



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, Dipsocomorpha, 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. Collected specimens were labelled by noting the date of collection, locality, and coordinates. The specimens were stored in collection boxes which contained naphthalene balls to avoid any damage by stored insect pests, mainly ants.

Identification of captured specimens

The collected specimens were studied under a Labomed CZM6 microscope. They were identified on the basis of morphological characters by using different taxonomic keys such as the volumes on Rhynchocha 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.

After identification, the specimens were deposited in the Biosystematics Laboratory, Department of Entomology, PMAS-Arid Agriculture University Rawalpindi.

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, Dinidoridae, Scutelleridae, Largidae, Lygaeidae, Pyrrhocoridae, Miridae, Rhopalidae, Rhyparochromidae, Alydidae, and Coreidae. The identified species are as follows: *Riptortus linearis*, *Geotomus peshawarensis*, *Aethus perpunctatus*, *Cydnus aterrimus*, *Petillopsis calcar*, *Cletus rubidiventris*, *Coridius obscurus*, *Physopelta gutta*, *Spilostethus hospes*, *Taylorilygus apicalis*, *Dysdercus koenigii*, *Antilochus russus*, *Liorhyssus hyalinus*, *Metochus uniguttatus*, *Chrysocoris stolii*, *Dolycoris indicus*, *Dolycoris baccarum*, *Erthesina pakistanensis*, *Eysarcoris ventralis*, *Eurydema dominulus*, *Dalpada affinis*, *Nezara viridula*, and *Piezodorus hybneri*.

Order: Hemiptera Linnaeus, 1758

Suborder: Heteroptera Latreille, 1810

Family: Cydnidae Billberg, 1820

Genus *Geotomus* Mulsant and Rey, 1866

· *Geotomus peshawarensis* (Moizzuddin and Ahmed 1990)

Material examined: NARC, 5-iii-18, 2 ♀.

Biological affiliation: Kheyber Pakhtunkhwa (Peshawar and Abottabad), Punjab (Changamanga, Chunian, and Murree)(Moizuddin and Ahmed 1990)

Genus *Cydnus* Fabricius, 1803

· *Cydnus atterimus* (Forster 1771)

Material examined: NARC, 5-iii-18, 2 ♀ and 1 ♂. PMAS-AAUR, 3-xi-18, 2 ♂. Nawaz Sharif Park, 8-v-18, 2 ♀.

Biological affiliation: Srilanka, Myanmar, Pakistan, and China (Ahmed and Bajwa, 2016).

Genus *Aethus* Dallas, 1851

· *Aethus perpunctatus* (Signoret 1881)

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

Biological affiliation: India, Burma (Moizuddin and Ahmad, 1990).

Family: Pentatomidae Leach, 1815

Genus: *Erthesina* Spinola, 1837

· *Erthesina pakistanensis* (Ahmad *et al.*, 2004)

Material examined: NARC, 5-iii-18, 1 ♂. Shakarparian, 12-x-18, 3 ♂ and 5 ♀.

Biological affiliation: Punjab, Kheyber Pakhtunkhwa, Kashmir (Ahmad *et al.*, 2004).

Genus: *Dalpada* Amyot and Serville, 1843

· *Dalpada affinis* (Dallas, 1815)

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

Biological affiliation: India: Sikhim, Upper Tenasserim (Distant, 1902).

Genus: *Nezara* Amyot and Serville, 1843

· *Nezara viridula* (Linnaeus, 1758)

Material examined: Ayub National Park, 6-vii-18, 1 ♀. Jasmine Park, 7-vi-18, 1 ♀. Kotli Satiyan, 25-viii-18, 1 ♀ and 1 ♂.

Biological affiliation: Cosmopolitan. Includes S.E Asia: Pakistan, India, China. North America: U.S.A, Canada. Africa: South Africa. Europe: Switzerland, Germany. Australia.

Genus: *Piezodorus* Fieber, 1860

· *Piezodorus hybneri* (Gmelin, 1790)

Material examined: Koont Farm, 12-v-18, 1 ♂.

Biological affiliation: Wide distribution across Ethiopian and Oriental regions, including Pakistan (Ahmad, 1995).

Genus: *Eurydema* Laporte, 1833

· *Eurydema dominulus* (Scopoli, 1763)

Material examined: NARC, 5-iii-18, 1 ♂. Koont Farm, 12-v-18, 1 ♂. Ayub National Park, 6-vii-18, 1 ♀.

Biological affiliation: Pakistan, India, China, Indoesia, East Africa and Sri Lanka (Ullah *et al.*, 2017).

Genus: *Dolycoris* Mulsant & Rey, 1866

· *Dolycoris indicus* (Stal, 1876)

Material examined: NARC, 5-iii-18, 2 ♀. Rose Garden, 2-v-18, 1 ♀.

Biological affiliation: Pakistan, India, Afghanistan, China, Sri Lanka, and Myanmar (Rider, 2018).

· *Dolycoris baccarum* (Linnaeus, 1758)

Material examined: Koont Farm, 12-v-18, 1 ♀ and 1 ♂.

Biological affiliation: Pakistan, China and Russia. Also found throughout Asia and Europe (Rider, 2018).

Genus: *Eysarcoris* Westwood, 1837

· *Eysarcoris ventralis* (Westwood, 1837)

Material examined: Kotli Satian, 25-viii-18, 2 ♂. NARC, 5-iii-18, 2 ♂ and 1 ♀. PMAS-AAUR, 2-xi-18, 2 ♀.

Biological affiliation: India and Myanmar (Biswas *et al.*, 2014b).

Family: Scutelleridae Leach, 1815

Genus: *Chrysocoris* Hahn, 1834

· *Chrysocoris stolii* (Wolff, 1801)

Material examined: NARC, 2-xi-18, 1 ♀.

Biological affiliation: Pakistan: Sindh (Distant, 1902). India (Parveen *et al.*, 2013).

Family: Dinidoridae Stal, 1867

Genus: *Coridius* Illiger, 1807

· *Coridius obscurus* (Fabricius, 1794)

Material examined: Sohan, 5-xi-18, 4 ♀ and 2 ♂.

Biological affiliation: Pakistan and India.

Family: Miridae Hahn, 1831

Genus: *Taylorilygus* Leston, 1952

· *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

· *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 Dornh, 1859

Genus: *Antilochus* Stal, 1863

· *Antilochus russus* (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

· *Dysdercus koenigii* (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

· *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 Australasian region including China, India, Iran, Hong Kong, Myanmar, Philippines, Japan, Australia, and New Zealand (Saha *et al.*, 2016).

Family: Rhopalidae Amyot and Serville, 1843

Genus: *Liorhyssus* Stal, 1870

· *Liorhyssus hyalinus* (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)

Material examined: Trail No 5, 1-vi-18, 1 ♂. Trail No 3, 20-vii-18, 1 ♂.

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)

Material examined: PMAS-AAUR, 16-vi-18, 2 ♀ and 1 ♂. Koont Farm, 12-v-18, 2 ♂. Sohan, 5-xi-18, 1 ♀. NARC, 5-iii-18, 3 ♀.

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: *Petillopsis* Hsiao, 1963

· *Petillopsis calcar* (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 (Biswas *et al.*, 2014a).

CONFLICT OF INTEREST

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

REFERENCES

Ahmad, I. 1995. A review of pentatomine legume bug genus

Piezodorus Fieber (Hemiptera: Pentatomidae: Pentatominae) with its cladistic analysis. In Proc. Pak. Congr. Zool, 15: 329-358.

Ahmad, I., Abbas, N., Shadab, M. U., and Khan, A. A. 1979. Generic and supergeneric keys with reference to a checklist of Alydid and Stenocephala fauna of Pakistan, Azad Kashmir and Bangladesh (Heteroptera: Coreidae) with notes on their distribution and food plants. Entomol. Soc. Kar. (Pakistan), 4(2): 1-19.

Ahmad, I., Memon, N., and Kamaluddin, S. 2004. A Revision of Hayline Stink Bug Genus *Erthesina Spinola* (Hemiptera: Pentatomidae: Pentatominae) and Their Cladistics. Pak. J. Zool., 36: 285-293.

Ahmed, N., and Bajwa, G. A. (2016). Hemiptera Fauna of Haripur District, Pakistan. *Pak. Entomol.*, 38(1), 43-45.

Ahmad, N. and Rab N., 2006. New records and redescription of a gonocerine squash gug *Cletomorpha hastata* (F.) (Hemiptera: Coreidae) from Indo-Pakistan sub-continent and its cladistic relationships. Pak. J. Zool., 38(2):115.

Biswas, B., Hassan, M. E., Chandra, K., and Praveen, K. 2014a. On an account of Coreoidea (Heteroptera: Hemiptera) from Chhattisgarh, India. Rec. Zool. Surv. of India, 114(4): 637-650.

Biswas, B., Hassan, M. E., Chandra, K., Kushwaha, S., and Mukherjee, P. 2014b. On an Account of Pentatomoidea (Heteroptera: Hemiptera) from Chhattisgarh, India. Rec. Zool. Surv. India, 114(2): 211-231.

Cobben, R.H., 1978. Evolutionary trends in Heteroptera. Part II Mouthpart-structures and feeding strategies. Sys. Zool., 28: 653-656.

Cobben, R.H., 1979. On the original feeding habits of the Hemiptera (Insecta): a reply to Merrill Sweet. Ann. Entom. Soc. America, 72(6): 711-715.

Distant, W.L., 1902. The fauna of British India including Ceylon and Burma, Rhynchota Vol. I, Taylor and Francis, London, 28-438 p

Distant, W.L., 1903. The fauna of British India including Ceylon and Burma, Rhynchota Vol. 2, Taylor and Francis, London, 10-242 pp.

Ghosh, L. and Biswas, B., 1995. Fauna of conservation areas No. 6. Fauna of Indravati Tiger Reserve, 19-29.

Henry, T.J., 2009. Biodiversity of Heteroptera. Ins. Biodiv. Sci. and Soc., 1:223-263.

Hradil, K., Kment, P., and Roháčová, M. 2007. New records of *Liorhyssus hyalinus* (Heteroptera: Rhopalidae) in the Czech Republic, with a review of its worldwide distribution and biology. Acta Mus. Morav., Sci. Biol., 92: 53-107.

Kapur, A. P. and Vazirani, T.G. 1956. The identity and geographical distribution of the species of the genus *Dysdercus* Boisduval (Hemiptera: Pyrrhocoridae). Zool. Surv. India, 54: 159-175.

Moizuddin, M., and Ahmad, I. 1990. A revision of Cydnidae (Hemiptera: Pentatomomorpha: Pentatomoidea) from Indo-Pakistan area with a cladistic analysis of the included genera. Orient. Insects, 24(1): 305-354.

Panizzi, A. R. 1997. Wild hosts of pentatomids: ecological significance and role in their pest status on crops. Annual review of entomology, 42(1): 99-122.

Parveen, S., Ramamurthy, V. V., Usmani, K., and Khokhar, S.

2013. Revision of the genus *Chrysocoris* hahn (Hemiptera: Scutelleridae) India. Bioscan, 8: 219-232.
- Rabitsch, W. 2010. True Bugs (Hemiptera, Heteroptera). Chapter 9.1. *Alien terrestrial arthropods of Europe*. Bio Risk, 4(1): 407-433.
- Rider, D.A. 2018. *Dolycoris* Mulsant and Rey, 1866. Available at: ndsu.edu/faculty/rider/Pentatomoidea/Genus_Carpocorini/Dolycoris.htm. Accessed on 17 January 2019.
- Schaefer, C. W. 1997. The origin of secondary carnivory from herbivory in Heteroptera (Hemiptera). Ecology and evolution of plant-feeding insects in natural and man-made environments, 229-239.
- Schaefer, C.W., and A.R. Panizzi, 2000. Heteroptera of economic importance. CRC press, Boca Raton, FL. p.856.
- Schuh, R.T. and J.A. Slater, 1995. True bugs of the world (Hemiptera: Heteroptera) classification and natural history. Cornell Unive. Press, Ithaca, NY and London. p.336.
- Saha, P.C., B. Biswas, M.E. Hassan, C. Kailash and K. Praveen. 2016. On an account of family Lygaeidae (Hemiptera:Heteroptera) Chhattisgarh, India. Rec. Zool. Surv. India, 116(2):129-158.
- Schuh, R.T. 2013. On-line Systematic Catalog of Plant Bugs (Insecta: Heteroptera: Miridae). Available on research.amnh.org/pbi/catalog/references.php?id=2169. Accessed on 17 January 2019.
- Slater, J., 1982. Hemiptera. *In*:Parker, S. P. (Ed.), Synopsis and classification of living organisms, 2:417-447.
- Stys, P. and I. Kerzhner, 1975. Rank and nomenclature of higher taxa in recent Heteroptera. Acta Entomo. Bohemoslovaca, 74: 64-79.
- Sweet, M. H. 1979. On the original feeding habits of the Hemiptera (Insecta). Ann. Entomo. Soc. America, 72(5): 575-579.
- Ullah, S., Ahmad, H., and M.A. Rafi, M., 2017. Taxonomy of Superfamily Pentatomoidea (Hemiptera: Heteroptera) from Swat-Pakistan. J. Entomol. Zool. Stud., 5(1): 725-731.
- Voigt, K., 2006. The Palearctic species of Largidae (Heteroptera: Largidae: Physopeltinae). Russ. Entomol. J., 15(2): 223-225
- Weirauch, C. and R.T. Schuh, 2011. Systematics and evolution of Heteroptera: 25 years of progress. Ann.Rev.Entomol., 56: 487-510.
- Wheeler, W.C., R.T. Schuh and R. Bang, 1993. Cladistic relationships among higher groups of Heteroptera: congruence between morphological and molecular data sets. Ins. Syst. And Evo., 24(2): 121-137.