



## A baseline study on the diversity of pentatomidae (order: hemiptera) in Bhavnagar, Gujarat

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### Abstract

This study investigates the diversity and distribution of Pentatomidae species in Bhavnagar, Gujarat, with a focus on their taxonomic classification and ecological roles. A total of 11 species were identified, all belonging to the Pentatomidae family, under the Hemiptera order and Heteroptera suborder. The species were classified into two subfamilies: Pentatominae (10 species) and Asopinae (1 species). The genus *Eysarcoris* was the most diverse, representing three species, while other genera such as *Nezara*, *Acrosternum*, and *Piezodorus* were also well-represented. Species such as *Nezara viridula* (southern green stink bug) are known agricultural pests, while *Erthesina acuminata*, a member of Asopinae, serves as a natural predator of other insect pests. The findings highlight the significant role of both herbivorous and predatory Pentatomidae species in Bhavnagar's agroecosystems, providing insights into potential pest management strategies. Additionally, the diversity of these insects in urban and agricultural landscapes emphasizes the need for further studies on their ecological interactions and response to environmental changes. This study contributes to the baseline knowledge of Pentatomidae fauna in Bhavnagar and provides a foundation for future research on insect biodiversity and pest control.

**Keywords:** Pentatomidae, bhavnagar, agricultural pests, pest management, insect biodiversity

### Introduction

The family Pentatomidae, commonly known as stink bugs, is one of the most diverse and ecologically significant groups within the order Hemiptera. The Pentatomidae, representing the fourth largest family within Heteroptera, are one of the most diverse groups with about 800 genera and more than 4,700 species in the world (Grazia *et al.*, 2015; Salini, 2019) <sup>[2, 7]</sup>. These insects are characterized by their distinctive triangular-shaped bodies and are found in a wide range of habitats, including forests, grasslands, and agricultural ecosystems. While many species of Pentatomidae are considered agricultural pests due to their feeding habits on crops, others play important roles in natural ecosystems, such as predators of other insect pests. The diversity of Pentatomidae species and their distribution patterns are influenced by various ecological factors, including habitat type, climate, and the availability of resources (Salini, & Viraktamath, 2015) <sup>[8]</sup>.

The diversity of Pentatomidae is underexplored, especially in regions like Bhavnagar, a city located in the coastal region of Gujarat. Bhavnagar is characterized by its unique combination of urban, agricultural, and natural habitats, providing an opportunity to explore the diversity of insect fauna across different ecological zones. Despite the presence of a range of ecosystems, there is a lack of comprehensive studies documenting the diversity of Pentatomidae species in this region. Such studies are crucial for understanding the ecological roles of these insects, as well as their potential impact on local agriculture.

The importance of studying Pentatomidae diversity in Bhavnagar is multifaceted. These insects are known to affect a variety of crops, including cotton, pulses, groundnut and vegetables, through their feeding activities. Additionally, species such as *Nezara viridula* (the southern green stink bug) are notorious for their role in transmitting plant diseases, which can further compromise agricultural productivity. On the other hand, predatory species from the subfamily Asopinae, such as *Erthesina acuminata*, provide natural pest control by preying on other insect pests.

Understanding the distribution of these species can provide valuable insights into the potential for integrated pest management strategies in the region.

Furthermore, the ongoing urbanization of Bhavnagar, coupled with climate change, poses additional challenges to local biodiversity (Makwana *et al.*, 2024a; Makwana *et al.*, 2024b) <sup>[5, 6]</sup>. Habitat fragmentation and changes in microclimates can influence the distribution and abundance of insect species, including Pentatomidae (Hoyle & Harborne, 2005; Khatsuriya *et al.*, 2024) <sup>[3, 4]</sup>. Monitoring the diversity of these insects across different habitats in Bhavnagar can help establish baseline data for future studies on the effects of environmental changes on insect populations.

In this study, we aim to provide a comprehensive survey of the Pentatomidae fauna in Bhavnagar, Gujarat, with a focus on documenting species diversity, habitat preferences, and ecological roles. Through field surveys and species identification, this research seeks to contribute to the understanding of Pentatomidae distribution patterns in urban, agricultural, and natural habitats in Bhavnagar, offering insights into their potential impact on local ecosystems and agriculture.

### Materials and Methods

#### Study Area

The study was conducted in Bhavnagar, a coastal city in the state of Gujarat, India, known for its diverse agroecosystems and urban landscapes. The region's varied vegetation, including agricultural fields, urban green spaces, and natural areas, provided an ideal setting for surveying the diversity of Pentatomidae species. The survey was carried out from September 2022 to August 2023, covering different habitat types to capture a broad spectrum of species diversity.

#### Insect Collection

Pentatomidae specimens were collected using a combination of passive and active sampling methods. Passive sampling

involved placing pitfall traps and sweep nets along selected transects in agricultural fields, urban green spaces, and forested areas (Biswas *et al.*, 2014) [1]. The traps were set at various intervals within each habitat type to ensure a comprehensive representation of the species. The active sampling method included hand collection by entomologists using entomological aspirators and forceps to target specific species based on visual identification (Schwertner *et al.*, 2020) [9]. Each collection method was repeated across multiple sites within the study area to maximize the diversity of species captured. Field observations were also made to record the relative abundance of different species in the various habitats.

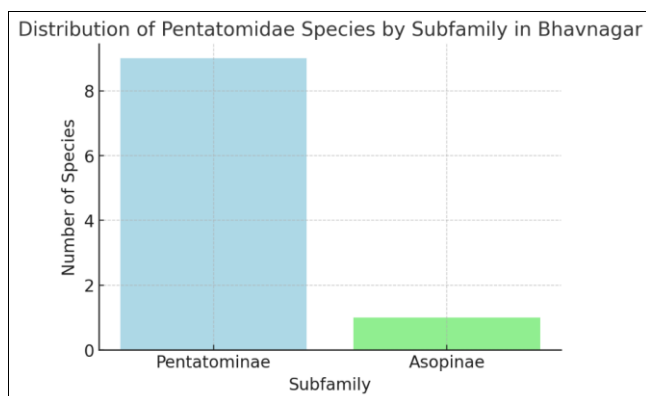
## Results and Discussion

The taxonomic composition of the Pentatomidae fauna from Bhavnagar, Gujarat, as represented in the checklist, reveals a diverse assemblage of species primarily classified under the family Pentatomidae. This family belongs to the superfamily Pentatomoidea within the suborder Heteroptera, class Hemiptera, which includes a variety of true bugs commonly recognized for their ecological and economic significance. The data presents a total of 11 species from the Pentatomidae family, categorized at various taxonomic levels, such as genus and species, providing insight into the diversity and distribution of this group in the region.

**Table 1:** Taxonomic checklist of Pentatomidae species recorded in Bhavnagar, Gujarat

Sr No.	Order	Sub Order	Family	Sub family	Species
1	Hemiptera	Heteroptera	Pentatomidae	Pentatominae	<i>Erthesina acuminata</i>
2	Hemiptera	Heteroptera	Pentatomidae	Pentatominae	<i>Bagrada hilaris</i>
3	Hemiptera	Heteroptera	Pentatomidae	Asopinae	<i>Andrallus spinidens</i>
4	Hemiptera	Heteroptera	Pentatomidae	Pentatominae	<i>Piezodorus hybneri</i>
5	Hemiptera	Heteroptera	Pentatomidae	Pentatominae	<i>Eysarcoris montivagus</i>
6	Hemiptera	Heteroptera	Pentatomidae	Pentatominae	<i>Carbula biguttata</i>
7	Hemiptera	Heteroptera	Pentatomidae	Pentatominae	<i>Eysarcoris ventralis</i>
8	Hemiptera	Heteroptera	Pentatomidae	Pentatominae	<i>Laprius varicornis</i>
9	Hemiptera	Heteroptera	Pentatomidae	Pentatominae	<i>Acrosternum gramineum</i>
10	Hemiptera	Heteroptera	Pentatomidae	Pentatominae	<i>Niphe subferruginea</i>
11	Hemiptera	Heteroptera	Pentatomidae	Pentatominae	<i>Nezara viridula</i>

All species listed in the Table 1 belong to the order Hemiptera and suborder Heteroptera, indicating that the collected specimens are typical of true bugs. This consistent taxonomic classification underscores the reliability of the dataset and supports the generalization of the findings to other regions where Pentatomidae species are encountered. Furthermore, all the species belong to the Pentatomoidea superfamily, a group that includes various stink bugs, which are of significant interest due to their role in agriculture and natural ecosystems.



**Fig 1:** Distribution of Pentatomidae species by Subfamily in Bhavnagar, Gujarat

Within the Pentatomidae family, the species are further classified into two subfamilies: Pentatominae and Asopinae. The Pentatominae subfamily is the most prevalent, with 8 species recorded in the checklist. This subfamily is characteristic of the more common stink bugs, which often exhibit herbivorous feeding behavior. The Asopinae subfamily, represented by a single species (*Erthesina acuminata*), is notable for its predatory members, which contribute to natural pest control mechanisms. The presence

of both herbivorous and predatory species within the dataset suggests a diverse ecological role of the Pentatomidae in the local ecosystem, with implications for both agriculture and biodiversity.

The species diversity observed in Bhavnagar is indicative of a robust Pentatomidae community with potential implications for both agricultural pest control and the broader ecological interactions in the region. The predominance of species from the Pentatominae subfamily suggests that herbivorous stink bugs may have a substantial impact on local crops, while the presence of predatory Asopinae adds an element of natural pest control to the ecosystem. Additionally, the occurrence of species such as *Nezara viridula* and *Acrosternum gramineum* reinforces the need for further investigation into the agricultural importance of these species, particularly in relation to their feeding habits and distribution patterns.

The study provides a foundational baseline for future ecological studies and pest management strategies involving Pentatomidae in Bhavnagar. The diversity of genera and species observed offers valuable insights into the local insect fauna, laying the groundwork for further taxonomic, ecological, and pest control research in the region. The identification of both herbivorous and predatory species within the Pentatomidae family highlights the ecological complexity of these insects, making them crucial players in the natural and agricultural ecosystems of Bhavnagar.

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