Article

Species composition and richness of bugs (Hemiptera) fauna in Tehsil Sheringal, District Upper Dir, Khyber Pakhtunkhwa, Pakistan

Sher Abdullah[1], **Rooh Ullah**[1], **Ahmed Zia**[2], **Sumera Aslam**[3], **Inayat ul Islam**[1], **Bibi Shabnem**[4]

[1]Department of Zoology, Shaheed Benazir Bhutto University, Sheringal, Upper Dir, Khyber Pakhtunkhwa, Pakistan

[2]National Insect Museum, NARC Islamabad, Pakistan

[3]Honey Bee Research Institute, NARC Islamabad, Pakistan

[4]Department of Zoology, Hazara University, Mansehra, Pakistan

E-mail: sherabdullaha@gmail.com

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Abstract

The present study was conducted to explore the diversity of bugs in the Sheringal Valley, District Upper Dir, Khyber Pakhtunkhwa, Pakistan. Field visits were carried out from March to September 2025 in various localities including Cham, Shahoor, SBBU, Siah Sheringal, Samang, and Gurlai. Specimens were collected through Sweep net, beating sheet, hand collection and identified under stereomicroscope. A total of 93 specimens were collected and identified under 7 families, 7 subfamilies, and 15 species. Among the collected specimens, *Eurydema lituriferum* was recorded more frequent, comprising 20 specimens. Conversely, *Spilostethus hospes* was represented by a single specimen. Extended surveys covering additional localities and multiple seasons are required for reliable abundance assessments. More research focus on studying the bugs nymphal stages and in different seasons/time of the year is suggested in the study area that will play a crucial role in their management.

Keywords Hemiptera; species; Pentatomidae; Sheringal; Upper Dir; Pakistan.

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1 Introduction

Hemiptera is a diverse insects order and true bugs are members of this broad order and are characteristically identified by the specific odor which are emitted from their special gland called metathoracic scent gland (Schuh & Slater, 1995). Hemiptera is divided into 133 families and comprising approximately 184000-193000 species (Chandra & Kushwaha, 2013). The Heteroptera suborder has about 40,000 species (Ali et al., 2020). Insects belong to order Hemiptera possess unique mouthparts which are their characteristic feature and specially used for piercing and sucking the juice of plants. In these types of insects, the palps and labium are

modified into a beak-like structure known as the rostrum, which includes two pairs of slender stylets analogous to the mandibles and maxillae found in other insects (Stonedahl & Dolling, 1991). These insects show a clear separation between their forewings and hindwings.

The forewings are characterized by a basal portion that is leathery and an apical portion that is membranous, a condition referred to as hemelytra. The venation of the membranous part of the forewings varies among different families. Their hindwings are entirely membranous and usually smaller in size (Wootton & Betts, 1986). Wings or wing musculature in some heteropteran species is reduced and there are species that in this respect are sexually dimorphic, many are good flyers, and capable of making long-distance negotiation (Rabitsch, 2010). Well-developed scent glands, which typically appear in the abdomen in immature stages and the metathorax in adults, are a defining feature of true bugs, which are tiny chemical factories. Strong irritants, the scent glands' secretions act as powerful chemical barriers (Millar, 2004). Because of their highly specialized mouthparts, which are adapted to piercing and sucking heteropterans feed on any form of food item such as plants, fungi, small animals and even blood of vertebrates such as humans (Ghahari et al., 2023).

True bugs have predatory species that prey on insect larvae, such as those of beetles and moths. For example, bugs in the Pentatomid subfamily Asopinae are effective biological control agents targeting lepidopteran larvae, while some Reduviidae family members are hematophagous that feed on blood (Ambrose, 2000). Their mouthparts are specially designed to pierce and suck and can be project either forward (prognathous) or downward (hypognathous) from the head (Panizzi, 2000). Stink bugs, members of the family Pentatomidae are widespread and found in diverse habitats including agricultural fields, gardens, grasslands, and forests. These insects prefer areas rich in vegetation, especially those with fruiting plants or crops, feeding primarily on plant sap through their piercing-sucking mouthparts. Certain assassin bugs display specialization in preying upon particular arthropod groups such as ants, millipedes, and termites (Weirauch et al., 2014). The mouthparts, which have developed into sucking stylets, are one of the distinguishing characteristics designed to consume liquid food and inject digestive salivary gland secretions; limited diets are frequently noted. While some species are generalists (poly-phagous), feeding on dozens to hundreds of different host plants, the majority are plant-feeders (phytophagous). Several species are of considerable economic concern in agriculture or (more rarely) forestry, many species are predatory and some are used as biocontrol agents against agricultural pests (Schaefer & Panizzi, 2000).

Heteroptera have many species that are regarded to be significant pests, due to immediate impact of feeding on plants and animals or serving as vectors of pathogenic microorganisms like protozoans, bacteria and viruses (Ghahari et al., 2023).The coreid bug drains the pulp out of the fingers and the feeding damage leads to the formation of black sunken dots on the peel (Padmanaban et al., 2016). They undergo incomplete metamorphosis or hemimetabolous development which Include three basic phases that are adult stage, nymph stage, and egg stage.

2 Materials and Methods

2.1 Study area

District Upper Dir is located in the Malakand Division of Khyber Pakhtunkhwa, Pakistan. Geographically, it lies between 35°04′ to 35°46′ North latitudes and 71°32′ to 72°22′ East longitudes, covering an area of approximately 3,699 square kilometers. It is bordered by Chitral to the north, Swat to the east, Lower Dir to the south, and Afghanistan to the northwest. Administratively the district is divided into three subdivisions namely Dir, Wari and Sheringal (Asmat et al., 2011). The district is home to a population of 1,083,566 people (Pakistan Census, 2023). Sheringal is a small valley in Dir Upper with a total area is 7992.7 acres (Perveen,

2016) and situated between ever green mountains at an average height of 2000 meters above sea level. The valley was separated by the Panjkora River into left and right side and is flowing north to south before joining the Swat River near Bosaq.

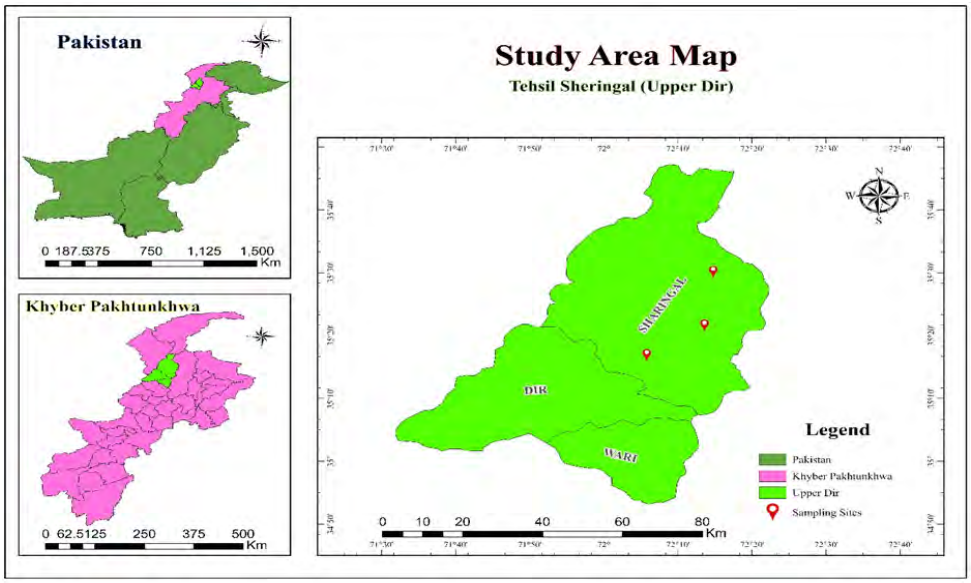

Fig. 1 Map of study area, Sheringal Valley where specimens were collected.

2.2 Specimens collection

The present survey was conducted in Tehsil Sheringal, District Dir Upper, Khyber Pakhtunkhwa, Pakistan. Field visits were carried out from March to September 2025 in various localities. In tehsil Sheringal, sites including Cham, Shahoor, SBBU, Siah Sheringal, Samang and Gurlai were visited. Each locality was visited on a weekly basis under clear sunny weather conditions. Insect Collection was carried out daily from 9:00 am to 5:00 pm. Insect specimens were collected through sweep net, beating sheet, hand collection and light traps (Ullah et al., 2018). Collected specimens were preserved and later deposited at the National Insect Museum (NIM), NARC, Islamabad for identification and future reference.

Fig. 2 Pictures A and B for *Erthesina fullo* collected during field work.

2.3 Mounting and preservation

Specimens were euthanized upon collection. Larger insects were pinned through the thorax, while smaller ones were glued to triangular card points. All specimens were stored in Styrofoam-lined wooden boxes with naphthalene balls to prevent damage. Each specimen was labeled with locality, date, collector name, and host plant (Ullah et al., 2018).

2.4 Taxonomic identification and photography

Specimens were recognized using taxonomic keys down to the species level., regional catalogues and morphological characters under a stereo zoom microscope. Key traits such as rostrum, antennae, hemelytra, pronotum, labium, and corium were used (Ahmad et al., 2021). Images were taken using a Nikon FSi2 camera and edited using Adobe Photoshop (Zaman et al., 2022a).

2.5 Distribution and mapping

GPS-based locality data (latitude, longitude, and elevation) were recorded. Distribution maps were created using Google Earth to visualize species range across the study area and compare globally.

2.6 Statistical analysis

Data were compiled in Microsoft Excel. Species diversity and composition were calculated at the family and genus level. Species representation percentage was computed using the formula % Species strength = (Number of species in a genus / Total number of species) × 100 (Zaman et al., 2022b).

3 Results

Field surveys were conducted during the summer months from March to September 2025, in sunny days. Sampling took place from six locations within the study area, including Cham, Shahoor, SBBU, Siah Sheringal, Samang and Gurlai. Different habitats such as agricultural fields, gardens, grasslands, and vegetated areas were targeted. Specimens were collected between 9:00 am and 5:00 pm using sweep nets and manual collection techniques. Total of 93 specimens were collected and identified, belonging to 7 families, 7 subfamilies, and 15 species. Among the collected specimens, Eurydema lituriferum was recorded more frequently during the sampling period, comprising 20 specimens and accounting for 21.50% of the total population sampled. Conversely, Spilostethus hospes was represented by a single specimen representing 1.07% of the population.

Table 1 Species richness of Hemiptera fauna in the Study Area.

Order	Family	Sub family	Genus	Species	No. of Specimens	% Composition
Hemiptera	Pentatomidae	Pentatominae	*Nizara*	*Nezara viridula*	10	10.75%
			Bagrada	*Bagrada hilaris*	4	4.30%
			Carpocoris	*Carpocoris nigricornis*	4	4.30%
			Eurydema	*Eurydema lituriferum*	20	21.50%
			Halyomorpha	*Halyomorpha halys*	10	10.75%
			Halys	*Halys dentatus*	10	10.75%

			Erthesina	*Erthesina fullo*	11	11.82%
	Coreidae	Coreinae	*Cletus*	*Cletus bipunctatus*	7	7.52%
	Lygaeidae	Lygaeinae	*Spilostethus*	*Spilostethus pandurus*	4	4.30%
				Spilostethus hospes	1	1.07%
	Alydidae	Alydinae	*Riptortus*	*Riptortus pedestris*	2	2.15%
	Cimicidae	Cimicinae	*Climex*	*Climex hemipterus*	1	1.07%
	Pyrrhocoridae	Pyrrhocorinae	*Antilochus*	*Antilochus coquebertii*	4	4.30%
			Dysdercus	*Dysdercus cingulatus*	3	3.22%
	Rhyparochoridae	Rhyparochorinae	*Appolonius*	*Appolonius indicus*	2	2.15%

Table 1 Taxonomic distribution of Bug families (genus, species, specimens with percentages).

Family	Number of Genus	Number of Species	Number of Specimens
Pentatomidae	7 (50.00%)	7 (46.67%)	69 (74.19%)
Coreidae	1 (7.14%)	1 (6.67%)	7 (7.53%)
Lygaeidae	1 (7.14%)	2 (13.33%)	5 (5.38%)
Alydidae	1 (7.14%)	1 (6.67%)	2 (2.15%)
Cimicidae	1 (7.14%)	1 (6.67%)	1 (1.08%)
Pyrrhocoridae	2 (14.29%)	2 (13.33%)	7 (7.53%)
Rhyparochoridae	1 (7.14%)	1 (6.67%)	2 (2.15%)

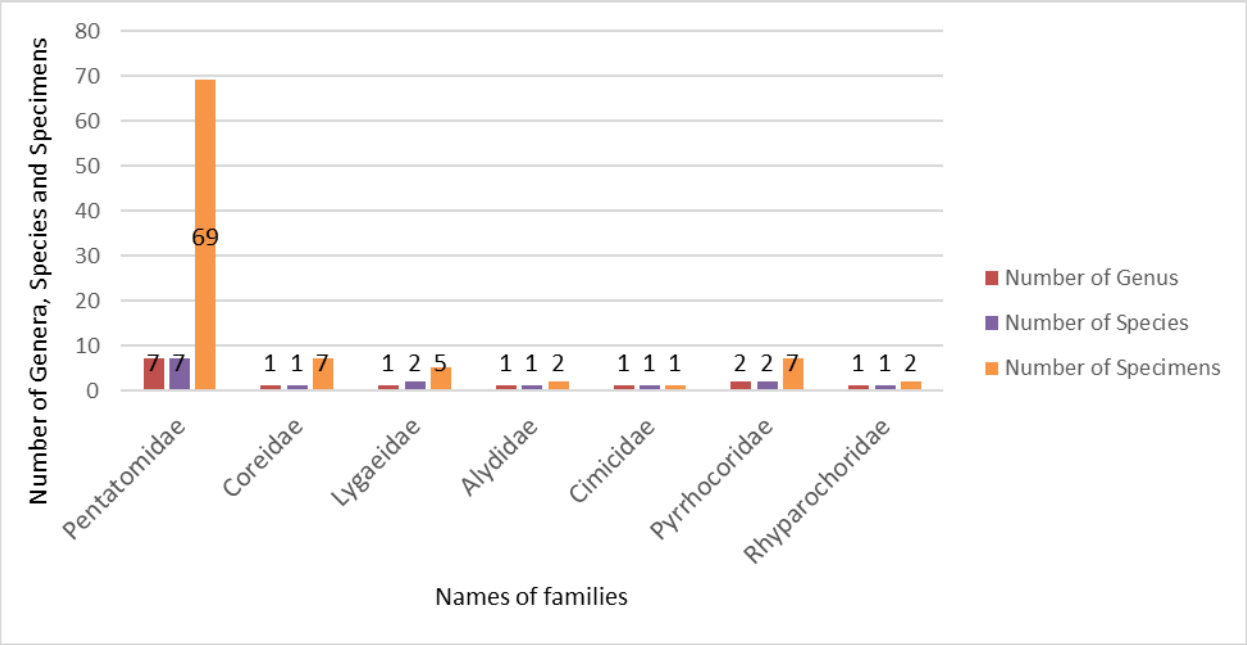

Fig. 3 Number of genus, species and specimens.

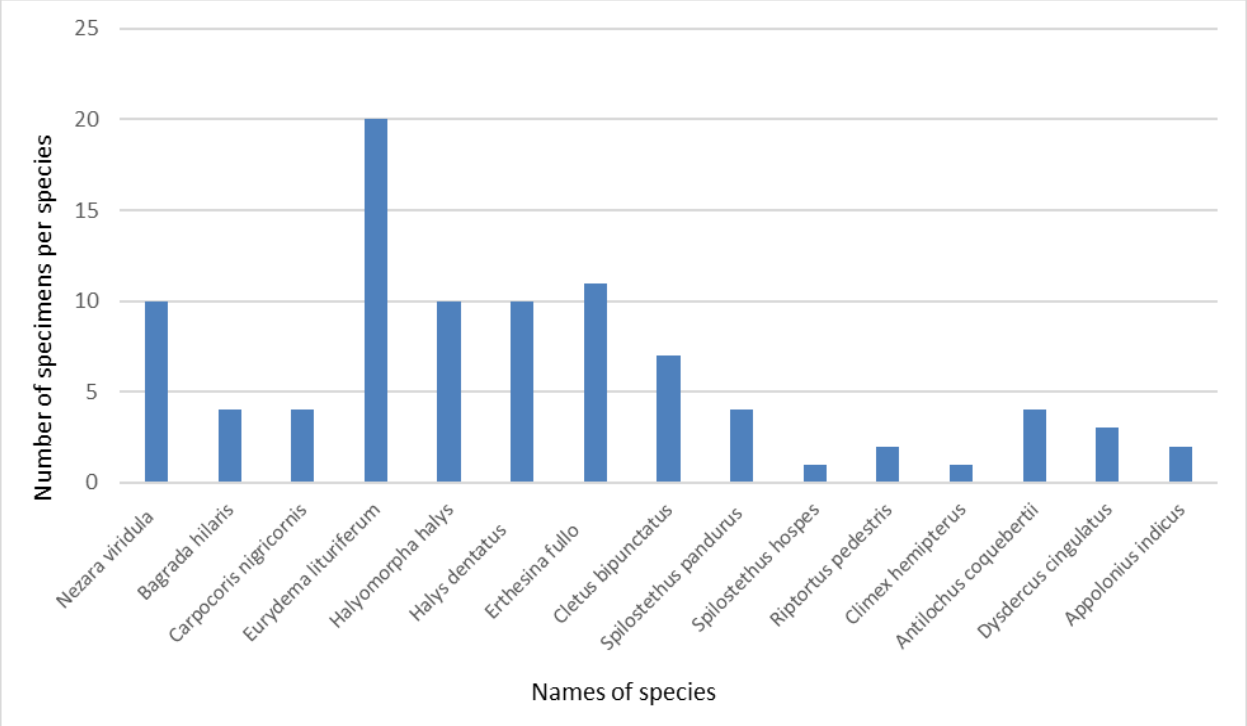

Fig. 4 Number of bugs specimens of study area.

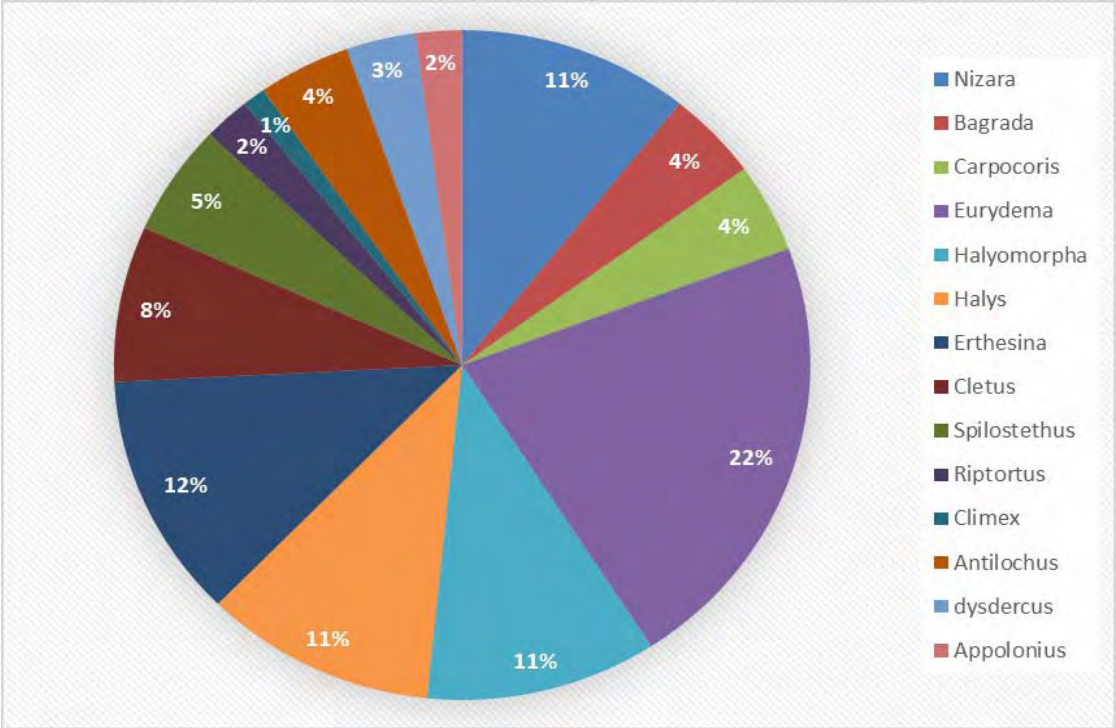

Fig. 5 Genera wise (%) composition of Hemiptera (true bugs).

4 Discussion

The present study was conducted to explore bugs fauna in the Sheringal Valley, Upper Dir, Khyber Pakhtunkhwa, Pakistan. By documenting species composition and richness of bugs fauna enhance our information about insect biodiversity in the Himalayan region. In the entire survey 93 specimens were collected comprised 15 species which were categorized into 14 genera, 7 families and 7 subfamilies. In my findings the family Pentatomidae was most frequent having genera of 50%, species of 46.67% and overall specimens collected was 74.19%. Family Pentatomidae are so widespread and diverse for several reasons. First of all, because they are phytophagous, and can feed on a wide variety of host plants, including many of the cultivated crops present in the agricultural settings of the research area (Rider et al., 2024). Second, because of their relatively large size and powerful sclerotization, they are more robust and easier to collect than smaller, more ambiguous groups. The need for careful observation of this group is highlighted by the documenting of seven species in this family, including significant ones like *Nezara viridula* and *Bagrada hilaris*. The most common species was observed to be *Eurydema lituriferum* with 21.50% and which is important pest of agriculture. Eurydema (cabbage stink bugs) is a genus with a widespread distribution throughout the Palearctic region, which contains several polyphagous species of the genus that normally feeds on cultivated or wild cabbages (Cruciferae) by sucking sap out of the leaves and leaving damaged areas whitish or yellowish (Piersanti et al., 2020). Their high population in the study area recommends the occurrence of special host plants and normal environment for breeding, which leads to a risk for local vegetable production. Likewise, the high incidence of the polyphagous pest *Erthesina fullo* (11.82%), which forages on fruit trees and forests (Magura et al., 2021), and the Brown Marmorated Stink Bug, *Halyomorpha halys* (10.75%), an extremely invasive and destructive pest of fruits and decorations (Leskey et al., 2012), indicating the bug fauna's probable

economic significance. Brown Marmorated stink bug is very mobile and is able to alternate hosts by shifting between plants that have early-ripening. fruits to the late-fruiting fruitful ones (Welty et al., 2008). According to their "Very Common" grade, these species are well fixed in the habitat. Their survival can be attributed to the Sheringal Valley's moderate environment, varied vegetation, and farming methods, which offer plenty of food supplies and habitats with little pressure from parasitoids or predators. A typical heteropteran community structure is reflected in the representation of several families, such as Coreidae, Pyrrhocoridae, and Lygaeidae, at lesser number (7.53%, 7.53%, and 5.38%, respectively), where a few families were in large number and several others contribute to the overall variety (Dolling, 1991).

It is important to pay attention to the scarcity of *Spilostethus hospes* (1.07%). Certain species may naturally be rare due to their specialized niches or poor capacity for dispersal (Gaston & Blackburn, 1996). It might, however, also mean that these species are at the boundary of their geographic distribution in Sheringal Valley or that there was insufficient sampling of their particular microhabitats or hosts during the study period.

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