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Abstract

The purpose of this study is to examine a zoogeographic analysis of terrestrial true bugs (Heteroptera) in the Lower Amudarya territory. According to the findings of a literature review, there are 149 species of terrestrial hemipterans in the Lower Amudarya. All hemipteran species, with the possible exception of five, have most likely been misidentified. Until now, full information on the zoogeography of true bug species in Uzbekistan's north-western part has not been published. The composition of species, diversity, and the proportion of endemism vary greatly across the country's zoogeographic regions. The Heteroptera fauna of the Khorezm and Karakalpakstan could be divided into four groups: most species belonging to the Palaearctic region, with 125 species constituting 83.89%; the second group of Holarctic species is characterized by no more than ten species, which constitutes 6.71%; and the third group is the endemic ones, 13 species or 8.72% of various genera, and one species (0.67%) is a Cosmopolitan species. As a result, more research is needed to investigate distribution effects in a more northern climate. The introduction of alien Heteroptera to the north-western part of Uzbekistan will increase and deserves further consideration.

Keywords

Abundance, distribution, faunistics, geography range, Khorezm, Karakalpakstan, occurrence, the Lower Amudarya

Introduction

Heteroptera or true bugs are the largest groups of insects. Presently, more than 40,000 species of true bug species are known from approximately 50 families distributed across different continents (Weirauch and Schuh 2011; Henry 2017a). The order is further subdivided into the suborders Cryptocerata and Gymnocerata, which are grouped into 87 families (Mityushev 2020).

In Russia, 760 species from 285 genera, 35 families, and six infraorders are recorded (Vinokurov et al. 2010); however, more than 1250 species are distributed in Central Asia (Esenbekova 2013), and ~ 700 species of true bugs are distributed in Uzbekistan (http://www.orient-tracking.com/Fauna.htm).

The study of the fauna of true bugs by region has endured more than 170 years (Saprykin 2013). Many entomologists have studied regional true bugs from 1995–2013 using the large published catalogue of Palaearctic true bugs (https://catpalhet.linnaeus.naturalis.nl).

The geographical distribution of Heteroptera species around the world has always attracted the interest of researchers (Panizzi and Grazia 2015; Schuh and Weirauch 2020). Scientific studies on the global distribution of Heteroptera can be found in the works of foreign scientists such as Latreille (1810) and Leach (1815). Many research papers have been published recently, including Chandra and Kushwaha (2013); Samra et al. (2015); Vinokurov et al. (2015); Yasunaga (2016); Drapolyuk (2017); Henry (2017b); Oh et al. (2017); Kim and Jung (2018); Kuzhuget and Vinokurov (2018); Gapon (2019); Yazici (2020); Gandjaeva (2011, 2012a, b, 2020); Gandjaeva et al. (2019, 2020a, b, c, d, e, 2021, 2022a, b, c, d, e, f); Abdullaev et al. (2020a, b); Allabergenova and Gandzhaeva (2022); Yusupova et al. (2022a, b); and Iskandarov et al. (2022).

Since the second half of the 19th century, new descriptions of Central Asian species have been published regularly in the works of Yakovlev (1890), Oshanin (1891) and others. These researchers conducted route surveys in the Fergana Valley, Turkestan Ridge, Alay Range, and Alay Valley, as well as in Samarkand and Djizzakh. Approximately 384 species of true bugs were identified during expeditions, and their zoogeography was studied in Central Asia by prominent zoologists such as Oshanin (1891), who was the first scientist to investigate Heteroptera zoogeography and listing more than 530 species of true bugs.

In the 21st century, many American entomological scientists studied heteropteran species with their bioecological characteristics found in North America, South America,

and Mexico including Rider (2006, 2016); Hoebeke and Carter (2003); Bundy and McPherson (2018); Schuh and Weirauch (2020).

The literature on the fauna of terrestrial true bugs in different habitats of the Republic of Uzbekistan is meager There is only limited information devoted to studying of the fauna of the true bugs of the Republic of Uzbekistan, as well as in research works on the study and capture of true bugs in Central Asia, mainly in the southern regions, which cover the territories of Samarkand, Bukhara, Tashkent, Andijan, Fergana, Kashkadarya, and Surkhandarya.

The purpose of the current paper is to explain the database entries for the Lower Amudarya Heteroptera species, including brief geographic histories and original references. Every database should be a living document, with the ability to track changes regularly. Additional information on newly studied species is being added continuously (Gandjaeva et al. 2021, 2022a–f).

The goals of this study include classifying species ranges and conducting a zoogeographical analysis of the nation’s actual true bug fauna, as well as determining species composition and distribution in the various belts of the Khorezm region and Karakalpakstan Republic.

Materials and methods

The study was carried out in a lowland area in the northwestern part of Uzbekistan along the lower sections of the Amudarya River: between 60' and 61' longitude and 41' and 42' latitude, at an altitude of 113–138 m above sea level. The vegetative cycle of plants lasts 200–210 days. The climate is incredibly continental, with an average annual precipitation of 80–90 mm, and the average temperature ranges from -5°C in January to 40°C in July. Nowadays the climate has changed, and the temperature has risen in summer, reaching 50°C in July. The usual alkali soils are meadow, meadow–marsh, and marsh–sandy. The area is 100 m above sea level and located in the steppe zone, as well as in the southern portion of the Aral Sea and the western part of the Khorezm oasis. The historic Amudarya delta is made up of river sediments. Sand can be found on the sections connecting with Karakum in the west and southwest. Minerals include limestone, sand, clay, and other building materials.

For the analysis, we used zoogeographical categories of the heteropteran species that had been recorded earlier. Approximately 180 specimens of Heteroptera were indexed in the territory of the Lower Amudarya River were identified as 149 species, 89 genera, and 2 infraorders. These species were deposited in the Zoological

collections of the Zoology Institute (**ZIN**) of the Academy of Sciences of the Republic of Uzbekistan.

The experimental research was carried out between 2007 and 2020 (see Gandjaeva (2011, 2012a, b, 2020); Gandjaeva et al. (2019, 2020a, b, c, d, e, 2021, 2022a, b, c, d, e, f)). True Bugs were collected from various fields, including the agricultural farms “Odilbek”, “Amir Temur”, “Gulrukhbegim”, “Oltin Kal’a” located in the Urgench district, “Dildora Bojimon” and “Buz Os Yep” agricultural farms, as well as the educational-experimental station of UrSU named “Uchkhoz” in Yangibazar district, “Ziroat-21” agricultural farm of Kushkupir district, “Raximbergan Xoji Anbar” in Khiva district, “Otabek garchak” and “Gulkand Istikbolli bog’i” in Khanka district and natural landscapes in the Khorezm region, as well as “Zaripboy”, “Kilchinok”, “Yangiyer” agricultural farms in Ellikkala district of the Republic of Karakalpakstan and “Badai Tugai Nature Reserve”, Karatau mountain in the Beruniy district of the Republic of Karakalpakstan (Gandjaeva et al. 2021). The geographical locations of the sites are shown in Fig. 1.

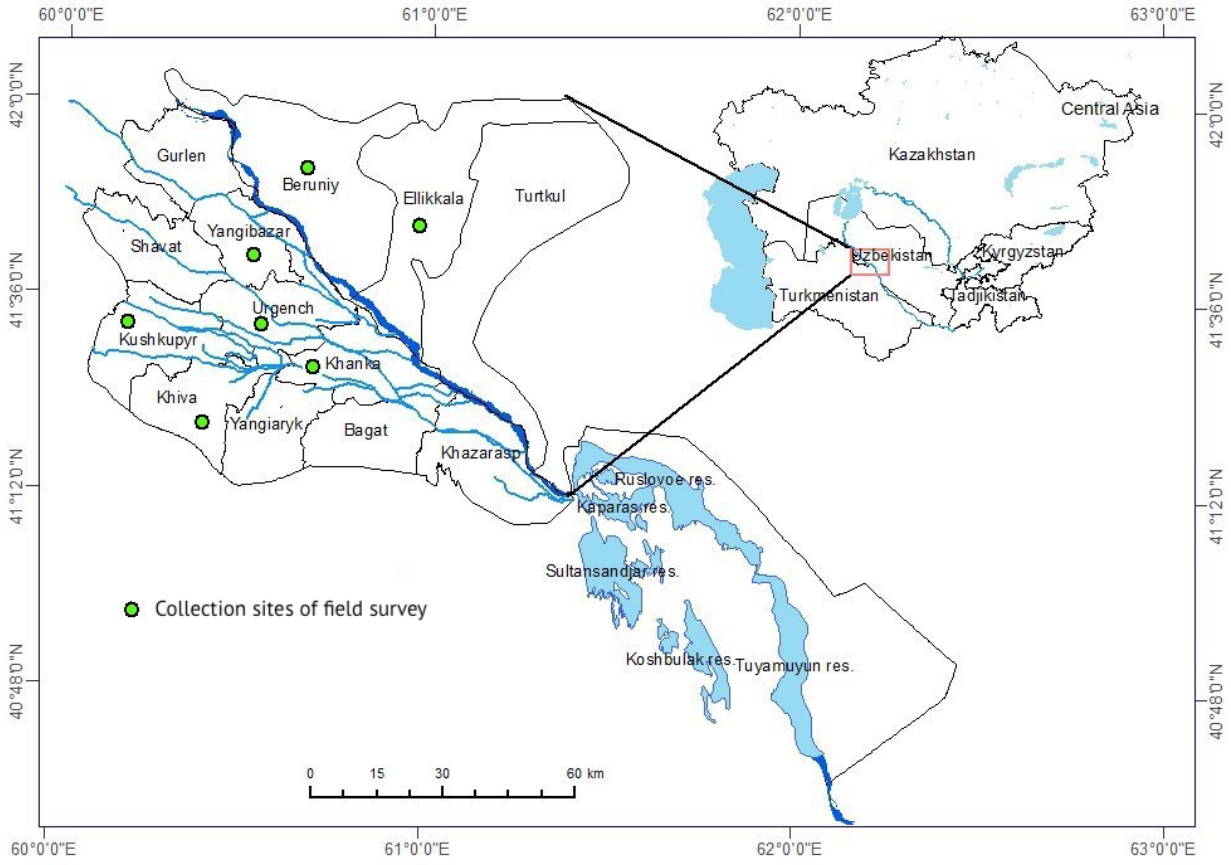

Figure 1. Geographical locations of the collection sites of terrestrial hemipteran specimens in the territory of the Lower Amudarya.

The zoogeographic analysis of the studied true bug species identified in the Lower Amudarya was based on zoogeographical nomenclature by Emelyanov (1974) (https://www.zin.ru/animalia/coleoptera/rus/palearct.htm). In brief, geographic longitude was used to establish the zone along its meridional boundaries.

The descriptive area nomenclature utilized in this work uses the concepts of physical geography and applies two axis coordinates: the latitudinal axis runs from north to south and is critical because it is used to determine climatic conditions of the distributed species, especially temperature; the longitudinal axis runs from west to east. In some species, the range coincides with the boundaries of the landscape zone and is labeled as Arctic (polar deserts, tundra), boreal (taiga), subboreal (broad-leaved forests), subtropical, tropical (evergreen forests), etc. (Lopatin and Meleshko 2016).

We used the basic data on the geographic distribution of these species from the Catalogue “Heteroptera of the Palaearctic” Volumes I-VI, published by the Netherlands Entomological Society, Amsterdam (**NES**) (1995–2013) (https://catpalhet.linnaeus.naturalis.nl) to describe the analysis of the zoogeographic areas of terrestrial true bugs (Aukema et al. 2013)l the database is continually updated.

An analysis of the occurrence and abundance of species on cultivated and wild plants were carried out by observing 50–100 plant specimens every day along the diagonal of the fields.

The number of adult bugs, larvae of all ages, and egg clutches was recorded (Gandjaeva et al. 2021).

The number of species and their occurrence was calculated using the formula devised by Dajoz (2000):

$$F\ (\%) = 100 \times (Pi / P)$$

where Pi refers to the species that was found; P is an absolute number
Species are divided into four groups based on their frequency of occurrence:

Constantly occurring species: $F \geq 50\%$

Often occurring species: $25\% < F < 50\%$

Additional occurring species: $5\% \leq F < 25\%$

Rarely occurring species: $F < 5\%$.

The dynamics of the abundance of species was calculated using the formula of Zaime and Gautier (1989):

$$Ar\ (\%) = 100 \times (Ni / N)$$

where Ni is the coefficient of special observable species; N is the absolute number of all observable species.

The analyses of the dynamics of the numbers of species are also divided into four groups:

Abundant: Ar ≥ 10

Frequent: 5 ≤ Ar < 10

Some: 1 ≤ Ar < 5

Few: Ar < 1.

Results and discussion

Checklists of Heteroptera for the Khorezm region and Karakalpakstan Republic were published more than 20 years ago. Khamraev (2003) and Kulumbetova (1998,1999) listed several species found to the north of Uzbekistan and, respectively, but species have yet to be discovered while others are rare or migratory.

We carried out a comparative analysis of the lists of regional faunas using the data from Khamraev (2003) in the Khorezm Region and Kulumbetova (1998,1999) in the Republic of Karakalpakstan, which allowed us to determine regional features of the fauna in the Lower Amudarya (Table 1). Based on taxonomic distribution, this method enables the collection of data about species complexes with various zoogeographical characteristics (Table 1; Fig. 2). To classify the areas of the Lower Amudarya, information from Gandjaeva et al. (2020) was used (Fig. 2).

Entomologists discovered five new species, *Tarajala brevicornis* (Reuter, 1879), *Emblethis dilaticollis* (Jakovlev, 1874), *Aethus nigronervosus* (Melichar, 1906), *Microporus virgata* (Fabricius, 1974), and *Sciocoris helferi* (Fieber, 1851), which were indexed between 1998–2003 for the Lower Amudarya, but these species have been discovered between 2007–2020. As mentioned earlier, these could be rare or migratory species, or are probably wrongly identified. These five species, shaded in Table 1, have not yet been verified and these records are not used in the distributional and zoogeographical analyses of the group; they are only mentioned in the checklist of the heteropterans found in the Khorezm region and Karakalpakstan.

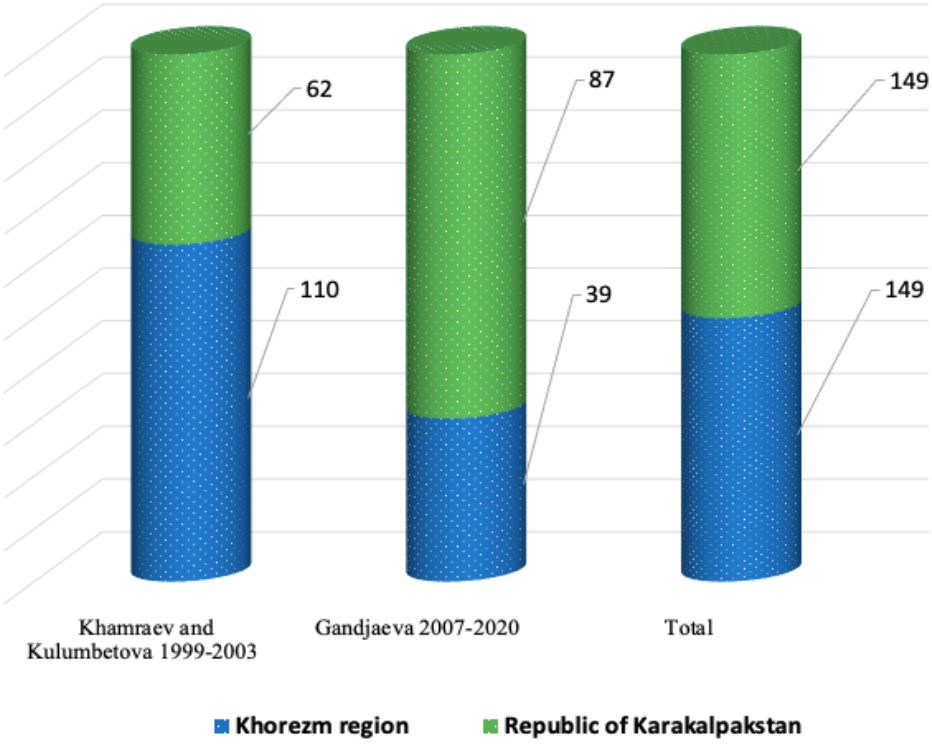

Figure 2. Numbers of the terrestrial true bugs recorded in the regions of the northern part of Uzbekistan.

According to the literature, Khamraev (2003) have been identified 110 species for the Khorezm, and Kulumbetova (1998,1999) 62 species for the Republic of Karakalpakstan. The analysis of entomo-complexes of terrestrial hemipterans in the Lower Amudarya by Gandjaeva (2007–2020) represented 39 species, which were first studied for the fauna of the Khorezm region and 87 species for the Republic of Karakalpakstan. According to the data, there are currently 149 species of terrestrial hemipterans recorded in the Lower Amudarya (Fig. 2).

Table 1. Checklist of the terrestrial Heteroptera from the Lower Amudarya (2007–2020).

Taxon	Family	Occurrence	Abundance	Distribution	Zoo--geographic categories	References
1. *Anthocoris pilosus* (Jakovlev, 1877)	Anthocoridae Fieber, 1837	+	F	***	SA	Khamraev (2003); Gandjaeva et al. (2021)
2. *Orius niger* (Wolff, 1811)		++	FR	○	TP	Khamraev (2003); Kulumbetova (1999); Gandjaeva et al. (2021)
3. *Orius ribauti* (Wagner, 1952)		+	F	***	P	Khamraev (2003); Gandjaeva et al. (2021)
4. *Orius albidipennis* (Reuter, 1884)		+	S	**	TP	Kulumbetova (1999); Gandjaeva et al. (2021)
5. *Nabis ferus* (Linnaeus, 1758)	Nabidae Costa, 1852	++	FR	○	TP	Khamraev (2003); Kulumbetova (1999); Gandjaeva et al. (2021)
6. *Nabis palifer* (Seidenstücker, 1954)		+	F	***	TS	Khamraev (2003); Gandjaeva et al. (2021)
7. *Nabis viridis* (Brullé, 1839)		+	F	***	SA	Khamraev (2003); Gandjaeva et al. (2021)
8. *Nabis rugosus* (Linnaeus, 1758)		++	FR	***	SA	Khamraev (2003); Gandjaeva et al. (2021)
9. *Nabis remanei* (Kerzhner, 1962)		+	F	**	ChCA	Kulumbetova (1999); Gandjaeva et al. (2021)
10. *Nabis sareptanus* (Dohrn, 1862)		+	F	***	TP	Khamraev (2003); Gandjaeva et al. (2021)
11. *Prostemma sanguineum* (Rossi, 1790)		+	F	**	PA	Kulumbetova (1999); Gandjaeva et al. (2021)
12. *Deraeocoris punctulatus* (Fallén, 1807)	Miridae Hahn, 1833	++	FR	○	P	Khamraev (2003); Kulumbetova (1999); Gandjaeva et al. (2021)
13. *Deraeocoris serenus* (Douglas & Scott, 1868)		++	FR	** **	W	Gandjaeva et al. (2021)
14. *Adelphocoris lineolatus* (Coeze, 1778)		+++	A	○	TP	Khamraev (2003); Kulumbetova (1999); Gandjaeva et al. (2021)
15. *Adelphocoris seticornis* (Fabricius, 1775)		+++	A	** **	W	Gandjaeva et al. (2021)
16. *Agnocoris rubicundus* (Fallen, 1807)		++	FR	***	TP	Khamraev (2003);

						Gandjaeva et al. (2021)
17. *Brachycoleus decolor* (Reuter, 1887)		++	FR	***	W	Khamraev (2003); Gandjaeva et al. (2021)
18. *Lygus pratensis* (Linnaeus, 1758)		+++	A	○	SA	Khamraev (2003); Kulumbetova (1999); Gandjaeva et al. (2021)
19. *Lygus gemellatus* (Herrich-Schaeffer, 1835)		+++	A	○	TP	Khamraev (2003); Kulumbetova (1999); Gandjaeva et al. (2021)
20. *Lygus pachycnemis* (Reuter, 1879)		+++	A	***	TNT	Khamraev (2003); Gandjaeva et al. (2021)
21. *Lygus rugulipennis* (Poppius, 1911)		+++	A	** **	TP	Gandjaeva et al. (2021)
22. *Lygus punctatus* (Zetterstedt, 1838)		+++	A	** **	TP	Gandjaeva et al. (2021)
23. *Megacoelum brevirostre* (Reuter, 1879)		++	FR	***	TS	Khamraev (2003); Gandjaeva et al. (2021)
24. *Orthops basalis* (Costa, 1853)		++	FR	***	SA	Khamraev (2003); Gandjaeva et al. (2021)
25. *Orthops kalmi* (Linnaeus, 1758)		++	FR	○	SA	Khamraev (2003); Kulumbetova (1999); Gandjaeva et al. (2021)
26. *Polymerus vulneratus* (Panzer, 1806)		+++	A	○	TP	Khamraev (2003); Kulumbetova (1999); Gandjaeva et al. (2021)
27. *Polymerus cognatus* (Fieber, 1858)		+++	A	**	TP	Kulumbetova (1999); Gandjaeva et al. (2021)
28. *Notostira elongata* (Geoffroy, 1785)		++	FR	** **	SA	Gandjaeva et al. (2021)
29. *Megaloceroea recticornis* (Geoffroy, 1785)		++	FR	** **	W	Gandjaeva et al. (2021)
30. *Stenodema calcaratum* (Fallen, 1807)		+++	A	○	TP	Khamraev (2003); Gandjaeva et al. (2021)
31. *Stenodema tripsinosa* (Reuter, 1904)		+++	A	***	TP	Khamraev (2003); Gandjaeva et al. (2021)
32. *Stenodema laevigata* (Linnaeus, 1758)		+++	A	***	PA	Khamraev (2003); Gandjaeva et al. (2021)
33. *Stenodema turanica* (Reuter, 1904)		++	FR	○	NC	Khamraev (2003); Kulumbetova (1999); Gandjaeva et al. (2021)
34. *Trigonotylus ruficornis* (Geoffroy, 1785)		++	FR	○	PA	Khamraev (2003); Kulumbetova (1999); Gandjaeva et al. (2021)

35. *Trigonotylus pulchellus* (Hahn, 1834)		++	FR	** **	P	Gandjaeva et al. (2021)
36. *Orthotylus eleagni* (Jakovlev, 1881)		++	FR	***	TS	Khamraev (2003); Gandjaeva et al. (2021)
37. *Orthotylus flavosparsus* (Sahlberg, 1841)		++	FR	***	TP	Khamraev (2003); Gandjaeva et al. (2021)
38. *Campylomma annulicorne* (Signoret, 1865)		++	FR	**	P	Kulumbetova (1999); Gandjaeva et al. (2021)
39. *Campylomma diversicornis* (Reuter, 1878)		+++	A	***	NS	Khamraev (2003); Gandjaeva et al. (2021)
40. *Campylomma verbasci* (Meyer-Dur, 1843)		+++	A	**	PA	Kulumbetova (1999); Gandjaeva et al. (2021)
41. *Camptotylidea alba* (Reuter, 1879)		++	FR	***	TNT	Khamraev (2003); Gandjaeva et al. (2021)
42. *Camptotylus meyeri* (Frey-Gessner, 1863)		++	FR	***	NS	Khamraev (2003); Gandjaeva et al. (2021)
43. *Europiella alpina* (Reuter, 1875)		++	FR	** **	TP	Gandjaeva et al. (2021)
44. *Heterocapillus tigripes* (Meyer & Dur, 1852)		+	F	*	SA	Gandjaeva et al. (2021)
45. *Macrotylus herrichi* (Reuter, 1873)		+	F	*	SA	Gandjaeva et al. (2021)
46. *Tuponia elegans* (Jakovlev, 1867)		++	FR	***	SA	Khamraev (2003); Gandjaeva et al. (2021)
47. *Tuponia pallida* (Jakovlev, 1867)		++	FR	***		Khamraev (2003); Gandjaeva et al. (2021)
48. *Tuponia roseipennis* (Reuter, 1889)		++	FR	***	ChCA	Khamraev (2003); Gandjaeva et al. (2021)
49. *Tarajala brevicornis* (Reuter, 1879)		-	-	-	-	Khamraev (2003)
50. *Monosteira discoidalis* (Jakovlev, 1883)	Tingidae Laporte, 1832	+	F	○	SA	Khamraev (2003); Kulumbetova (1999); Gandjaeva et al. (2021)
51. *Stephanitis pyri* (Fabricius, 1775)		+	F	** **	P	Gandjaeva et al. (2021)
52. *Tingis leptochila* (Horvath, 1906)		+	F	***	ITCA	Khamraev (2003); Gandjaeva et al. (2021)
53. *Stenolemus bogdanovi* (Oshanin, 1896)	Reduviidae Latreille, 1807	+	F	***	TS	Khamraev (2003); Gandjaeva et al. (2021)
54. *Coranus aegyptius* (Fabricius, 1775)		++	FR	***	SA	Khamraev (2003); Gandjaeva et al. (2021)
55. *Coranus subapterus* (De Geer, 1773)		++	FR	**	NS	Kulumbetova (1999); Gandjaeva et al. (2021)
56. *Rhynocoris monticola* (Oshanin, 1870)		++	FR	***	TS	Khamraev (2003); Gandjaeva et al. (2021)

57. *Rhinocoris nigronitens* Reuter, 1881		++	FR	***	TS	Khamraev (2003); Gandjaeva et al. (2021)
58. *Vachiria deserta* (Becker,1867)		+	F	** **	ITCA	Gandjaeva et al. (2021)
59. *Ectomocoris ululans* (Rossi, 1807)		+	F	***	ETPE	Khamraev (2003); Gandjaeva et al. (2021)
60. *Reduvius testaceus* (Herrich-Schaeffer, 1845)		+	S	***	TS	Gandjaeva et al. (2021)
61. *Reduvius disciger* (Horváth, 1896)		+	F	***	TS	Khamraev (2003); Gandjaeva et al. (2021)
62. *Reduvius christophi* (Jakovlev, 1874)		+	S	○	TS	Khamraev (2003); Kulumbetova (1999); Gandjaeva et al. (2021)
63. *Reduvius fedtschenkianus* (Oshanin, 1871)		+	F	○	TNT	Khamraev (2003); Kulumbetova (1999); Gandjaeva et al. (2021)
64. *Reduvius semenovi* (Jakovlev, 1885)		+	F	***	TNT	Khamraev (2003); Gandjaeva et al. (2021)
65. *Reduvius elegans* (Jakovlev, 1885)		++	FR	***	TNT	Khamraev (2003); Gandjaeva et al. (2021)
66. *Oncocephalus brachymerus* (Reuter, 1882)		++	FR	***	TS	Khamraev (2003); Gandjaeva et al. (2021)
67. *Oncocephalus termezanus* (Kiritshenko, 1914)		++	FR	**	ITCA	Kulumbetova (1999); Gandjaeva et al. (2021)
68. *Camptopus lateralis* (German, 1817)	Alydidae Amyot & Serville, 1843	+	F	○	SA	Khamraev (2003); Kulumbetova (1999); Gandjaeva et al. (2021)
69. *Megalotomus ornaticeps* (Stal, 1858)		+	F	**	NS	Kulumbetova (1999); Gandjaeva et al. (2021)
70. *Centrocoris volxemi* (Puton, 1878)	Coreidae Leach, 1815	+	F	***	TS	Khamraev (2003); Gandjaeva et al. (2021)
71. *Coreus marginatus* (Linnaeus, 1758)		+	S	***	TP	Khamraev (2003); Gandjaeva et al. (2021)
72. *Enoplops eversmanni* (Jakovlev, 1881)		+	F	***	T	Khamraev (2003); Gandjaeva et al. (2021)
73. *Bathysolen nubilus* (Fallen, 1807)		+	F	**	TS	Kulumbetova (1999); Gandjaeva et al. (2021)
74. *Bothrostethus annulipes* (Herrich-Schaeffer, 1835)		+	S	**	TS	Kulumbetova (1999); Gandjaeva et al. (2021)
75. *Coriomeris vitticollis* (Reuter,1900)		+	F	○	TS	Khamraev (2003); Kulumbetova (1999); Gandjaeva et al. (2021)

76. *Brachycarenus tigrinus* (Schilling, 1829)	Rhopalidae Amyot & Serville, 1843	++	FR	○	TP	Khamraev (2003); Kulumbetova (1999); Gandjaeva et al. (2021)
77. *Chorosoma schillingi* (Schilling, 1829)		++	FR	***	SA	Khamraev (2003); Gandjaeva et al. (2021)
78. *Corizus limbatus* (Rey, 1887)		+++	A	○	SA	Khamraev (2003); Kulumbetova (1999); Gandjaeva et al. (2021)
79. *Corizus tetraspilus* (Horvath, 1917)		+++	A	**	NS	Khamraev (2003); Kulumbetova (1999); Gandjaeva et al. (2021)
80. *Corizus hyoscyami* (Linnaeus, 1758)		+++	A	***	TP	Khamraev (2003); Gandjaeva et al. (2021)
81. *Maccevethus persicus* (Jakovlev, 1882)		++	FR	***	TS	Khamraev (2003); Gandjaeva et al. (2021)
82. *Liorhyssus hyalinus* (Fabricius, 1794)		++	FR	○	C	Khamraev (2003); Kulumbetova (1999); Gandjaeva et al. (2021)
83. *Rhopalus parumpunctatus* (Schilling, 1829)		++	FR	***	TP	Khamraev (2003); Gandjaeva et al. (2021)
84. *Rhopalus distinctus* (Signoret, 1859)		++	FR	***	TS	Khamraev (2003); Gandjaeva et al. (2021)
85. *Stictopleurus unicolor* (Jakovlev, 1873)		++	FR	***	W	Khamraev (2003); Gandjaeva et al. (2021)
86. *Dicranocephalus marginatus* (Ferrari, 1874)	Stenocephalidae Dallas, 1852	+	F	○	TS	Khamraev (2003); Kulumbetova (1999); Gandjaeva et al. (2021)
87. *Dicranocephalus ferghanensis* (Horvath, 1887)		+	F	○	TS	Khamraev (2003); Kulumbetova (1999); Gandjaeva et al. (2021)
88. *Artheneis alutacea* (Fieber, 1861)	Artheneidae Stål 1872	+	S	***	W	Khamraev (2003); Gandjaeva et al. (2021)
89. *Geocoris ater* (Fabricius, 1787)	Geocoridae Baerensprung, 1860	++	FR	**	TP	Kulumbetova (1999); Gandjaeva et al. (2021)
90. *Geocoris arenarius* (Jakovlev, 1867)		+	F	**	NS	Kulumbetova (1999); Gandjaeva et al. (2021)
91. *Geocoris dispar* (Waga, 1839)		++	FR	**	W	Kulumbetova (1999); Gandjaeva et al. (2021)
92. *Geocoris lapponicus* (Zetterstedt, 1838)		+	F	** **	P	Gandjaeva et al. (2021)
93. *Geocoris fedtschenkoi* (Reuter, 1885)		+	F	***	NS	Khamraev (2003);

						Gandjaeva et al. (2021)
94. *Geocoris scutellatus* (Montandon, 1907)		+	F	***	KNTIT	Khamraev (2003); Gandjaeva et al. (2021)
95. *Engistus salinus* (Jakovlev, 1874)		+	F	***	TS	Khamraev (2003); Gandjaeva et al. (2021)
96. *Engistus exsanguis* (Stál, 1872)		++	FR	***	TS	Khamraev (2003); Gandjaeva et al. (2021)
97. *Henestaris halophilus* (Burmeister, 1835)		+	F	***	W	Khamraev (2003); Gandjaeva et al. (2021)
98. *Lygaeus equestris* (Linnaeus, 1758)	Lygaeidae Schilling, 1829	++	FR	○	TP	Khamraev (2003); Kulumbetova (1999); Gandjaeva et al. (2021)
99. *Spilostethus rubriceps* (Horvath, 1899)		+	F	○	TS	Khamraev (2003); Kulumbetova (1999); Gandjaeva et al. (2021)
100. *Spilostethus pandurus* (Scopoli, 1763)		+	F	**	TS	Kulumbetova (1999); Gandjaeva et al. (2021)
101. *Nysius graminicola* (Kolenati, F.A., 1845)		++	FR	***	SA	Khamraev (2003); Gandjaeva et al. (2021)
102. *Oxycarenus pallens* (Herrich-Schäffer, 1850)		+	S	***	SA	Khamraev (2003); Gandjaeva et al. (2021)
103. *Ortholomus punctipennis* (Herrich-Schäffer, 1850)		++	FR	***	P	Khamraev (2003); Gandjaeva et al. (2021)
104. *Beosus quadripunctatus* (Muller, 1766)	Rhyparochromidae Amyot & Serville, 1843	++	FR	**	SA	Kulumbetova (1999); Gandjaeva et al. (2021)
105. *Bleteogonus beckeri* (Frey-Gessner, 1863)		+	F	**	TS	Kulumbetova (1999); Gandjaeva et al. (2021)
106. *Emblethis griseus* (Wolff, 1802)		+	F	○	SA	Khamraev (2003); Kulumbetova (1999); Gandjaeva et al. (2021)
107. *Emblethis verbasci* (Fabricius, 1803)		+	F	○	SA	Khamraev (2003); Kulumbetova (1999); Gandjaeva et al. (2021)
108. *Emblethis ciliatus* (Horváth, 1875)		+	F	○	SA	Khamraev (2003); Kulumbetova (1999); Gandjaeva et al. (2021)
109. *Emblethis denticollis* (Horváth, 1878)		+	F	***	P	Khamraev (2003); Gandjaeva et al. (2021)
110. *Emblethis dilaticollis* (Jakovlev, 1874)		-	-	-	-	Kulumbetova (1999)
111. *Hyalocoris pilicornis* (Jakovlev, 1874)		+	S	○	TS	Khamraev (2003);

						Kulumbetova (1999); Gandjaeva et al. (2021)
112. *Lamprodema maura* (Fabricius, 1803)		++	FR	○	W	Khamraev (2003); Kulumbetova (1999); Gandjaeva et al. (2021)
113. *Aethus pilosulus* (Klug, 1845)	Cydnidae Billberg, 1820	+	F	○	TS	Khamraev (2003); Kulumbetova (1999); Gandjaeva et al. (2021)
114. *Aethus nigronervosus* (Melichar, 1906)		-	-	-	-	Khamraev (2003)
115. *Byrsinus fossor* (Mulsant & Rey, 1866)		+	F	○	TP	Khamraev (2003); Kulumbetova (1999); Gandjaeva et al. (2021)
116. *Microporus virgata* (Fabricius, 1794)		-	-	-	-	Khamraev (2003)
117. *Microporus nigrita* (Fabricius, 1794)		+	F	**	ETPE	Gandjaeva et al. (2021)
118. *Stibaropus hohlbecki* (Kiritshenko, 1912)		+	F	**	TNT	Kulumbetova (1999); Gandjaeva et al. (2021)
119. *Sehirus morio* (Linnaeus, 1761)		+	F	***	W	Khamraev (2003); Gandjaeva et al. (2021)
120. *Amaurocoris candidus* (Horvath, 1889)		+	F	***	TS	Khamraev (2003); Gandjaeva et al. (2021)
121. *Aelia acuminata* (Linnaeus, 1758)	Pentatomidae Leach, 1815	+++	A	**	W	Kulumbetova (1999); Gandjaeva et al. (2021)
122. *Aelia furcula* (Fieber, 1868)		+++	A	***	TS	Khamraev (2003); Gandjaeva et al. (2021)
123. *Aelia melanota* (Fieber, 1868)		+++	A	**	TS	Kulumbetova (1999); Gandjaeva et al. (2021)
124. *Brachynema germari* (Kalenati, 1846)		++	FR	○	TP	Khamraev (2003); Kulumbetova (1999); Gandjaeva et al. (2021)
125. *Carpocoris pudicus* (Poda, 1761)		++	FR	***	P	Khamraev (2003); Gandjaeva et al. (2021)
126. *Carpocoris fuscispinus* (Boheman, 1851)		++	FR	○	W	Khamraev (2003); Kulumbetova (1999); Gandjaeva et al. (2021)
127. *Palomena prasina* (Linnaeus, 1761)		+++	A	** **	SA	Gandjaeva et al. (2021)
128. *Dolycoris penicillatus* (Horvath, 1904)		+++	A	○	TS	Khamraev (2003); Kulumbetova (1999); Gandjaeva et al. (2021)
129. *Desertomenida quadrimaculata* (Horváth, 1892)		+++	A	***	NS	Khamraev (2003); Gandjaeva et al. (2021)

130. *Desertomenida albula* (Kiritshenko, 1914)		+++	A	***	TS	Khamraev (2003); Gandjaeva et al. (2021)
131. *Derula longipennis* (Oshanin, 1871)		+	F	** **	TP	Gandjaeva et al. (2021)
132. *Apodiphus integriceps* (Horvath, 1888)		+++	A	○	TS	Khamraev (2003); Kulumbetova (1999); Gandjaeva et al. (2021)
133. *Cellobius abdominalis* (Jakovlev, 1885)		++	FR	***	NS	Khamraev (2003); Gandjaeva et al. (2021)
134. *Codophila varia* (Fabricius, 1787)		++	FR	***	SA	Khamraev (2003); Gandjaeva et al. (2021)
135. *Holcostethus nitidus* (Kiritshenko, 1914)		++	FR	***	TNT	Khamraev (2003); Gandjaeva et al. (2021)
136. *Holcostethus strictus vernalis* (Wolff, 1804)		++	FR	**	P	Kulumbetova (1999); Gandjaeva et al. (2021)
137. *Menaccarus deserticola* (Jakovlev, 1900)		++	FR	***	TS	Khamraev (2003); Gandjaeva et al. (2021)
138. *Eurydema ornata* (Linnaeus, 1758)		+++	A	***	SA	Khamraev (2003); Gandjaeva et al. (2021)
139. *Eurydema oleracae* (Linnaeus, 1758)		+++	A	** **	SA	Gandjaeva et al. (2021)
140. *Eurydema wilkinsi* (Distant, 1879)		+++	A	*	NS	Gandjaeva et al. (2021)
141. *Eurydema ventralis* (Kolenati, 1846)		+++	A	** **	SA	Gandjaeva et al. (2021)
142. *Eurydema maracandica* (Oshanin, 1871)		+++	A	**	NS	Kulumbetova (1999); Gandjaeva et al. (2021)
143. *Graphosoma lineatum* (Linnaeus, 1758)		++	FR	***	SA	Khamraev (2003); Gandjaeva et al. (2021)
144. *Graphosoma consimile* (Horvath, 1903)		++	FR	***	TS	Khamraev (2003); Gandjaeva et al. (2021)
145. *Tarisa elevata* (Reuter, 1901)		++	FR	***	TS	Khamraev (2003); Gandjaeva et al. (2021)
146. *Tarisa subspinosa (Germar, 1839)*		++	FR	***	TP	Khamraev (2003); Gandjaeva et al. (2021)
147. *Tarisa virescens* (Herrich-Schäffer, 1851)		++	FR	***	NS	Khamraev (2003); Gandjaeva et al. (2021)
148. *Tarisa pallescens* (Jakovlev, 1871)		++	FR	***	TS	Khamraev (2003); Gandjaeva et al. (2021)
149. *Sciocoris helferi* (Fieber, 1851)		-	-	-	-	Kulumbetova (1999)
150. *Eurygaster integriceps* (Puton, 1881)	Scutelleridae Leach, 1815	++	FR	○	P	Khamraev (2003); Kulumbetova (1999); Gandjaeva et al. (2021)

151. *Odontotarsus impictus* (Jakovlev, 1886)		+	F	○	TS	Khamraev (2003); Kulumbetova (1999); Gandjaeva et al. (2021)
152. *Odontotarsus angustatus* (Jakovlev 1883)		+	F	***	TS	Khamraev (2003); Gandjaeva et al. (2021)
153. *Scantius aegyptius* (Linnaeus, 1758)	Pyrrhocoridae Amyot & Serville, 1843	+	F	○	NS	Khamraev (2003); Kulumbetova (1999); Gandjaeva et al. (2021)
154. *Pyrrhocoris apterus* (Linnaeus, 1758)		++	FR	○	W	Khamraev (2003); Kulumbetova (1999); Gandjaeva et al. (2021)
Total number of species: 154						

Symbols and Abbreviations used in the table

Occurrence: Constantly occurring species **(CO)**: **++++**; Often occurring species **(OO)**: **+++**; Additional occurring species **(AO)**: **++**; Rarely occurring species **(RO)**: **+**.

Abundance: Abundant: **A**; Frequent: **FR**; Some**: S;** Few: **F**.

Distribution*:* ○ – species presence;

– species presence not confirmed

* – previously unregistered species for Uzbekistan;

** – previously unregistered species for the Khorezm region;

*** – previously unregistered species for the Republic of Karakalpakstan;

** ** – previously unregistered species for the Khorezm region and the Republic of Karakalpakstan.

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Zoogeographical categories

C – Cosmopolitan; **TP –** Trans-palaearctic; **P –** Pancontinental; **ETPE –** Ethiopia – Trans-palaearctic – Eastern; **SA –** Super-Atlantic; **W–** The Western; **PA–** Pan-Atlantic; **NC –** Narrow continental; **NS –** The North Setian; **TS –** Tethyan-Siberian; **ChCA –** Chinese-Central Asian endemics; **TNT –** Turkestanian-Northern Turanian endemics; **ITCA –** Irano-Turanian-Central Asian endemics; **KNTIT –** Kazakh-Northern Turanian, Irano-Turanian; **T –** Turanian endemics.

During 2007–2020, 149 species of heteropterans have been recorded in the territory of the Lower Amudarya and the zoogeography of heteropterans has been represented in Table 1.

From the surveys, it has been established that approximately 30 species abundant, and that these species were very numerous. The results indicating 62 species at the sites are frequent. Eight some species and 49 few species were recorded. They belong to 17 families, 89 genera and the most numerous are *Miridae* – 37 species and *Pentatomidae* – 28 species, followed by *Reduviidae* – 15; *Rhopalidae* – 10; *Geocoridae* – 9; *Rhyparochromidae* – 8; *Nabidae* – 7; *Coreidae*, *Lygaeidae, Cydnidae* – 6, *Anthocoridae* – 4 and others families not more than 3 – 2 species (Table 2).

Table 2. Distribution of the number of genera, species of families, as well as their share in % in the fauna of terrestrial heteropterans

Family	Number of genera	%	Number of species	%
Anthocoridae	2	2.27	4	2.68
Nabidae	2	2.27	7	4.70
Miridae	20	21.59	37	24.16
Tingidae	3	3.41	3	2.01
Reduviidae	7	7.95	15	10.07
Alydidae	2	2.27	2	1.34
Coreidae	6	6.82	6	4.03
Rhopalidae	7	7.95	10	6.71
Stenocephalidae	1	1.14	2	1.34
Artheneidae	1	1.14	1	0.67
Geocoridae	3	3.41	9	6.04
Lygaeidae	5	5.68	6	4.70
Rhyparochromidae	5	5.68	8	5.37
Cydnidae	6	6.82	6	4.03
Pentatomidae	15	17.05	28	18.79
Scutelleridae	2	2.27	3	2.01
Pyrrhocoridae	2	2.27	2	1.34
Total:	**89**	**100**	**149**	**100**

Based on current information on true bug distribution, zoogeographic classifications of the heteropteran species were created. The studied species belong to 11 types according to the sector ranges, and 28 groups of areas according to the belt ranges. The Lower Amudarya's hemipteran species were divided into four large groups: Wide Areas, Holarctic Areas, Palaearctic Areas, and Endemic Areas (Fig. 3).

- Broad areas – extend beyond the Holarctic;
- Cosmopolitan areas - occur on at least three continents;
- Holarctic areas - cover the Palaearctic and the Nearctic region;
- Palaearctic areas - cover parts of Europe, Asia, and North Africa;
- Nearctic areas - cover North America, Mexico, and Greenland;
- The Ethiopia – Trans-Palaearctic - Eastern areas - this complex combines the Palaearctic, Ethiopia and Eastern regions;
- Trans-Palaearctic areas - cover the entire Palaearctic;
- Super-Atlantic areas - cover from the Atlantic sectors to the Eastern transitional sectors;
- The Western areas - cover the part of the Palaearctic Realm from the Eastern Atlantic to the Western Eucontinental sectors;
- Pan-Atlantic areas - encompass the Atlantic sector as well as the western subcontinental subsectors;
- Pancontinental areas - located from the sub-Atlantic to the eastern sharp continental sectors inclusive;
- Narrow Continental areas - cover the Sahara-Gobi Desert area, the Mediterranean and the Irano-Turanian sub-areas.
- The North-Setian areas - cover the Trans-Scythian, the Western-Scythian, and the Eastern-Scythian sub-regions;
- Tethyan-Siberial areas - cover the Tethyan Subkingdom, Scythian, Setian, and European, Mediterranean, and Irano-Turanian subregions;
- Endemic areas - occur only in a certain area and nowhere else.

Table 3. Percentage of the terrestrial true bugs Heteropterans by area grouping.

Type area	The sector and belt range	The number of species	Percentage, in %
Groups of wide areas	**Cosmopolitan**	**1**	**0.67**
Holarctic	**Trans-Palaearctic**	**9**	**6.04**
	a) Extratropical, Nearctic	3	2.01
	b) Boreal-subtropical, Nearctic	3	2.01
	c) Boreal-subtropical	2	1.34
	d) Boreal – subboreal	1	0.67
	Pancontinental	**1**	**0.67**
	a) Extratropical	1	0.67
Palaearctic	**Ethiopia – Trans-Palaearctic – Eastern**	**2**	**1.34**
	Trans-Palaearctic	**16**	**10.74**
	a) Extratropical	1	0.67

	b) Arctic	3	2.01
	c) Boreal	2	1.34
	d) Boreal-subtropical	9	6.04
	e) Boreal - subboreal	1	0.67
	Super-Atlantic	**28**	**18.79**
	a) Arcto-Subboreal	7	4.70
	b) Boreal - subboreal	1	0.67
	c) Boreal-subtropical	7	4.70
	d) Subboreal	8	5.37
	e) Subboreal-subtropical	2	1.34
	f) Southern	3	2.01
	The Western	**13**	**8.72**
	a) Boreal	2	1.34
	b) Boreal-subtropical	5	3.36
	c) Boreal - subboreal	2	1.34
	d) Subboreal	3	2.01
	e) Southern	1	0.67
	Pan-Atlantic	**4**	**2.68**
	a) Boreal-subtropical	2	1.34
	b) Boreal - subboreal	1	0.67
	c) Subboreal-subtropical	1	0.67
	Pancontinental	**10**	**6.71**
	a) Northern	1	0.67
	b) Boreal-subtropical	5	3.36
	c) Subboreal	1	0.67
	d) Subboreal-subtropical	1	0.67
	e) Southern	2	1.34
	Narrow Continental	**2**	**1.34**
	a) Eastern Mediterranean Gobian	1	0.67
	b) Mediterranean-Irano-Turanian	1	0.67
	The North Setian	**12**	**8.05**
	a) Trans-Scythian	1	0.67
	b) Western Scythian	3	2.01
	c) Eastern Scythian	8	5.37
	Tethyan-Siberian	**38**	**25.50**
	a) Western-Scythian-Saharo-Gobian	1	0.67
	b) Euro-Mediterranean – Turanian	10	6.71
	c) Irano-Turanian-Gobian	4	2.68
	d) Irano-Turanian	15	10.07
	e) Kazakh-Northern Turanian, Irano-Turanian	6	4.03
	f) Tethys-Ethiopian	2	1.34
Endemics	**Endemics**	**13**	**8.72**
	a) Chinese-Central Asian	2	1.34
	b) Chinese-Irano-Central Asian	1	0.67
	c) Turkestanian-Northern Turanian	6	4.03
	d) Irano-Turanian-Central Asian	3	2.01
	e) Turanian	1	0.67
Total:		**149**	**100**

Classification of the zoogeographic ranges of terrestrial heteropterans in the Lower Amudarya:

I. A Group of broad areas

I.1. Cosmopolitan range - 1 species: *Liorhyssus hyalinus;*

II. Holarctic group

II.1 Trans-Palaearctic range - 9 species:

a) Extratropical, Nearctic (3): *Lygus rugulipennis, Orius albidipennis, Derula longipennis;*

b) Boreal-subtropical, Nearctic (3): *Agnocoris rubicundus, Lygus punctatus, Polymerus cognatus;*

c) Boreal-subtropical (2): *Polymerus vulneratus, Orthotylus flavosparsus;*

d) Boreal-Subboreal (1): *Stenodema tripsinosa;*

II.2. Pancontinental range - 1 species:

a) Extratropical (1): *Deraeocoris punctulatus;*

III. Palaearctic group

III.1. Ethiopia – Trans-palaearctic - Eastern range – 2 species:

a) *Ectomocoris ululans, Microporus nigrita*

III.2. Trans-Palaearctic range - 16 species:

a) Extratropical (1): *Europiella alpina;*

b) Arctic (3): *Brachynema germari, Byrsinus fossor, Tarisa fraudatrix;*

c) Boreal (2): *Nabis ferus, Nabis sareptanus;*

d) Boreal-subtropical (9): *Orius niger, Adelphocoris lineolatus*, *Lygus gemellatus gemellatus, Stenodema calcaratum, Geocoris ater*, *Coreus marginatus*, *Brachycarenus tigrinus*, *Corizus hyoscyami hyoscyami*, *Rhopalus parumpunctatus*;

e) Boreal-subboreal (1): *Lygaeus equestris;*

III.3. Super-Atlantic range - 28 species:

a) Arcto-subboreal (7): *Tuponia elegans, Tuponia pallida, Coranus aegyptius, Nysius graminicola graminicola, Emblethis griseus, Emblethis verbasci, Corizus limbatus;*

b) Boreal-subboreal (1): *Orthops basalis;*

c) Boreal-subtropical (7): *Lygus pratensis, Notostira elongata, Eurydema ornata, Eurydema oleracae, Palomena prasina, Orthops kalmi, Chorosoma schillingi;*

d) Subboreal (8): *Nabis rugosus, Nabis viridis Brullé, Heterocapillus tigripes, Macrotylus herrichi, Monosteira discoidalis, Beosus quadripunctatus, Codophila varia, Camptopus lateralis;*

e) Subboreal-subtropical (2): *Eurydema ventralis, Graphosoma lineatum;*

f) Southern (3): *Anthocoris pilosus, Oxycarenus pallens, Emblethis ciliatus;*

III.4. The Western Range - 13 species:

a) Boreal (2): *Deraeocoris serenus, Adelphocoris seticornis*;

b) Boreal-subtropical (5): *Lamprodema maura*, *Stictopleurus unicolor, Sechirus morio, Aelia acuminata, Carpocoris fuscispinus*;

c) Boreal - subboreal (2): *Pyrrhocoris apterus, Megaloceroea recticornis;*

d) Subboreal (3): *Artheneis alutacea, Brachycoleus decolor, Geocoris dispar;*

e) Southern (1): *Henestaris halophilus;*

III.5. Pan-Atlantic range - 4 species:

a) Boreal-subtropical (2): *Stenodema laevigata, Campylomma verbasci*;

b) Boreal - subboreal (1): *Trigonotylus ruficornis;*

c) Subboreal-subtropical (1): *Prostemma sanguineum;*

III.6. Pancontinental range – 10 species:

a) Northern (1): *Geocoris lapponicus*;

b) Boreal-subtropical (5): *Ortholomus punctipennis, Emblethis denticollis, Holcostethus strictus vernalis*, *Carpocoris pudicus, Trigonotylus pulchellus;*

c) Subboreal (1): *Orius ribauti;*

d) Subboreal-subtropical (1): *Eurygaster integriceps*

e) Southern (2): *Campylomma annulicorne, Stephanitis pyri;*

III.7. Narrow continental range -2 species:

a) Eastern Mediterranean-Gobian (1): *Stenodema turanica;*

b) Mediterranean-Irano-Turanian (1): *Geocoris fedtschenkoi*

III.8. The North-Setian range - 12 species:

a) Trans-Scythian (1): *Geocoris arenarius*;

b) Western Scythian (3): *Coranus subapterus, Campylomma diversicorne, Camptotylus meyeri*;

c) Eastern Scythian (8): *Corizus tetraspilus*, *Megalotomus ornaticeps, Desertomenida quadrimaculata, Cellobius abdominalis, Eurydema wilkinsi, Eurydema maracandica, Tarisa virescens, Scantius aegyptius;*

III.9. Tethyan-Siberian range - 38 species:

a) Western-Scythian-Saharo-Gobian (1): *Stenolemus bogdanovi*;

b) Euro-Mediterranean - Turanian (10): *Spilostethus pandurus, Tarisa pallescens, Reduvius testaceus, Centrocoris volxemi, Bathysolen nubilus, Coriomeris vitticollis, Rhopalus distinctus, Engistus exsanguis, Aelia furcula, Graphosoma consimile*;

c) Irano-Turanian-Gobian (4): *Megacoelum brevirostre, Orthotylus eleagni, Oncocephalus brachymerus, Bothrostethus annulipes;*

d) Irano-Turanian (15): *Reduvius disciger, Reduvius christophi, Engistus salinus, Tarisa elevata, Desertomenida albula, Odontotarsus impictus, Odontotarsus angustatus, Amaurocoris candidus, Aelia melanota, Dolycoris penicillatus, Apodiphus integriceps, Menaccarus deserticola, Maccevethus corsicus persicus, Dicranomerus marginatus, Dicranomerus ferghanensis*;

e) Kazakh-Northern Turanian, Irano-Turanian (6): *Nabis palifer, Rhynocoris monticola monticola, Rhynocoris nigronitens, Spilostethus rubriceps, Bleteogonus beckeri, Geocoris scutellatus;*

f) Tethys-Ethiopian (2): *Hyalocoris pilicornis, Aethus pilosulus*;

IV. Endemic species of the Hemipterans

In the fauna of hemipterans of the Lower Amu Darya, the degree of endemism is very low and is divided into 5 groups of endemics of different genesis.

IV.1. Chinese and Central Asian endemics (2): *Nabis remanei, Tuponia roseipennis* - China, Kazakhstan, Turkmenistan, and Uzbekistan are among the countries where these species are available;

IV. 2. Chinese and Irano-Central Asian endemics (1): *Reduvius fedtschenkianus;*

IV. 3. Turkestanian-Northern Turanian endemics (6): – *Stibaropus hohlbecki, Holcostethus nitidus,* and *Lygus pachycnemis* are common in Kazakhstan, Kyrgyzstan, Tajikistan, and Uzbekistan, *Camptotylidea alba* is common in Turkmenistan, Uzbekistan, and Kazakhstan, *Reduvius semenovi* and *Reduvius elegans;*

IV.4. Irano-Turanian-Central Asian endemics (3): *Vachiria deserta, Tingis leptochila,* and *Oncocephalus termezanus;*

IV.5. Turanian endemics (1): *Enoplops eversmanni.*

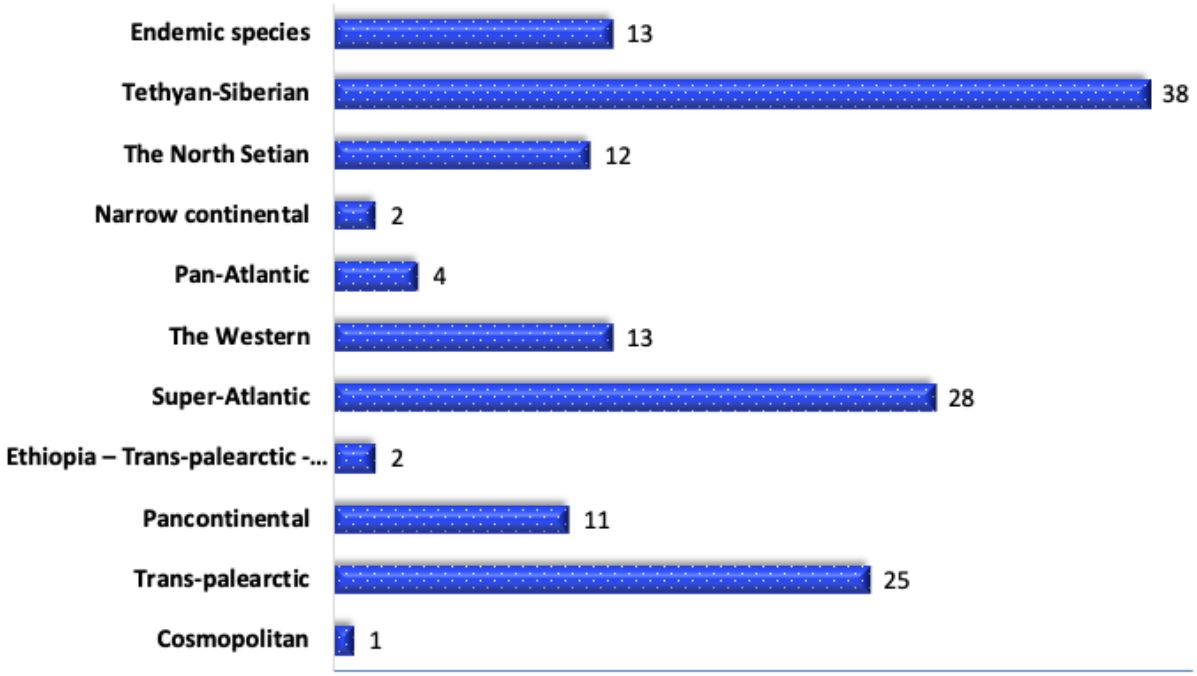

Figure 3. Species numbers of true bugs by area grouping.

In the northern part of Uzbekistan, only one species (0.67 %) belongs to the Cosmopolitan group. The group of the Holarctic range is characterized by no more than ten species, which constitute 6.71 % of the total, and most species belong to the Palaearctic group. Due to its diversity and the large number of species, this group is critical for true bugs. The group contains 125 species (83.89 %), with 38 species from the Tethyan-Siberian type constituting 25.50 %. Approximately 15 species accounts for 10.07 % of the Irano-Turanian range, while ten species constitute 6.71 % of the Euro-Mediterranean-Turanian range. In the Super-Atlantic range, 28 species accounts for 18.79 % of the species, with eight species making up 5.37 % of subboreal and seven species accounting for 4.70 % of boreal-subtropical species recorded. Sixteen Trans-Palaearctic species (10.74 %) have been recorded, followed by 13 Western (8.72 %), 12 North Setian (8.05 %), ten Pancontinental (6.71 %), and four Pan-Atlantic (2.68 %) species. The number of species with Ethiopia-Trans-Palaearctic-Eastern distributions and Narrow Continental is only two for each area or 1.34 %. It can be seen that the prevailing part of the group,125 species (83.89 %), were found in wider areas of the Holarctic, and 13 are endemic species (8.72 %).

The endemics are divided into Chinese-Central Asian, Chinese-Irano-Central Asian, Turkestanian-Northern Turanian, Irano-Turanian-Central Asian, and Turanian

(found in Central Asia only). For the assessment of any territory, endemics have a high conservation value since they indicate the distinctive nature of the fauna.

Conclusions

In this study, we collected new 39 species for the Khorezm region and new 87 species for the Republic of Karakalpakstan during 2007–2020. In addition, we compare our dates with reports of Khamraev (2003) and Kulumbetova (1998,1999) and a total of 154 species (17 families) of the order Heteroptera (Fig. 2, Table 1) were analyzed.

On the basis of the literature, Khamraev (2003) have been identified 110 species for the Khorezm, and Kulumbetova (1998,1999) 62 species for the Republic of Karakalpakstan. There are currently 149 species of terrestrial hemipterans in the Lower Amudarya. The results show that 62 species that highly abundant at the site, divided into 17 families and 89 genera, with the Miridae and Pentatomidae having the most species (37 and 28 respectively), followed by the Reduviidae (15), the Rhopalidae (10), the Geocoridae (9), the Rhyparochromidae (8), the Nabidae (7), the Coreidae, the Lygaeidae, the Cydnidae (6 each) (Table 2). The Heteroptera fauna of Khorezm and Karakalpakstan can be divided into four groups: the Cosmopolitan range with one species (0.67%); the Holarctic range, with no more than ten species, or 6.71%; the Palaearctic ranges, with the most species (125 species, or 83.89%); and the endemic species, which comprise 13 species, or 8.72%, of various genera.

These numbers are important, as the productivity of crops is currently being negatively impacted by new alien species from neighbouring countries. For example, recently we recorded (Gandjaeva et al. 2022e) the brown marmorated stink bug *Halyomorpha halys* (Stål, 1855) (Heteroptera: Pentatomidae) from Uzbekistan for the first time. Several imagines and larvae were found in the Khorezm and Ferghana provinces. This species native to East Asia (China, Korea, Japan and Taiwan) (Hoebeke and Carter 2003; Rider et al. 2003; Rider 2006). The invasive stink bug species *Halyomorpha halys* (Stål, 1855) (Heteroptera: Pentatomidae), a dangerous pest of many agricultural plants. Therefore, more study is required to examine the impacts of dispersion in a northern environment. In the north-western region of Uzbekistan, an increase in the number of aliens Heteroptera is expected, which will require careful monitoring.

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