DIVERSITY OF TERRESTRIAL HETEROPTERANS (HEMIPETRA) FROM VARIOUS LOCALITIES OF RAWALPINDI AND ISLAMABAD

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ABSTRACT

The suborder Heteroptera contains insects known as true bugs. They are ranked as the 5th most diverse group of insects on the planet in terms of number of species. True bugs are economically important due to certain species being phytophagous pests of various commercially grown crops and trees. However, many other species are predators and their importance in natural and biological control programmes cannot be neglected. This research aimed to identify the species of terrestrial true bugs from the regions of Rawalpindi and Islamabad. A total of 23 species under 22 genera belonging to 12 families were identified in this study. Family Pentatomidae was the most dominant and had 9 species, 3 species were identified for family Cydnidae, 2 each for the families Pyrrhocoridae and Coreidae, whereas the remaining families had 1 species each.

Keywords: Heteroptera; Biodiversity; Taxonomy, Pakistan

INTRODUCTION

Members of the suborder Heteroptera, classed under the insect order Hemiptera, are called true bugs. They represent the biggest group of insects that undergo incomplete metamorphosis (Henry, 2009). Heteroptera is classed at the same level as the other suborders of Hemiptera i.e. Auchenorrhyncha, Coleorrhyncha, and Sternorrhyncha (Wheeler et al., 1993). The suborder Heteroptera contains approximately 40,000 species (Weirauch and Schuh, 2011).

The true bugs are hemimetabolous insects and their life stages go from egg to nymph to adult, with the nymphal morphology greatly resembling the adult's except for the underdeveloped wings and scent glands (Ghosh and Biswas, 1995). The primary function of these glands is defence and act as repellents against ants and other predators.

The defining morphological characters of true bugs are that both pairs of their wings lie flat on the dorsal surface of the insect's body, with the forewings being partially hardened and partially membranous. They also possess a specialised piercing-sucking labium, often called a rostrum, with an opisthognathous orientation, an easily distinguishable scutellum, as well as a pair of metathoracic scent glands in adults and dorsal abdominal scent glands in nymphs (Schuh and Slater, 1995; Slater, 1982).

The Heteropterans are further classified into 7 infraorders (Stys and Kerzhner, 1975). Among these, only 5 are considered as terrestrial i.e. Pentatomomorpha, Dipsocormorpha, Enicocephalomorpha, Leptodomorpha, and Cimicomorpha. The remaining two infraorders are considered as aquatic and thus will not be covered under this study. Further arguments in favour of the 7 infraorder classification have been given by Cobben (1978).

Despite true bugs having a reduced wing apparatus as well as weaker flight muscles, many members of the suborder are decent flyers and can travel larger distances. Another reason for their spread and dispersal is the fact that their juvenile stages can be shifted from one area to another by hiding in parts of their host plants, which may be moved from site of cultivation to different market places within a country or even abroad (Rabitsch, 2010).

Regarding their economic importance, many species are pests of cultivated crops, while some are even pests of forest trees. However, a large number of true bugs are predators, with some even being used as agents in biological control against crop pests. The majority of the harmful species fall under the infraorders Cimicomorpha and Pentatomomorpha (Schaefer and Panizzi, 2000).

Heteropteran pests can suck the fluids of plants that are
beneficial to humans. They are considered as economically important due to their ability to penetrate plant defences, their abundance in population numbers as well as in species diversity, and due to their lack of competition (Panizzi, 1997). It is regarded that originally all Heteropterans were predators (Cobben, 1979). Though there are alternative beliefs according to which predation and herbivory were evolved separately (Sweet, 1979). Many groups of true bugs are entirely carnivorous, while many families and genera contain predaceous as well as phytophagous species. Even the modern predatory bugs can be classed as primitively or secondarily predaceous, depending on the feeding habits of their ancestors (Schaefer, 1997).

Although biodiversity studies on terrestrial Heteropterans have been conducted throughout various areas of Pakistan, yet the data from the Potohar region including Rawalpindi and Islamabad is lacking. Furthermore, the previous work done utilized taxonomic keys from neighbouring countries of Pakistan as there is a lack of native Heteropteran pictorial keys. This gap in research can lead to a difficulty in the identification of important true bug species, which can result in problems associated with management of Heteropteran pests as well as in utilization of Heteropteran biocontrol agents.

The present research work was undertaken to identify and catalogue the terrestrial true bug fauna of Rawalpindi and Islamabad, as there is a need for taxonomic work to be done on the entirety of the biodiversity relating to this suborder from the above mentioned area.

MATERIALS AND METHODS

Study area
Specimens were collected from different localities of Rawalpindi and Islamabad, located in the Punjab province of Pakistan. The collection procedure was undertaken whilst staying within the coordinates: 33°20′N 73°15′E and 33°41′N 73°05′E for both areas respectively. The district of Rawalpindi is further divided into 7 tehsils. The region's main crops include Wheat, Maize, Barley, Millets, and Pulses. The district's elevation ranges from 1,100 ft. to 9160 ft. The Islamabad Capital Territory includes 3 parts: Islamabad City, Islamabad Rural Area, and the Margalla Hills. The area's elevation range is 1,610 ft. to 2,000 ft.

Sampling sites
The collection of terrestrial Heteropterans was done from different localities of the districts of Rawalpindi and Islamabad in the year 2018, with a focus on the rangelands, agricultural fields, and forests. The localities were checked by sweeping as well as visual observations on host plants as well as on the ground.

Collection techniques
The main tool used for collection purposes was a sweep net i.e. a large piece of transparent white cloth fixed around a metal frame and attached to wooden handle. It was used primarily on the smaller plants, shrubs, grasses, and vegetation near the ground level. Captured insects were killed using a killing bottle (a glass jar) whose bottom contained poisonous Potassium Cyanide under a layer of Plaster of Paris.

Preservation of captured specimens
After killing, the insects were immediately removed from the glass jar to avoid discolouration and stiffening of bodily appendages. The specimens were retained in a vial containing 70% ethyl alcohol for some time. Afterwards they were dried and directly pinned through middle of the scutellum.

Identification of captured specimens
The collected specimens were studied under a Labeled CZM6 microscope. They were identified on the basis of morphological characters by using different taxonomic keys such as the volumes on Rhynchota by Distant (1902), as well as the ones provided by Schuh and Slater (1995). After identification, each specimen's binomial name was added to its label.

Preparation of a checklist
In the end, the checklist of all the terrestrial Heteropteran specimens collected and identified from the districts of Rawalpindi and Islamabad during the study was made. The list organized the identified species in family-wise alphabetical order while also maintaining a descending order of taxa, starting from the suborder Heteroptera and going all the way down to the species level. The names of taxa authors were confirmed using the website of the Global Biodiversity Information Facility (GBIF.org).

RESULTS AND DISCUSSION

A total of 22 species belonging to 12 different Heteropteran families were identified in the study. The families are Pentatomidae, Cydnidae, Dimidioridae, Scutelleridae, Largidae, Lygaeidae, Pyrrhocoridae, Miridae, Rhopalidae, Rhygarochromidae, Alydidae, and Coreidae. The identified species are as follows: Riptortus linearis, Geotomus peshawarensis, Aethus perpunctatus, Cydnus aterrimus, Petilopsis calcar, Cletus rubidiventris, Coridius obscurus, Physopelta gutta, Spilostethus hospes, Tayloryligus apicalis, Dysdercus koenigii, Antilochus russus, Liorhyssus hyalinus, Metochus uniguttatus, Chrysocoris stolii, Dolycoris indicus, Dolycoris baccarum, Erthesina pakistanensis, Eysarcoris ventralis, Eurydemia dominulus, Dalpada affinis, Nezora viridula, and Piezodorus hybneri.

Order: Hemiptera Linnaeus, 1758
Suborder: Heteroptera Latreille, 1810
Family: Cydnidae Billberg, 1820
Genus Geotomus Mulsant and Rey, 1866

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<tr>
<th>Genus</th>
<th>Species</th>
<th>Authors</th>
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<tr>
<td>Geotomus</td>
<td>peshawarensis</td>
<td>Moizuddin and Ahmed 1990</td>
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Material examined: NARC, 5-iii-18, 2 ♀.
Family: Pentatomidae Leach, 1815
Genus: Erthesina Fabricius, 1803
\[ \text{Erthesina pakistanensis} \] (Ahmad et al., 2004)
Material examined: NARC, 5-iii-18, 1 ♀.
Biological affiliation: Pakistan: Sindh (Distant, 1902). India (Parveen et al., 2013).

Family: Dinidoridae Stal, 1867
Genus: Coridius Illiger, 1807
\[ \text{Coridius obscurus} \] (Fabricius, 1794)
Material examined: Sohan, 5-ix-18, 4 ♀ and 2 ♂.
Biological affiliation: Pakistan and India.

Family: Miridae Hahn, 1831
Genus: Taylorilygus Leston, 1952
\[ \text{Taylorilygus apicalis} \] (Fieber, 1861)
Material examined: Ayub National Park, 6-vii-18, 1 ♀.
Biological affiliation: Found globally including U.S.A., Europe, Turkey, Australia, China, Chile, Egypt, Libya, Peru, Mexico, Saudi Arabia, Yemen, New Zealand, and Sri Lanka (Schuh, 2013).

Family: Largidae Amyot and Serville, 1843
Genus: Physopelta Amyot and Serville, 1843
\[ \text{Physopelta gutta} \] (Burmeister, 1834)
Material examined: Koont Farm, 12-v-18, 1 ♀.
Biological affiliation: Widely reported from South East Asia including Pakistan, India, China, Afghanistan, Japan, Korea, Taiwan, Nepal, Sri Lanka, and Philippines. Also reported from Australia (Voigt, 2006).

Family: Pyrrhocoridae Dohrn, 1859
Genus: Antilochus Stal, 1863
\[ \text{Antilochus russels} \] (Stal, 1863)
Material examined: Nawaz Sharif Park, 8-v-18, 1 ♀ and 1 ♂.
Biological affiliation: Kashmir, India, Burma (Distant, 1903).

Genus: Dysdercus Amyot and Serville, 1835
\[ \text{Dysdercus koenigi} \] (Fabricius 1775)
Material examined: NARC, 5-iii-18, 1 ♂ and 1 ♀.
Biological affiliation: Throughout South East Asia including Pakistan, India, and Burma. Also found in Australia (Kapur and Vazirani, 1956).

Family: Rhyparochromidae Amyot and Serville, 1843
Genus: Metochus Scott, 1874
\[ \text{Metochus uniguttatus} \] (Thunberg 1822)
Material examined: Trail No 5, 1-vi-18, 2♀ and 2♂. NARC, 5-iii-18, 4♂. PMAS-AAUR, 17-iii-18, 2♂.

Biological affiliation: Throughout South East China, India, Philippines, Sri Lanka, and Myanmar (Saha et al., 2016).

Family: Lygaeidae Schilling, 1829
Genus: Spilostethus Stal, 1868
Spilostethus hospes (Fabricius & J.C., 1794)

Material examined: Ayub National Park, 6-vii-18, 1♂.

Biological affiliation: Found across South and Far East Asia as well as Australan region including China, India, Iran, Hong Kong, Myanmar, Philippines, Japan, Australia, and New Zealand (Saha et al., 2016).

Family: Riptortus Amyot and Serville, 1843
Genus: Liorrhysus Stal, 1870
Liorrhysus hylalimus (Fabricius, 1794)

Material examined: NARC, 5-iii-18, 1♂.

Biological affiliation: Cosmopolitan species found in almost all major geographical regions of the world. It has been reported from Pakistan as well as all of its neighbors i.e. China, India, Iran, and Afghanistan (Hradil et al., 2007).

Family: Alydidae Amyot and Serville, 1843
Genus: Riptortus Stal, 1860
Riptortus linearis (Fabricius 1775)


Biological affiliation: Distributed across the Oriental and Australian region i.e. Iran, China, Pakistan, Taiwan, Iraq, and Japan (Dolling, 2006). In Pakistan, the species has been reported from a large number of areas including Islamabad, Rawalpindi, Lahore, Quetta, Karachi, Tandojam, and Thatta (Ahmad et al., 1979).

Family: Coreidae Leach, 1815
Genus: Cletus Stal, 1860
Cletus rubidiventris (Westwood, 1842)


Biological affiliation: The species has been reported from Pakistan and India. In Pakistan specifically, it has been reported from all four provinces as well as from Azad Kashmir (Ahmad and Rab, 2006).

Genus: Petilopsis Hsiao, 1963
Petilopsis calcinar (Dallas, 1852)

Material examined: Trail No 3, 20-vii-18, 1♂ and 2♀.

Biological affiliation: Found across South-East Asia including Myanmar, Philippines, Sri Lanka, and India (Biswa et al., 2014a).

CONFLICT OF INTEREST
The authors declare that there is no conflict of interests regarding the publication of this article.

REFERENCES


