and Melolonthinae subfamily, has a flat, nearly convex shape with a length of 8mm and a width of 5mm. Its coloration varies from red to yellow or orange, with the pronotum being completely orange and adorned with black spots. The head is tiny and shielded by the pronotum, and the elytra feature ridges running from the anterior to the posterior end, with deep black lines along the middle and lateral margins. The legs are orangish-black (**Figure:12**). Specimens have been collected from Swat, Buner, Chitral, and other regions in Pakistan. This species, previously recorded in places like the United States, China, and Japan, is new to Pakistan.

Clinteria confinis (Hope, 1831), part of the Scarabaeidae family and Cetoniidae subfamily, has a flat, oval shape with a length of 11mm and a width of 8mm. Its coloration is dark red with yellowish-brown asymmetrical spots on the elytra. The head is minute and partially hidden by the pronotum, while the thorax has a yellowish thick line. The elytra feature scattered yellowish spots, and the legs are narrow and spiny with a tibial spur (**Figure:13**). Specimens have been collected from Swat, Chitral, and Lower Dir in Pakistan, as well as from regions in India and Nepal. This species has been recorded in Pakistan by Ratcliffe and Ahmed (2010).

Chiloloba acuta (Wiedeman, 1823), part of the Scarabaeidae family and Cetoniinae subfamily, has a length of 14-15mm and a width of 9mm. The entire body is covered with irregular hairs and features metallic green coloration. The head is shiny, hairy, and short, with a clypeus that has a median keel. The thorax is broad, shiny, and convex, while the elytra have elevated margins and lack punctures. The legs are narrow and spiny (**Figure:14**). Specimens have been collected from regions in Swat, Chitral, and Lower Dir in Pakistan. This species is also found in Sri Lanka, West Bengal, and India, with records in Baluchistan and Azad Kashmir in Pakistan by Fazal et al. (2018).

Cetonia aurata (Linnaeus, 1775) part of the Scarabaeidae family, has a length of 19mm and a width of 10mm. Its body is covered with small hair and exhibits metallic bluish-green coloration with uneven white spots, creating a lustrous, oil-slick-like effect in the sunlight. The head is minute and black, shielded by a large pronotum. The thorax is of moderate size, and the elytra are V-shaped on the back. The legs are black, narrow, and spiny (**Figure:15**). Specimens have been collected from Swat, Chitral, and Lower Dir in Pakistan. This species is found across Europe, southern England, Wales, Hong Kong, and various parts of Asia, including Pakistan, with recent records in Dhirkot, Azad Kashmir (Faiz et al., 2020).

Torynorrhina flammea (Gestro, 1888) a member of the Scarabaeidae family and Cetoniinae subfamily, has an oval shape, measuring 30mm in length and 14-16mm in width. The beetle's reddish-brown body is clothed with hairs, and it has a rugose, elongated head with large, prominent compound eyes. The thorax has a smooth, shiny pronotum, while the elytra are adorned with minute, regular speckles arranged in lines from the anterior to the edges. The legs are black, broad, and spiny (**Figure:16**). Specimens have been collected from Chitral, Malakand, and Lower Dir in Pakistan. The species is also found in Malaysia, Thailand, China, and Assam, with this being a new record for Pakistan.

Torynorrhina hyacinthina, (Hope, 1841) part of the Scarabaeidae family and Cetoniinae subfamily, has a large, flat, oval shape with a length of 18-20mm and a width of 8-11mm. Its coloration is shiny dark black, and the head is very minute, shielded by the pronotum. The thorax features a nearly circular pronotum, and the elytra are marked with dark brown spots. The legs are covered with fine hairs (**Figure: 17**). Specimens have been collected from regions such as Swat, Chitral, and Lower Dir in Pakistan. This species, originally found in Thailand, Bangladesh, Myanmar, Nepal, and India, is a new record for Pakistan.

Heterorrhiniola porphyretica, (Bourgoin, 1917) part of the Scarabaeidae family, has a flat, elongated oval shape with a length of 10-13mm and a width of 10mm. Its coloration is blue, with a tiny head and large compound eyes. The anterior pronotum is dark blue, and the posterior is weakly blue. The elytra are U-shaped with deep lines, spots, and speckles. The legs are long, and all three pairs are of the same size and length (**Figure: 18**). Specimens have been collected from regions like Swat, Chitral, and Shangla in Pakistan. This species, found in the Palaearctic Region, is a new record for Pakistan.

Oxycetonia versicolor (Fabricius, 1775) is a scarab beetle with an oval body, measuring 12 mm long and 9 mm wide. Its color pattern is black and blood red with irregular white markings. The head is small and black, and the pronotum has two edge dots and a black mark at the front. The thorax is dark red, and the wings are black with red elytra and white spots. The legs are small, black, and spiny. Specimens were collected from Swat, Chitral, and Shangla in Pakistan. This species is found in Madagascar, Chagos, Samoa, Sri Lanka, South Africa, China, and both North and South India (Matot, 2000; Fletcher, 1914), and is newly recorded in Pakistan. *Onitis lama* (Lansberge, 1875), from the Scarabaeidae family, has a convex, elongated body, measuring 27mm long and 10mm wide. It is black, and males have a deeply folded clypeus at the front. The thorax is strongly hardened, and the elytra are smooth with fine bands. The legs have reddish-brown hairs, sharp-toothed front femurs, and a long front tibia with four terminal teeth (**see Figure 20**). Specimens were collected from Swat, Chitral, and Lower Dir in Pakistan. This species is found in India and Pakistan and was previously recorded by Siddiqui et al. (2014).

Onitis falcatus, (Wulfen, 1786) part of the Scarabaeidae family, has a smooth, shining black body with a convex, oval shape. It measures 22mm in length and 11mm in width. The clypeus is larger than the head and separated by the clypeal suture, with antennal segments 7–9, where the last three segments form a club shape. The thorax is large, broad, and convex, while the elytra feature minute striae. The legs are covered in reddish hairs on the lower surface, and the trochanters lack spines (**Figure: 21**). The front and hind femurs are smooth and rounded in the middle. Specimens have been collected from Swat, Chitral, and Lower Dir in Pakistan. This species is found in both the Oriental and Palaearctic regions, and it has been recorded in Balochistan and Azad Kashmir, Pakistan.

Onitis philemon, (Fabricius, 1801) part of the Scarabaeidae family and Scarabaeinae subfamily, has an oval, short body with a length of 19mm and a width of 9mm. The body color is green with shiny copper-black hues. The head is flat and rugulose, with a parabolic clypeus, and a curved carina dividing the clypeus from the forehead. The clypeus is diagonally rugose in females and granulate in males. The thorax lacks a median line, and the elytra are smooth, rarely punctured. The legs feature elongated forelegs, with males having a slender tibia and females a broad tibia. Both have a four-toothed, jointed spur (**Figure: 22**). Specimens have been collected from Swat, Chitral, and Lower Dir in Pakistan. This species is found in regions across the South and West Palaearctic, East Oriental, and Northeast Ethiopian regions

Gymnopleurus bombayensis, (Arrow, 1931) part of the Scarabaeidae family, has an oval shape with a length of 12.2-14.6mm and a breadth of 10.2-11.1mm. Its coloration is shining, metallic bluish-green with markings on the body. The head is deeply punctured with two prominent angled side carinae, and the clypeus has two rounded teeth. The antennae are 9-segmented. The thorax has a pronotum that is deeply and rarely punctured, while the elytra are clearly striated and spotless. The legs have slender tibiae, and the front tibiae feature three terminal teeth (**Figure: 23**). Specimens have been collected from Swat, Chitral, and Lower Dir in Pakistan. This species is found in the Oriental Region, including India and Pakistan, and was previously recorded in Pakistan by Arrow (1931) and Siddiqui et al. (2014).

Gymnopleurus cyaneus, (Fabricius, 1798) part of the Scarabaeidae family, has a convex, oval shape, with a length of 9.5-13mm and a width of 7-9mm. Its coloration is shining and brightly metallic green. The head is minute, flat in the middle at the posterior edge, and unevenly punctured at the frontal lateral sides. The antennae are 9-segmented. The thorax has a pronotum that is longer than it is broad, flat, and deeply punctured, lacking lateral spots. The elytra have 7 spotless bands, and the front tibiae feature a spur that strongly curves inward (**Figure: 24**). Specimens have been collected from Swat, Chitral, and Lower Dir in Pakistan. This species is found in Sri Lanka, Bangladesh, India, and Pakistan, with previous records in Pakistan by Hashmi and Tashfeen (1992) and Siddiqui et al. (2014).

Gymnopleurus flagellates (Waterhouse, 1890), part of the Scarabaeidae family, has a slightly convex, oval shape with a length of 12mm and a width of 8.5mm. Its coloration is dull black, and the head is tiny with asymmetrical punctuation, with the clypeus featuring two rounded structures on the front edge. The antennae are 9-segmented. The thorax has a pronotum that is longer than it is broad, with large, dense punctures and no spots. The elytra have shallowly defined bands, lack spots, and feature shiny elevations. The legs are long, with the front femur having a minute sharp tooth (**Figure: 25**). Specimens were collected from regions like Swat, Chitral, and Lower Dir in Pakistan. This species is found in the West Palearctic and West Oriental regions and has been recorded in Pakistan by Arrow (1931) and Siddiqui et al. (2014).

Gymnopleurus mopsus, (Pallas, 1781) a member of the Scarabaeidae family, has a glossy metallic sheen ranging from dark brown to bluish-green or bronze, with a length of 8.5–12.0mm and a width of 5.0–7.0mm. This small, convex dung beetle has a large head with a bidentate, reflexed clypeus and a highly punctate surface. The elytra are convex and clearly striated, with smooth spaces between the striae, and frequently exhibit metallic reflections. The pronotum is metallic, strongly punctate, and wider than long. The pygidium is convex and coarsely punctate. The fore tibiae are tridentate for digging, while the mid and hind tibiae have transverse ridges and powerful apical spurs. Males tend to be larger, with a more convex clypeus and broader fore tibiae, indicating sexual dimorphism (**Figure: 26**). This species is adapted to dung-rolling and burying behaviors, especially in arid and semi-arid regions. Specimens have been collected from Swat, Chitral, and Lower Dir in Pakistan. It is found in the West Palearctic and West Oriental regions and has been previously recorded in Pakistan by Arrow (1931) and Siddiqui et al. (2014).

Paragymnopleurus sinuatus assamensis, (Waterhouse, 1890) part of the Scarabaeidae family, has a broad, thick, and oval shape with a length of 21.4mm and a width of 13mm. Its coloration is flat and shining black, with orange antennae. The head is tiny, smooth, and minutely punctured, with non-protruding ocular lobes that are rugose. The clypeus has a bidentate anterior margin. The pronotum is longer than broad, convex, and lacks lateral spots. The elytra are slightly shagreened, velvety black, and finely striate. The legs feature tibiae with three outer margin teeth, and the remaining outer margins are saw-like with a broad, smooth spur and a spine (**Figure: 27**). Specimens have been collected from Swat, Chitral, and Lower Dir in Pakistan. This species is found in New Caledonia, Sudan, Nepal, India, and Pakistan, and has been previously recorded in Pakistan by Siddiqui et al. (2014).

Digitonthaphagus gazella, (Fabricius, 1787) part of the Scarabaeidae family and Scarabaeinae subfamily, has a length of 12mm and a width of 9mm. Its coloration is greenish-black, with a semi-circular front edge on the head and fine punctures on the forehead, separated from the clypeus by a

deep inward carina. The female's clypeus is thick and slightly rugulose, while the male's is slightly rugulose and shining. The vertex contains a straight carina. The median part of the pronotum consists of thin granules, and the elytra are finely striated, lacking punctures. The front legs have 4 external teeth and a spur (**Figure: 28**). Specimens have been collected from regions like Swat, Chitral, and Lower Dir in Pakistan. This species is widely distributed, including regions such as Texas (introduced), Central and South America, Australia, Madagascar, West Africa, Kenya, Sri Lanka, Japan, and India. It was also recorded in Pakistan by Abbas (2015) and Siddiqui and Kamaluddin (2012).

Digitonthaphagus bonasus, (Fabricius, 1787) part of the Scarabaeidae family and Scarabaeinae subfamily, has a length of 16mm and a width of 12mm. The coloration of the head is green, while the elytra are brown. The head is semi-circular in shape with a front edge and features a pair of horns on the vertex. The thorax is very flat in the front, with sparse granules in the middle part and a small median furrow on each side. The elytra have minute striae with very few and small punctures. The legs are broad and short, with middle and hind femora and strongly toothed tibiae (**Figure: 29**). Specimens have been collected from Swat, Chitral, and Lower Dir in Pakistan. This species is found in Cambodia, Vietnam (Tonkin), Belgium, Sri Lanka, Myanmar, Thailand, South Afghanistan, and India. It was also recorded in Pakistan by Arrow (1931) and Abbas (2015).

Onthophagus ramosus, (Wiedemann, 1823) a member of the Scarabaeidae family and Scarabaeinae subfamily, has an oval, convex shape, with a length of 12mm and a width of 8mm. Its coloration is indigo-black or simply black, with shining black sternal segments. The head is semicircular with a reflexed front margin and a pair of horns between the eyes on the vertex. The antennae are short and consist of 9 segments. The thorax features moderate punctures, and the elytra lack black spots, with punctured striae and weak punctures on the dorsal side. The front tibiae have 4 teeth, with the terminal tooth being small (**Figure: 30**). Specimens have been collected from regions like Chitral, Malakand, and Lower Dir in Pakistan. This species is found in the Oriental region, including India and Pakistan, and has been recorded in Pakistan by Siddiqui and Kamaluddin (2011) and Siddiqui et al. (2014).

Onthophagus gazella, (Fabricius, 1787) a member of the Scarabaeidae family and Scarabaeinae subfamily, has an oval, convex shape with a length of 14mm and a width of 7mm. Its coloration is brownish-black with brown or green luster. The head is longer than broad, with two curved, protruding spiny horns articulated at the base. The antennae have 8-9 segments. The thorax is broad with brown edges, and the abdomen is hairy. The brown convex elytra have fine striae and yellow setae, with dark brown at the base. The elongated, cylindrical front tibiae bear four external teeth (**Figure: 31**). Specimens have been collected from regions like Swat, Chitral, and Lower Dir in Pakistan. This species is found in Madagascar, Russia, Sri Lanka, Africa, Arabia, Nepal, India, and Pakistan. It has been recorded in Pakistan by Siddiqui and Kamaluddin (2011) and Siddiqui et al. (2014).

Onthophagus paliceps, (Arrow, 1931) a member of the Scarabaeidae family, has an oval, convex shape with a length of 10mm and a width of 7-8mm. Its coloration is dark black. The head is semi-circular, featuring a small median horn that curves upwards and a pair of short, sloping, rectangular rigid lobes arising from the inner side of each eye. The antennae have 8 segments. The thorax has a pronotum with weak and sparse punctures. The elytra contain seven smooth, shallow striae. The front tibiae have a short tibial spur (**Figure: 32**). Specimens have been collected from regions like Buner, Chitral, and Lower Dir in Pakistan. This species is found in India and Pakistan, with previous records by Arrow (1931), Chandra and Gupta (2012), and Siddiqui et al. (2014).

Onthophagus nuchicornis (Linnaeus, 1758) has an oval shape, with a body length of 10mm and a width of 6mm. Its coloration is black and brown, with the elytra being brown and adorned with some black spots. The major male features a small, single spine-like horn on the head, while the small male has extremely reduced horns. A distinct ocular canthus is present on the head, dividing the eye completely. The pronotum has rounded anterior angles. The front tibia of the female is more stout compared to the slender front tibia of the male (**Figure: 33**). This species is widely distributed across various regions, including the Netherlands, Mongolia, Italy, Poland, and many more, with some populations introduced in North America. It has also been reported from Pakistan by Abbas (2015).

Heliocopris midas, (Fabricius, 1775) a member of the Scarabaeidae family, has a broad and convex shape. Males measure 26–42mm in length and 24mm in width, while females are 36mm in length and 23mm in width. The coloration is black on the dorsal side and deep reddish-black on the ventral side. The head is broad with two tiny cephalic horns, and a hollow, broad clypeus. The antennae have 9 segments. The pronotum is broad with reddish hairs at the front and two sharp nodules. The abdomen is enclosed by a carina. The elytra have 7 bands, and the front tibiae are broad with three exterior teeth (**Figure:34**). Specimens have been collected from Swat, Chitral, and Lower Dir in Pakistan. This species is also found in China and India, with previous records in southern Pakistan by Hashmi and Tashfeen (1992) and Siddiqui et al. (2014).

Copris punjabensis, (Gillet, 1921) a member of the Scarabaeidae family, has an elongated shape with a length of 14mm and a width of 9mm. Its coloration is black, and the head features fine, strong, and dense punctures, along with a longitudinal flat elevation. The pronotum is covered with fine, dense punctures and has rounded front angles and lateral edges. The abdomen is almost entirely punctured, while the elytra are convex with strips. The legs have broad front tibiae with four terminal teeth (**Figure: 35**). Specimens have been collected from regions such as Swat, Chitral, and Lower Dir in Pakistan. This species is found in the West Oriental region, including India and Pakistan, and has been previously recorded in Pakistan by Arrow (1931) and Siddiqui et al. (2014).

Copris lunaris (Linnaeus, 1758) is a large dung beetle with a body length of 21.5mm and a width of 12mm. The species has a shiny black, globose appearance, with a convex and smooth vertex. The pronotum is transverse and strongly punctured, while the elytra are transverse with five striae. The legs are long and robust. This species exhibits sexual dimorphism: the male has a long, tapering cephalic horn and a pronotum with a short horn laterally, while the female has a short and truncate cephalic horn (**Figure: 36**). Specimens were collected from Swat, Chitral, and Lower Dir in Pakistan. *Copris lunaris* is widely distributed in Palaearctic temperate areas, ranging from China to Western Europe, and is a new record for Pakistan (Dortel et al., 2013; Tonelli et al., 2017).

Sisyphus longipes, (Olivier, 1789) a member of the Scarabaeidae family, has a convex oval shape with a length of 7.8mm and a width of 5.7mm. The coloration is shiny black. The head is tiny, deeply punctured, and semi-circular, with the clypeus having shortened anterior edges and two sharp, distant teeth. The thorax features a long, broad pronotum with hairy edges and fine punctures. The convex elytra taper at the end, with fine strips and smooth intervals. The hind legs are slender and longer, covered with stiff short bristles, while the front tibiae have three sharp teeth. The pygidium is elongated, narrow, and longitudinally sulcate with round punctures (**Figure: 37**). Specimens have been collected from Swat, Chitral, and Lower Dir in Pakistan. This species is found in Sri Lanka, Myanmar, Bengal, India, and Pakistan, with previous records in Pakistan by Arrow (1931) and Siddiqui et al. (2014).

Garreta lugens, (Fairmaire, 1891) **from** the Scarabaeidae family, has a convex oval body measuring 15 mm in length and 14 mm in width. Its color is bluish-black above and black below. The head is medium-sized and moves freely from the pronotum. The clypeus has four denticles: two large ones in the middle and two smaller ones. The thorax shows two grooves at the edge of the pronotum. The elytra are striated and lined from front to back, giving a shagreen appearance. The first elytral striae after the midline are widely spaced and only faintly punctured. The legs are narrow, and the front legs are slightly bent inward (**Figure: 38**). Specimens have been collected from Swat, Chitral, and Lower Dir in Pakistan. This species is also found in Somalia, Ethiopia, Tanzania, and Kenya, and has been newly recorded in Pakistan (Davis and Deschodt, 2018).

Phalops divisus (Wiedemann, 1823), a Scarabaeidae species, has been observed in Pakistan. The beetle is 11 mm long and 7 mm wide, with a shape that is short, broad, and not very convex. Its color ranges from coppery to dark blue, with a bright metallic green hue. The head has a carina separating the clypeus from the frons. The thorax features truncated anterior angles with tiny external denticles, while the elytra are covered with small bristles and lines. The legs have tibial spurs and spiny tarsi

(Figure: 39). This species, originally from Sri Lanka and India, is newly recorded in Pakistan (Gupta et al., 2014).

Catharsius pithecius (Fabricius, 1775), a member of the Scarabaeidae family, is found in Pakistan. This species measures 19-23 mm in length and 14 mm in width, with a short oval, very convex shape. Its coloration is shiny, dark black. The head is nearly semi-circular, with a clypeus having an expunged median region. Males have a slender, straight horn in front of their eyes, while females feature a small, acuminate, oblique elevation. The thorax of males has small, sharp conical knobs on each side of the medial furrow. The wings are lined with strips, and the legs have tibiae with four spines and bristles on the tarsi **(Figure: 40)**. This species is native to Sri Lanka, Taiwan, China, India, and Pakistan (Siddiqui et al., 2014).

Catharsius molossus (Linnaeus, 1758), a species from the Scarabaeidae family, has been recorded in Pakistan. The species has distinct differences in size between sexes, with males measuring 27-31 mm in length and 20 mm in width, while females are larger at 35-37 mm in length and 22 mm in width. The body is oval and very convex, with a dull black color. The head is semi-circular and broad, with a backwardly folded horn that has a smooth, blunt tip. The clypeus is nearly transverse and rugulose. The thorax has tiny granules and two smooth, blunt nodules on each side. The elytra are shallowly striate, and the legs feature front tibiae with three external denticles and broad middle and hind tibiae, with a shortened tibial spur on the hind tibia **(Figure: 41)**. This species is distributed across Malaysia, Timor, Laos, Tibet, Nepal, Cambodia, Vietnam, China, Sri Lanka, Thailand, Afghanistan, Indonesia, Hong Kong, India, and Pakistan (Abbas, 2015).

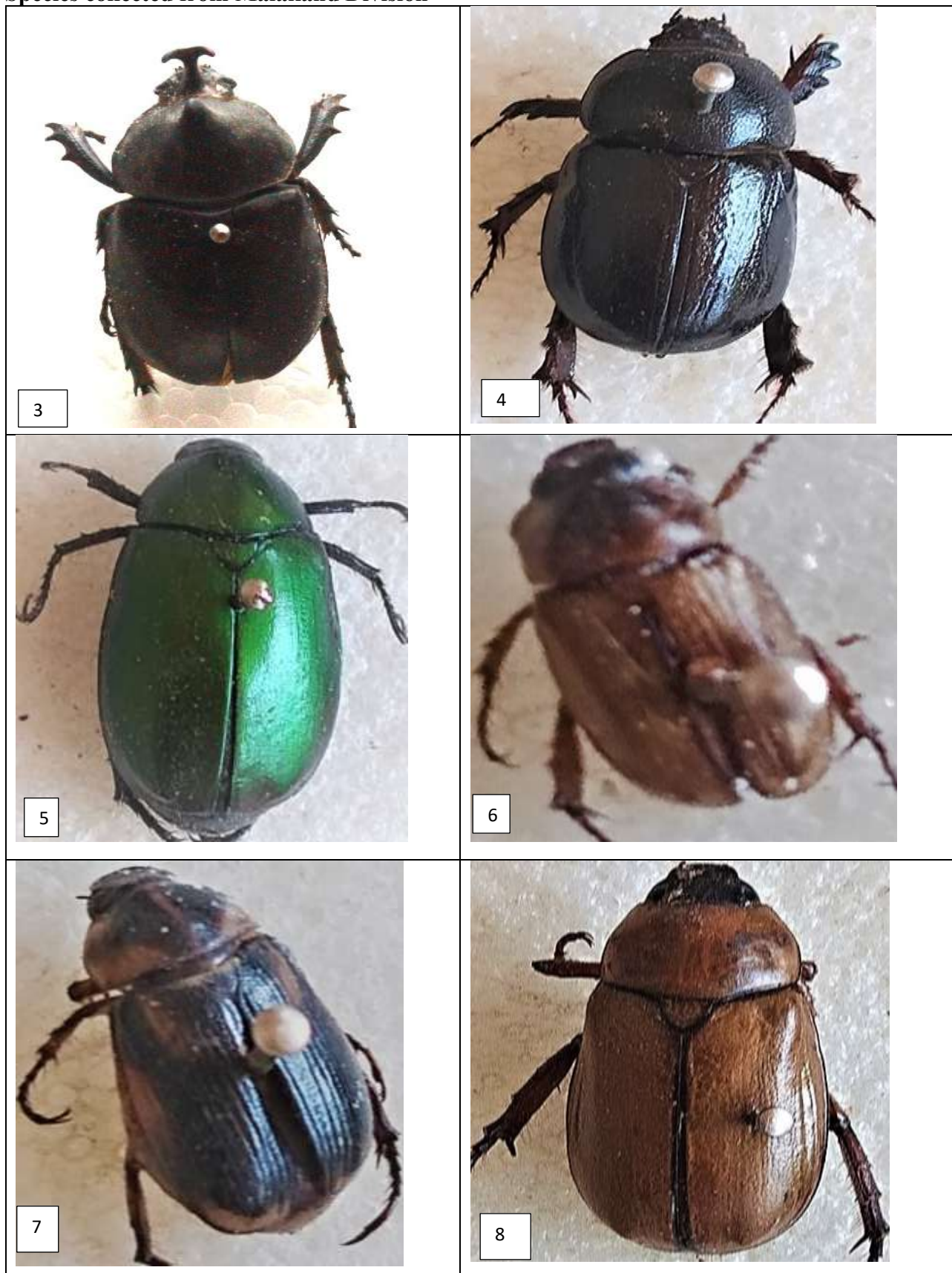
Oniticellus cinctus (Fabricius, 1775), from the Scarabaeinae subfamily, has been observed in Pakistan. The species measures 13 mm in length and 7 mm in width, with an oval, elongated shape and black coloration. The head features a slightly bidentate clypeus with two denticles. The thorax has a partial median stripe on the pronotum. The wings are well-defined with elytral striae bordered in yellow. The legs are equipped with tibial spurs and small hairs **(Figure: 42)**. This species is found in Burma, South China, India, and Pakistan (Arrow, 1931).

Tiniocellus modestus (Roth, 1851), a species from the Scarabaeidae family, is found in Pakistan. This species measures 6-7 mm in length and 3.4-4.2 mm in width, with an oval and convex shape. Its color is brownish or dark brown. The head is small and semi-circular. The thorax features a hairy black pronotum with a green metallic luster, and contains a medial basal depression with fine punctures. The wings have dark brown elytra with dull black spots and bristles. The legs are narrow, with spines and a tibial spur present **(Figure: 43)**. This species is distributed in India and Pakistan (Nasir et al., 2016).

Metacatharsius inermis (Laporte, 1840), a species from the Scarabaeinae subfamily, has been recorded in Pakistan. This species measures 21-23 mm in length and 12-13 mm in width, with an oval, convex shape and a black color. The head is broad, diagonally rugose, with a short nodule between the eyes, and the clypeus is semi-circular, expunged in the middle. The thorax has a broad and convex pronotum. The elytra are finely punctured with small striations, and the pygidium has dense and deep punctures. The front tibiae possess three transverse external denticles **(Figure: 44)**. This species is found in regions such as Ethiopia, Arabia, Africa, India, and Pakistan (Siddiqui et al., 2014; Abbas, 2015).

Phyllognathus dionysius (Fabricius, 1792) is a dung beetle species identified across various regions of Pakistan, including Swat, Buner, Chitral, and Malakand, with the material examined spanning from 2019 to 2021. The male measures 20 mm in length and 13 mm in width, while the female is 22 mm in length with the same width. Characterized by an oval and convex shape, the beetle exhibits a dark brown to purple color, with a rounded clypeus and mandibles extending sideways. The male features a single horn on its head, absent in females. The species has broad brownish thorax and shiny, dark brown elytra, with wide frontal and small, spiny hind legs. It is distributed across the Palearctic, Ethiopian, and Oriental regions, with its first recorded sighting in Pakistan (Siddiqui et al., 2005; Drumont et al., 2009).

Species collected from Malakand Division





9



10



11



12



13



14







27



28



29



30



31



32



33



34



35



36



37



38





Fig.3 *Xylotrupes ulysses*, **Fig. 4** *Pentodon idiota*, **Fig. 5** *Anomala dimidiata*, **Fig.6** *Anomala varicolor*, **Fig. 7** *Anomala rugosa*, **Fig.8** *Anomala bengalensis*, **Fig.** *Anomala dubia*, **Fig. 10** *Adoretus lasiopygus*, **Fig.11** *Lepidiota munda*, **Fig. 12** *Maladera castanea*, **Fig. 13** *Clinteria confinis*, **Fig.14** *Chiloloba acuta*, **Fig. 15** *Cetonia aurata*, **Fig. 16** *Torynorrhina flammea*, **Fig. 17** *Torynorrhina hyacinthine*, **Fig. 18** *Heterorrhiniola porphyretica*, **Fig.19** *Oxycetonia versicolor*, **Fig. 20** *Onitis lama*, **Fig. 21** *Onitis falactus*, **Fig.22** *Onitis philemon*, **Fig. 23** *Gymnopleurus bombayensis*, **Fig. 24** *Gymnopleurus cyaneus*, **Fig. 25** *Gymnopleurus flagellates*, **Fig.26** *Gymnopleurus mopsus*, **Fig. 27** *Paragymnopleurus sinuatus assamensis*, **Fig. 28** *Digitonthaphagus gazella*, **Fig.29** *Digitonthaphagus bonasus*, **Fig. 30** *Onthophagus ramosus*, **Fig. 31** *Onthophagus gazella*, **Fig. 32** *Onthophagus paliceps*, **Fig.33** *Onthophagus nuchicornis*, **Fig. 34** *Heliocopris midas*, **Fig.35** *Copris (Paracopris) punjabensis*, **Fig. 36** *Copris lunaris*, **Fig.37** *Sisyphus longipes*, **Fig.** *Garereta lugens*, **Figure 39** *Phalops divisus*, **Fig.40** *Catharsius pithecius*, **Fig.41** *Catharsius molossus*, **Fig. 42** *Oniticellus cinctus*, **Fig.43** *Tiniocellus modestus*, **Fig. 44** *Metacatharsius inermis*, and **Fig. 45** *Phyllognathus dionysius*.

Table Title: 10 Diversity Indices and Statistical Significance of Beetle Populations Across Sampling Sites (Malakand Division)

Site	Inverse Simpson	Shannon	Simpson	Fisher Alpha	Shannon P-Value	Simpson P-Value	Fisher P-Value	Inverse Simpson P-Value
Swat	18.29	2.95	0.95	22.82	0.433	0.433	0.719	0.433
Buner	22.12	3.13	0.95	10.01	0.433	0.433	0.719	0.433
Upper Chitral	21.07	3.10	0.95	12.20	0.433	0.433	0.719	0.433
Dargai	22.04	3.14	0.95	10.20	0.433	0.433	0.719	0.433
Shangla	22.86	3.15	0.96	11.62	0.433	0.433	0.719	0.433
Dir Upper	16.41	2.89	0.94	17.08	0.433	0.433	0.719	0.433
Dir Lower	22.46	3.14	0.96	10.20	0.433	0.433	0.719	0.433
Lower Chitral	20.74	3.08	0.95	11.81	0.433	0.433	0.719	0.433
Batkhela	20.55	3.07	0.95	12.53	0.433	0.433	0.719	0.433

Inverse Simpson Index:

This index measures species distribution and evenness, with higher values indicating more even distribution. Values ranged from 16.41 (Dir Upper) to 22.86 (Shangla), but the statistical tests (p -value = 0.433) show no significant difference between sites. This suggests that species are generally evenly distributed across the region.

Shannon Index:

The Shannon Index measures both species richness and evenness. It shows stability across sites with values between 2.95 and 3.15, indicating consistent species diversity and evenness. The p -value of 0.433 shows no significant differences between the sites, reinforcing the stability of beetle diversity across the region.

Simpson Index:

The Simpson Index assesses species dominance, with higher values reflecting higher dominance by fewer species. The values remained between 0.94 and 0.96, suggesting moderate dominance. Again, no significant differences were found (p -value = 0.433), indicating a balanced level of dominance across the sites.

Fisher Alpha Index:

Fisher Alpha measures species richness, with values ranging from 10.01 to 22.82. This index remained relatively stable across all sites, suggesting that the number of species did not fluctuate significantly. The p -value of 0.719 confirms no significant difference in species richness between sites.

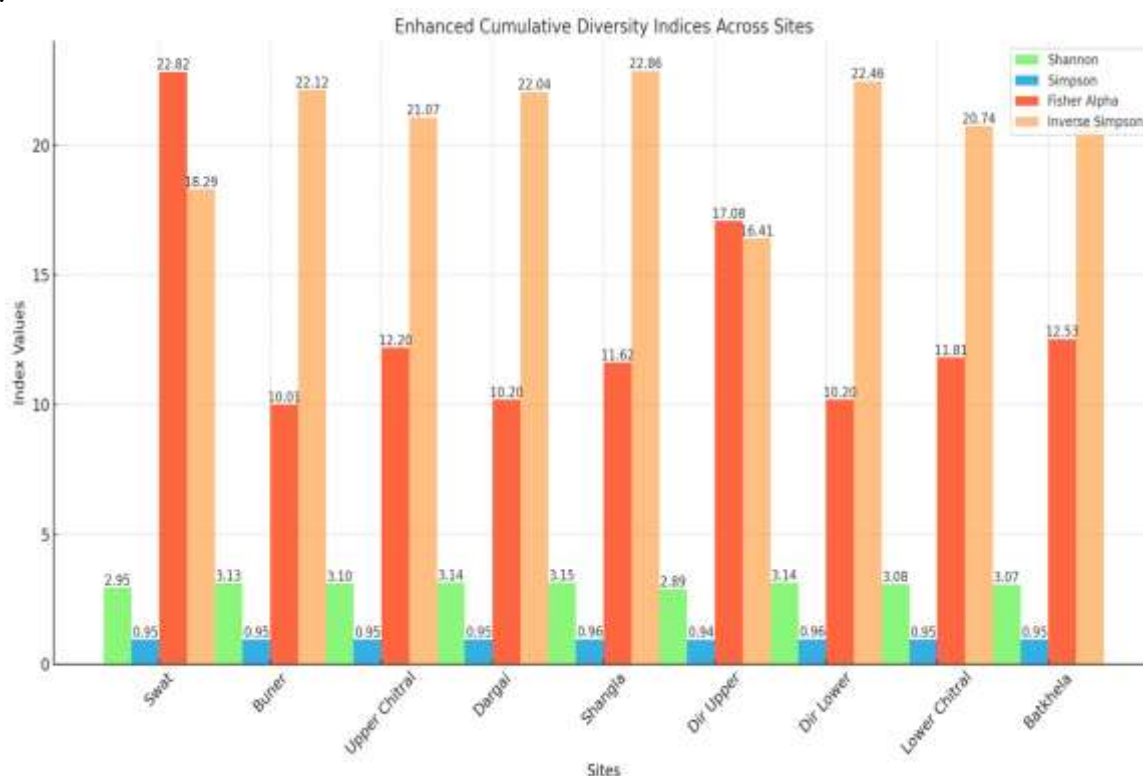


Figure: 46 Diversity indices (Shannon, Simpson, Inverse Simpson, and Fisher Alpha) with distinct colors for each index.

DISCUSSION

In the current Survey, a total of 2698 specimen of beetles were collected from different localities of Malakand division, Khyber Pakhtunkhwa, Pakistan. The collection was carried out during active season (in the months May to September) of 2019, 2020 and 2021. Among these specimens 2698 species were identified that belongs to 27 genera and 42 species.

All the collected samples 2698 of Dung Beetles were belongs to family *Scarabaeidae* represented by 43 species, 27 genera. Collected species were *Xylotrupes Ulysses*, *Phyllognathus dionysius*, *Pentodon algerinus*, *Anomala dimidiata*, *Anomala varicolor*, *Anomala rugosa*, *Anomala bengalensis*, *Anomala dubia*, *Adoretus lasiopygus*, *Lepidiota munda*, *Maladera castanea*, *Clinteria confinis*, *Chiloloba acuta*, *Cetonia aurata*, *Torynorrhina flammea*, *Torynorrhina hyacinthine*, *Heterorrhiniola porphyretica*, *Oxycetonia versicolor*, *Onitis lama*, *Onitis falactus*, *Onitis philemon*, *Gymnopleurus bombayensis*, *Gymnopleurus cyaneus*, *Gymnopleurus flagellates*, *Paragymnopleurus sinuatus assamensis*, *Digitonthaphagus gazella*, *Digitonthaphagus bonasus*, *Onthophagus ramosus*, *Onthophagus gazella*, *Onthophagus paliceps*, *Onthophagus nuchicornis*, *Heliocopris midas*, *Copris (Paracopris) punjabensis*, *Copris lunaris*, *Sisyphus longipes*, *Garereta lugens*, *Phalops divisus*, *Catharsius pithecius*, *Catharsius molossus*, *Oniticellus cinctus*, *Tiniocellus modestus* and

Metacatharsius inermis respectively. The family Scarabaeidae was the most diverse and abundantly found in the Malakand Division.

Among 2698 species, 17 species of family Scarabaeidae (*Xylotrupes ulysses*, *Pentodon Algerinus*, *Anomala Dubia*, *Adoretus Lasiopygus*, *Lepidiota Munda*, *Maladera Castanea*, *Torynorrhina Flammea*, *Torynorrhina Hyacinthina*, *Heterorrhiniola Porphyretica*, *Oxycetonia Versicolor*, *Copris Lunaris*, *Garreta Lugens*, *Phalops Divisus*) are new to study area and recorded for the first time in Malakand Division. Siddiqui et al (2014) recorded 48 species of dung beetles of family Scarabaeidae that belongs to 7 tribes, 12 genera, 4 sub-genera from Pakistan. The species were *Catharsius molossus*, *Catharsius pithecius*, *Catharsius platypus*, *Metacatharsius inermis*, *Copris (C.) fricator*, *Copris punjabensis*, *Copris (C.) sarpedon*, *Paracopris excisus*, *Heliocopris midas*, *Garreta dejeanii*, *Garreta mundus*, *Gymnopleurus bombayensis*, *Gymnopleurus cyaneus*, *Gymnopleurus flagellates*, *Gymnopleurus miliaris*, *Paragymnopleurus sinuatus assamensis*, *Euoniticellus pallens*, *Tiniocellus imbellis*, *Cheironitis*, *Onitis crassus*, *Onitis excavates*, *Onitis falcatus*, *Onitis humerosus*, *Onitis lama*, *Onitis punctatostratus*, *Onitis singhalensis*, *Onitis virens*, *Onthophagus (Colobonthophagus) hindu*, *Onthophagus (Colobonthophagus) paliceps*, *Onthophagus (Colobonthophagus) ramosus*, *Onthophagus (Digitonthophagus) bonasus*, *Onthophagus gazella*, *Onthophagus (O.) quadridentatus*, *Onthophagus (E.) semicinctus*, *Onthophagus (F.) variegatus*, *Onthophagus mopsus*, *Onthophagus falsus*, *Onthophagus ramosellus*, *Proagoderus amplexus*, *Phalops cyanescens*, *Scarabaeus andrewesi*, *Scarabaeus brahminus*, *Scarabaeus cristatus cristatus*, *Scarabaeus gangeticus*, *Scarabaeus sacer*, *Sisyphus crispatus ssp. Hirtus*, *Sisyphus longipes* and *Sisyphus neglectus*. In the current inquiry 17 species of dung beetles of family Scarabaeidae (*Onitis lama*, *Onitis falactus*, *Gymnopleurus bombayensis*, *Gymnopleurus cyaneus*, *Gymnopleurus flagellates*, *Paragymnopleurus sinuatus assamensis*, *Digitonthaphagus gazella*, *Digitonthaphagus bonasus*, *Onthophagus ramosus*, *Onthophagus gazella*, *Onthophagus paliceps*, *Heliocopris midas*, *Copris (Paracopris) punjabensis*, *Sisyphus longipes*, *Catharsius pithecius* and *Catharsius molossus* and *Metacatharsius inermis*) are similar and 7 species of dung beetles of family Scarabaeidae (*Onitis philemon*, *Onthophagus nuchicornis*, *Copris lunaris*, *Garereta lugens*, *Phalops divisus*, *Oniticellus cinctus* and *Tiniocellus modestus*) are also in quested from study area. Fazal et al (2018) recorded 20 species of family Scarabaeidae that belongs to 18 genera from Azad Kashmir and Balochistan, Pakistan. The identified species were *Chiloloba acuta*, *Gametis jucunda*, *Clinteria kluge*, *Xylotrupes mnischei*, *Apogonia granum*, *Anomala dimidiata barbata*, *Anomala dorsalis*, *Anomala polita*, *Anomala rugosa*, *Eotrichia longipennis*, *Holotrichia problematica*, *Metacatharsius inermis*, *Gymnopleurus (Gymnopleurus) cyaneus*, *Gymnopleurus (Gymnopleurus) persianus*, *Paragymnopleurus sinuatus assamensis*, *Cheironitis osiridis*, *Onitis falcatus*, *Onitis subopacus*, *Digitonthophagus bonasus*, *Onthophagus (Colobonthophagus) hindu*, *Onthophagus (Proagoderus) amplexus*, *Onthophagus ramosellus*, *Escarabaeus bannuensis* and *Sisyphus (Sisyphus) crispatus hirtus*. In the current research, 9 species of family Scarabaeidae (*Chiloloba acuta*, *Anomala rugosa*, *Onitis lama*, *Onitis falactus*, *Gymnopleurus cyaneus*, *Paragymnopleurus sinuatus assamensis*, *Digitonthaphagus bonasus*, *Onthophagus ramosus* and *Metacatharsius inermis*) are similar and 33 species of family Scarabaeidae (*Xylotrupes Gideon sondaicus*, *Phyllognathus dionysius*, *Pentodon algerinus*, *Anomala dimidiata*, *Anomala varicolor*, *Anomala bengalensis*, *Anomala dubia*, *Adoretus lasiopygus*, *Lepidiota munda*, *Maladera castanea*, *Clinteria confinis*, *Cetonia aurata*, *Torynorrhina flammea*, *Torynorrhina hyacinthine*, *Heterorrhiniola porphyretica*, *Oxycetonia versicolor*, *Onitis philemon*, *Gymnopleurus bombayensis*, *Gymnopleurus flagellates*, *Digitonthaphagus gazella*, *Onthophagus gazella*, *Onthophagus paliceps*, *Onthophagus nuchicornis*, *Heliocopris midas*, *Copris (Paracopris) punjabensis*, *Copris lunaris*, *Sisyphus longipes*, *Garereta lugens*, *Phalops divisus*, *Catharsius pithecius*, *Catharsius molossus*, *Oniticellus cinctus* and *Tiniocellus modestus*) are also investigated from this area. Ali et al (2015) recorded 14 species of dung beetles of family Scarabaeidae that belongs to 5 genera and 3 tribes from Pothohar Plateau of Punjab, Pakistan. The identified species were *Onthophagus gazella*, *Onthophagus (Digitonthophagus) bonasus*, *Onthophagus (Furconthophagus) variegates*, *Onthophagus (O.) Catta*, *Oniticellus pallens*, *Oniticellus spinipes*, *Oniticellus cinctus*, *Drepanocerus setosus*, *Onitis subopacus*, *Onitis virens*, *Onitis castaneus*, *Onitis*

crassus and *Chironitis indicus*. Among these 4 species, *Oniticellus pallipes* (Fabricius, 1781), *Oniticellus spinipes* (Roth, 1851), *Oniticellus cinctus* (Fabricius, 1775) and *Drepanocerus setosus* (Wiedemann, 1823) were recorded for the first time from Pakistan. In this exploration, 4 species of dung beetles of family Scarabaeidae (*Digitonthaphagus gazella*, *Digitonthaphagus bonasus*, *Onthophagus gazella* and *Oniticellus cinctus*) are similar and 20 species of dung beetles of family Scarabaeidae (*Onitis lama*, *Onitis falactus*, *Onitis philemon*, *Gymnopleurus bombayensis*, *Gymnopleurus cyaneus*, *Gymnopleurus flagellates*, *Paragymnopleurus sinuatus assamensis*, *Onthophagus ramosus*, *Onthophagus paliceps*, *Onthophagus nuchicornis*, *Heliocopris midas*, *Copris* (*Paracopris*) *punjabensis*, *Copris lunaris*, *Sisyphus longipes*, *Garereta lugens*, *Phalops divisus*, *Catharsius pithecius*, *Catharsius molossus*, *Tiniocellus modestus* and *Metacatharsius inermis*) are also explored from this area. Chandra and Gupta (2013) identified 43 species of beetles in two families, Hybosoridae and Scarabaeidae of the superfamily Scarabaeoidea that belongs to 25 genera, 16 tribes and eight subfamilies from Barnawapara Wildlife Sanctuary, Chhattisgarh, India. The identified species were *Hybosorus orientalis*, *Orphnus impressus*, *Aphodius* (*Calaphodius*) *moestus*, *Scarabaeus* (*Kheper*) *sanctus*, *Sisyphus* (*Sisyphus*) *longipes*, *Gymnopleurus* (*Gymnopleurus*) *cyaneus*, *Paragymnopleurus sinuatus*, *Heliocopris Bucephalus*, *Gymnopleurus* (*Metagymnopleurus*) *gemmatus*, *Catharsius* (*Catharsius*) *molossus*, *Gymnopleurus* (*Metagymnopleurus*) *miliaris*, *Catharsius* (*Catharsius*) *sagax*, *Garreta dejeani*, *Garreta mundus*, *Copris* (*Paracopris*) *surdus*, *Caccobius* (*Caccophilus*) *unicornis*, *Onthophagus* (*Onthophagus*) *dama*, *Onthophagus* (*Colobonthophagus*) *hindu*, *Onthophagus* (*Onthophagus*) *griseosetosus*, *Onthophagus gazella*, *Onthophagus* (*Onthophagus*) *ramosus*, *Onthophagus* (*Onthophagus*) *spinifex*, *Onthophagus* (*Onthophagus*) *abreui*, *Onthophagus* (*Onthophagus*) *unifasciatus*, *Onthophagus* (*Onthophagus*) *abreui*, *Onthophagus* (*Onthophagus*) *unifasciatus*, *Onthophagus* (*Onthophagus*) *cervus*, *Onthophagus* (*Onthophagus*) *quadridentatus*, *Onthophagus* (*Proagoderus*) *Pactolus*, *Onthophagus* (*Serrophorus*) *Sagittarius*, *Onitis philemon*, *Onitis subopacus*, *Oniticellus* (*Oniticellus*) *cinctus*, *Tiniocellus spinipes*, *Tibiodrepanus setosus*, *Mimela macleayana*, *Adoretus duvauceli*, *Clinteria kluge*, *Phyllognathus dionysius*, *Eophileurus platypterus*, *Holotrichia sculpticollis*, *Schizonychia ruficollis* and *Apogonia proxima*. In this examination, 9 species of family Scarabaeidae (*Phyllognathus dionysius*, *Onitis philemon*, *Gymnopleurus cyaneus*, *Digitonthaphagus gazella*, *Onthophagus ramosus*, *Onthophagus gazella*, *Sisyphus longipes*, *Catharsius molossus* and *Oniticellus cinctus*) are similar and 33 species of family Scarabaeidae (*Xylotrupes Gideon sondaicus*, *Pentodon algerinus*, *Anomala dimidiata*, *Anomala varicolor*, *Anomala rugosa*, *Anomala bengalensis*, *Anomala dubia*, *Adoretus lasiopygus*, *Lepidiota munda*, *Maladera castanea*, *Clinteria confinis*, *Chiloloba acuta*, *Cetonia aurata*, *Torynorrhina flammea*, *Torynorrhina hyacinthine*, *Heterorrhiniola porphyretica*, *Oxycetonia versicolor*, *Onitis lama*, *Onitis falactus*, *Gymnopleurus bombayensis*, *Gymnopleurus flagellates*, *Paragymnopleurus sinuatus assamensis*, *Digitonthaphagus bonasus*, *Onthophagus paliceps*, *Onthophagus nuchicornis*, *Heliocopris midas*, *Copris* (*Paracopris*) *punjabensis*, *Copris lunaris*, *Garereta lugens*, *Phalops divisus*, *Catharsius pithecius*, *Tiniocellus modestus* and *Metacatharsius inermis*) are also examined from this study area. Satheesha et al (2018) recorded 29 species of beetles that belongs to 10 families from Davangere University Campus, Davangere, Karnataka. Scarabaeidae was the most dominant family with 10 species followed by Coccinellidae with 7 species, Tenebrionidae with 4 species, Histeridae with 2 species, Cerambycidae, Chrysomelidae, Curculionidae, Dynastidae, Elateridae and Hydrophilidae with 1 species each. The Scarabaeidae species were *Oniticellus cinctus* Fabricius, *Liatongus rhadamistus*, *Scaptodera rhadamistus*, *Onthophagus Taurus*, *Onthophagus gazella*, *Apogonia apogonia*, *Anomala varicolor*, *Anomala pallida*, *Digitonthaphagus gazella*, and *Holotrichia serrata*. In the current study 38 species of family Scarabaeidae (*Xylotrupes Gideon sondaicus*, *Phyllognathus dionysius*, *Pentodon algerinus*, *Anomala dimidiata*, *Anomala rugosa*, *Anomala bengalensis*, *Anomala dubia*, *Adoretus lasiopygus*, *Lepidiota munda*, *Maladera castanea*, *Clinteria confinis*, *Chiloloba acuta*, *Cetonia aurata*, *Torynorrhina flammea*, *Torynorrhina hyacinthine*, *Heterorrhiniola porphyretica*, *Oxycetonia versicolor*, *Onitis lama*, *Onitis falactus*, *Onitis philemon*, *Gymnopleurus bombayensis*, *Gymnopleurus cyaneus*, *Gymnopleurus flagellates*, *Paragymnopleurus sinuatus assamensis*,

Digitonthophagus bonasus, *Onthophagus ramosus*, *Onthophagus paliceps*, *Onthophagus nuchicornis*, *Heliocopris midas*, *Copris (Paracopris) punjabensis*, *Copris lunaris*, *Sisyphus longipes*, *Garereta lugens*, *Phalops divisus*, *Catharsius pithecius*, *Catharsius molossus*, *Tiniocellus modestus*, *Metacatharsius inermis*) are different and 4 species (*Oniticellus cinctus*, *Onthophagus gazella*, *Anomala varicolor* and *Digitonthophagus gazella*) are similar to the above study. Arya et al (2016) reported 23 species, 18 genera and 6 families from Uttarakhand, India during the study period. On the basis of total number of species, *Scarabaeidae* was the most dominant family with 8 species followed by *Chrysomelidae* (5 species), *Coccinellidae* (2 species), *Meloidae* (2 species). The *Scarabaeidae* species were *Anomala lineatopennis*, *Gymnopleurus subtilis*, *Jumnos roylei*, *Lachnosterna cavifrons*, *Lytta limbata*, *Onthophagus gagates*, *O. rubricollis*, *Protaetia neglacta*, *P. pretiosa*, *Pseudolucanus cantor* and *Scarites sulcatus*. In this study all the 43 species of family *Scarabaeidae* were collected from different locality of the study area but no similar species are found in both studies. Abbas et al., (2024) worked on preserved specimens in Pakistan Museum of Natural History Islamabad (PMNH), these samples were randomly collected from various parts of the indo-Pak subcontents and identified 605 specimens. All the specimens were belonging to Family *Scarabaeidae* represented by 26 species and 12 genera these are *Heliocopris midas*, *Heliocopris ares*, *Heliocopris dominus*, *Catharsius molossu*, *Catharsius granulathus*, *Catharsius pithecus*, *Metacatharsius inermis*, *Copris sacontala*, *Copris sarpendon*, *Digitonthophagus bonasus*, *Onthophagus conspersus*, *Onthophagus nigrimargo*, *Onthophagus ramosus*, *Onthophagus falsus*, *Onthophagus concolor*, *Onithis falcatus*, *Onithis lama*, *Onithis philomon*, *Onithis subopacus*, *Onithis virens*, *Cheironitis arrowi*, *Euoniticellus fulvus*, *Gymnopleurus flagellatus hornei*, *Gymnopleurus miliaris*, *Scarabaeus bannuensis* and *Sisyphus longipes*.

CONCLUSION:

Dung beetles play an important role in keeping terrestrial ecosystems healthy by supporting nutrient cycling, soil aeration, pest control, and seed dispersal. Their variety helps maintain ecological balance. In this study, we examined dung beetle diversity, their ecological roles, and the factors affecting their distribution in the Malakand Division of Khyber Pakhtunkhwa, Pakistan, from 2019 to 2021. We identified 42 species from 27 genera in the *Scarabaeidae* family, including 17 species not previously recorded in Pakistan, such as *Xylotrupes ulysses*, *Phyllognathus dionysius*, *Anomala dimidiata*, and *Oniticellus cinctus*.

We found a moderate to high level of species diversity, with Shannon Index values between 2.89 and 3.17. Simpson Index values from 0.94 to 0.96 showed a balanced community with little species dominance. Changes in the Inverse Simpson Index over time pointed to shifts in which species were most common, likely due to environmental changes affecting resources. Still, the Fisher Alpha Index stayed consistent, suggesting a stable group of species overall. Dung beetles help keep ecosystems healthy through decomposition, nutrient cycling, pest control, and supporting plant growth.

Human activities like deforestation, intensive farming, and pesticide use threaten dung beetle populations by reducing dung and damaging their habitats. To protect these important species, we need strong conservation efforts. Long-term monitoring of dung beetle populations can help us understand how climate change and human actions affect their diversity and the roles they play in ecosystems.

RECOMMENDATIONS:

1. conservation and habitat protection: focus on conserving natural habitats by reducing deforestation and protecting forests, grasslands, and wetlands. this helps maintain beetle diversity and keeps ecosystems healthy.
2. **Sustainable Agricultural Practices:** Reducing the use of pesticides, herbicides, and fertilizers helps protect dung beetles and other wildlife. Choosing organic farming and integrated pest management supports healthy dung beetle populations.
3. **Awareness and Education:** Teaching local communities about the importance of dung beetles can improve conservation and encourage farming that supports biodiversity.

4. **Long-term Monitoring and Research:** Setting up long-term monitoring helps track dung beetle populations and see how changes like climate shifts or land use affect their diversity and communities.
5. **Restoration of Degraded Habitats:** Restoring habitats should include bringing back important plants and animals and making sure there is enough dung by managing livestock well.
6. **Legal Protection for Species:** Conservation policies should include dung beetles that play key ecological roles, protecting them from losing their habitats or being overused.
7. **Promoting Research on Ecological Roles:** More research is needed to understand how dung beetles help with nutrient cycling, soil health, pest control, and spreading seeds.
8. **Collaboration Between Stakeholders:** Researchers, government agencies, and local communities need to work together to create and carry out strong conservation plans.
9. **Encouraging Ecosystem-Friendly Infrastructure Development:** When building cities or roads, it is important to consider nature, like adding wildlife corridors, to reduce breaking up habitats.
10. **Incentivizing Biodiversity-Friendly Farming:** Offering financial support, like subsidies for organic farming and conservation, can motivate farmers to use practices that help dung beetles and boost biodiversity.

Acknowledgements:

The authors express their sincere gratitude to all collaborators and institutions who supported this research. This work was conducted independently, with no external funding sources.

Conflict of Interest Statement:

The authors declare no conflicts of interest in the conduct or publication of this research.

Authors' Contributions:

Israr Alam: (PhD Scholar), and Currently Lecturer department of zoology University of Buner data collection, statistical analysis, manuscript preparation.

Munawar Saleem Ahmad: advanced statistical analysis, manuscript revision.

Khushi Muhammad: Literature review, data interpretation, manuscript revision.

Abdul Aziz: fieldwork coordination.

Anwar Sultana: manuscript review, and supervision.

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