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Perizat Abdykadyrovna Esenbekova
Kazakhstan Institute of Zoology,
Almaty, Kazakhstan

Yernur Miramuly Kenzhegaliev
Kazakh National Agrarian
University, Almaty, Kazakhstan

Jurij Homziak
Rubenstein School of
Environment and Natural
Resources, University of
Vermont, Burlington VT, USA.
05403

Correspondence

Jurij Homziak
Rubenstein School of
Environment and Natural
Resources, University of
Vermont, Burlington VT, USA.
05403

Hemiptera (Heteroptera) of Sairam-Ugam National Park, Kazakhstan (fauna, biology, ecology and economic significance)

Perizat Abdykadyrovna Esenbekova, Yernur Miramuly Kenzhegaliev and Jurij Homziak

Abstract

The Hemiptera of Sairam-Ugam National Park, a new preserve recently established in Kazakhstan, was described for the first time along with a summary of life history characteristics and available natural history information. The present study recorded 161 species belonging to 25 families. Terrestrial species (157) comprised 91.4% of the fauna, and the remaining 14 species (8.6%) were aquatic. The most species rich families within the preserve included Miridae (40), Lygaeidae (27), Pentatomidae (25), Rhopalidae (12), Nabidae (10), Anthocoridae (6), Corixidae (5) and Acanthosomatidae (5); the remaining 17 families had 1-4 species. A first record for Kazakhstan of *Prostemma gutula* (Fabricius) was also reported.

Keywords: Heteroptera, Kazakhstan, biodiversity, Sairam-Ugam, *Prostemma gutula*

1. Introduction

The Western Tien Shan and Karatau Mountains of Kazakhstan, Kyrgyzstan and Uzbekistan feature diverse landscapes and exceptionally rich biodiversity^[1, 2]. Vertical extent, complex terrain and geological diversity of the Western Tien Shan Mountains define high plant biodiversity, with 16 vegetation types that include almost 2000 species of vascular plants. The percentage of endemism is very high, up to 9% at the species level^[3]. Because of the region's diversity of forest types, unique plant community associations, and genetic importance as the area of origin for a number of cultivated fruit crops, UNESCO designated the Western Tian Shan a World Heritage Site in 2016^[1].

Established only in 2006, Sairam-Ugam State Nature National Park (SUSNNP) covers over 149,000 ha and is contiguous with the better studied Aksu-Zhabagly State Nature Reserve. The SUSNNP includes the source and upper reaches of the Ugam River and 3 peaks over 4200 m in elevation. While information on plant, bird and mammal biodiversity is available, invertebrate biodiversity remains relatively poorly known^[1]. The present study is part of an ongoing program to document invertebrate biodiversity in the park^[4].

2. Material and Methods

2.1 Site description

Sairam-Ugam State National Nature Park (Figure 1) includes 7 vegetation zones, from montane steppe to alpine, with 1635 plant species in 539 genera and 102 families, with 62 protected species^[1, 2, 4]. The lower regions are primarily montane steppe. With increasing altitude, the vegetation changes to savannah then to a mosaic of open forest, with *Juniperus seravshanica* and *Juniperus semiglobosa*, and meadows of the Euro-Siberian and the Middle Eastern plants. About 34-35% of the park is forest. Some forest fragments contain wild apples (*Malus sieversii*), and maple (*Acer turkestanicum*). Meadows of herbaceous vegetation occur in the subalpine and alpine belts, with *Onobrychis echidna*, *Carex* and *Kobresia melanantha persica* as characteristic species. Gallery forests of willow and birch grow along the river valleys.

Sairam-Ugam State National Nature Park is divided into four management areas^[6]. Two are fully protected: the ecological preserve (55,590 ha, 37.3%), and areas under ecological restoration (13,125 ha, 8.8%). Activities in these areas are limited to research, and no economic or recreational use (excepting regulated eco-tourism) is permitted.

The remaining areas of the park are designated for recreation and non-permit tourism (19,711 ha, 13.2%), and for multi-use economic development (60,628 ha, 40.7%).

2.2 Collection

The ecological preserve and restoration areas include several research stations with associated active and inactive field research sites. The survey routes were established for Pollard walks [7, 8] within known research areas located in different habitats/vegetation types. Specimens were collected along these routes from 2010 to 2015, using established methods for entomological research in Kazakhstan [9-13]. Collection was primarily by netting or by hand of observed individuals. Sweep sampling was also used and beating onto drop cloths to collect from herbaceous plants, grasses, shrubs and tree branches. The species living on the surface of the soil, on the roots of the plants, in the forest litter, and under the bark of trees were collected by hand (tweezers, brush) or with an aspirator. Along the routes the study targeted plants showing insect damage (e.g. stress or wilting of foliar tissues, leaf or stem damage, dead/dying plants) for close examination, including roots. Standard D-shape aquatic nets were used to collect aquatic Hemiptera in the Ugam River, streams and standing water in all areas of the park.

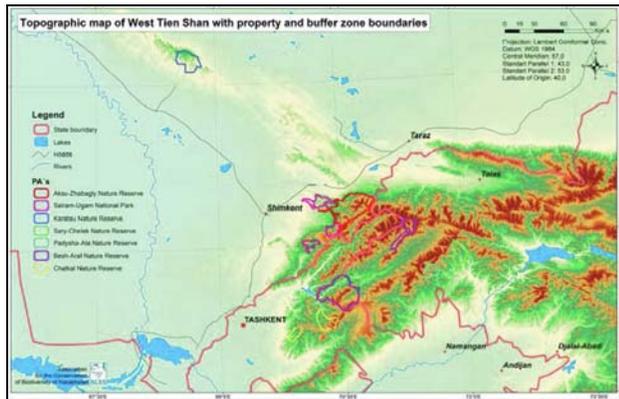


Fig 1: Sairam-Ugam State National Nature Park [5].

Most collected adult specimens were killed in ethyl acetate and stored on cotton backing in insect-proof containers. Immature specimens were killed and preserved in alcohol, as were soft bodied aquatic Gerridae and Corixidae. All collected specimens are part of the national collection at the Kazakhstan Institute of Zoology, in Almaty. A list of Hemiptera found in the territory of Sairam-Ugam SNNP, with a brief description of habitat and natural history, is provided below. The zoogeographic provincial affinity of each species is based on the subdivisions of the Palearctic Region of Emeljanov [14] and Krivokhatsky and Emeljanov [15].

3. Results

3.1 Family Nepidae

***Nepa cinerea* Linnaeus:** Found in standing and slow-moving bodies of water, large and small; predatory; one generation per year; winter as adults, but can hibernate as stage V larvae. Trans-Palearctic species.

3.2 Family Notonectidae

***Notonecta glauca* Linnaeus:** Occurs mostly in ponds, and in standing or slow moving floodplain waters; predatory; one generation per year; winter as adults, buried in the bottom mud. West Palearctic species.

3.3 Family Pleidae

***Plea minutissima minutissima* Leach:** Standing and slow-moving bodies of water of all sizes with abundant vegetation; predatory; one generation per year; winter as adults. West Palearctic species.

3.4 Family Corixidae

***Hesperocorixa occulta* (Lundblad):** Found in ponds, pools and oxbows on flood plain waters of mountain rivers; predator-herbivore; one generation per year; winters as adult. Central Mediterranean (Tethys) species.

***Corixa jakowleffi* Horvath.** Found primarily in standing bodies of water from low-lying to mountainous areas to an altitude of 2000-2300 m; predator-herbivore; one generation per year; winters as adult. Central Mediterranean (Tethys) species.

***Sigara striata* (Linnaeus):** Eurytopic, occurs in all types of standing waters, including reservoirs, but avoids heavily polluted waters; predator-herbivore; multiple (>2) generations per year; winters as adult in the water column. West Eurasian species.

***Sigara lateralis* (Leach):** Found in a variety of standing waters, often in highly saline or brackish and sometimes in polluted waters of the steppe and forest steppe zones; predator-herbivore; two generations per year; winters as adult. West Palearctic-Oriental species.

***Micronecta pusilla* (Horvath):** Standing and slow-moving bodies of water, small to large; predator-herbivore; one generation per year; overwinters as larva. West Eurasian species.

3.5 Family Mesoveliidae

***Mesovelia furcata* Mulsant & Rey:** Prefers ponds with large amounts of floating leaf vegetation (water lilies, Nymphaeaceae), often aggregating in large numbers on plant leaves or on the surface standing water; predatory; polyvoltine; winters in egg stage. West Palearctic species.

***Mesovelia thermalis* Horvath.** Prefers permanent ponds and lakes with duckweed (Lemnoideae) on the surface in the summer, even when the entire surface becomes fully overgrown; predatory; polyvoltine; overwinters in the egg stage. Central Mediterranean (Tethys) species.

3.6 Family Veliidae

***Microvelia buenoi* Drake:** Semi-aquatic, found along shorelines; on moist soil, rocks, and mosses on land, and on the surface of still or very slow moving waters near shore; sometimes found in marshes and swamps; predatory; polyvoltine; winter as adults. Holarctic species.

3.7 Family Hydrometridae

***Hydrometra stagnorum* (Linnaeus):** On floating leaves of aquatic plants or in wet soil and mosses along the shores of slow moving or still waters; predatory; possibly one generation per year; imago overwinters on the banks. West Palearctic species.

3.8 Family Gerridae

***Gerris costae fieberi* Stichel:** On the surface of various water bodies, ubiquitous in puddles and ponds; predatory; probably two generations per year; winter as adults. West Eurasian species.

***Gerris lacustris* (Linnaeus):** Occurs on the surface of bodies of standing water with emergent vegetation, including ponds, lakes and other floodplain water bodies; predatory; more than 2 generations per year; winter as adults. Trans-Palaearctic species.

3.9 Family Saldidae

***Salda littoralis* Linnaeus:** A terrestrial hygrophil (prefers wet habitats), this species is found on the shore of ponds and small waterbodies, in areas both with and without vegetation, as well as in wet soils and other humid places; predatory; one generation per year; winter as adults. Holarctic species.

***Saldula saltatoria* Linnaeus:** A terrestrial hygrophil, it is found on shores, especially in sedge, rush and grasses along rivers and streams high the mountains; reported from both bare and vegetated areas, wet soils, moss, shore puddles and other humid places; predatory; one generation per year; winter as adults. Holarctic species.

***Saldula palustris* (Douglas):** A terrestrial hygrophil, occurs in wet soil and wet areas on the banks of streams and rivers; predatory; one generation per year; winter as adults. Afrotropic-Trans-Palaearctic species.

3.10 Family Reduviidae

***Rhynocoris iracundus* (Poda):** Found on trees, shrubs and herbaceous vegetation in a variety of habitats, from steppe plains, riparian areas and lowland woodlands to wooded foothills, alpine forest glades and alpine meadows to 2000 m; predatory; one generation per year; overwinter as late stage larvae. Overwinter as larvae and adults. Western Palaearctic species.

***Rhynocoris annulatus* (Linnaeus):** On trees, shrubs and herbaceous vegetation in forest and steppe zones, riparian forests; generalist predator; one generation per year; overwinter as instar IV-V. Western Eurasian species.

***Coranus subapterus* (De Geer):** Found in riparian areas (meadows and reeds) of dry steppes, on the soil surface and under plant debris; predatory; one generation per year; overwinter in egg stage. Western Eurasian species.

***Coranus contrarius* Reuter:** Found under shrubs, stones and vegetation litter along lake shores and riverbanks in the steppe zone through foothills and low mountains; predatory; two generations per year; overwinter principally as stage III-V larvae and, possibly, as adults. Euro-Siberian-Kazakh species.

3.11 Family Nabidae

***Nabis ferus* (Linnaeus):** Very common in the forest zone, but confined mainly to the shores of rivers, lakes and springs in the mountains up to an altitude of 2500 m; predatory; one generation per year; winter as adults. Trans-Palaearctic species.

***Nabis remanei* Kerzhner:** Found primarily on grasses in river valleys and meadows in semi-arid steppe zone; predatory; two generations per year; winter as adults. Turanian species.

***Nabis brevis brevis* Scholtz:** Found on graminoid grasses in meadows and wet meadows, from the steppe zone to an altitude of 3600 m; predatory; one generation per year; winter as adults. Trans-Eurasian species.

***Nabis rugosus* (Linnaeus):** Found in a variety of habitats on grassy vegetation, often under the canopy of broadleaf forests, in forest glades and along forest edges; occurs in forest, forest steppe and mountain zones to elevations of about 2000 m; predatory; one generation per year; winter as adults. Trans-Eurasian species.

***Nabis punctatus punctatus* Costa:** Found on grasses and Fabaceae; a xerophyte that is the dominant species in the steppe, extends into dry meadows of forest steppe and foothills, and to xeric mountain slopes up to altitudes of 2500 m; predatory; one generation per year; winter as adults. Western Eurasian species.

***Nabis limbatus* Dahlbom:** Inhabitants of the soil surface; confined to the forest and steppe zone, found mainly in wet meadows and in grassy vegetation under the canopy of forest patches; predatory; one generation per year; winter as adults. Trans-Eurasian species.

***Nabis flavomarginatus* Scholtz:** Widely distributed in forest and forest-subalpine zones; found in mountains to 2000 meters in forest and subalpine meadows, principally in wet meadows and wetlands; predatory; one generation per year; overwinter as eggs. Holarctic species.

***Himacerus apterus* (Fabricius):** Found in riparian forests and mountain forests ranging up to subalpine zone; instars I-II found in grasses, instar III on shrubs, later stages on trees; predatory; one generation per year; overwinter as eggs. Holarctic species.

***Himacerus maracandicus* (Reuter):** Found on tall meadow plants (especially Apiaceae) and on the soil surface; in mountain meadows and shrubs at altitudes from 400 to 3000 m; predatory; one generation per year; winter as adults. Irano-Turanian species.

***Prostemma guttula* (Fabricius):** Found under rocks, among roots and on the soil surface; a xerophyte of dry open areas in the steppe zone; predatory; one generation per year; winter as adults. Mediterranean (Tethys) species, first record for Kazakhstan.

3.12 Family Anthocoridae

***Anthocoris pilosus* (Jakovlev):** On herbaceous plants, shrubs and deciduous trees in the mountains; predatory; 4-5 generations per year; overwinter as adults. Trans-Eurasian species.

***Anthocoris confusus* Reuter:** Found on various deciduous trees (rarely on conifers); predatory; one generation per year; winter as adults. Holarctic species.

***Anthocoris nemorum* (Linnaeus):** Found on various herbaceous, shrub and woody plants, rarely on grasses; occurs in mountain forests, alpine and subalpine meadows to 1000-3000 m.; generalist predator; 2-3 generations per year; overwinter as adults. Trans-Eurasian species.

***Orius minutus* (Linnaeus):** Found on herbaceous plants, shrubs and trees in mountain valleys; generalist predator; 3-4 generations per year; winter as adults. Holarctic species.

***Orius niger* Wolff:** Found on herbs, shrubs and trees, some grasses; in flood plains, on forest edges on mountain slopes; predatory; 3-5 generations per year; winter as adults. Holarctic-Oriental species.

***Orius horvathi* (Reuter):** On various herbaceous plants, reported throughout the preserve, from steppe and lower elevation riparian areas to the sub-alpine zone; predatory; 2-3 generations per year; winter as adults. Trans-Paleartic species.

3.13 Family Stenocephalidae

***Dicranocephalus agilis* (Scopoli):** Found in steppes, forest edges and clearings, floodplain meadows and other similar habitats; specialized herbivore on *Euphorbia uralensis*; one generation per year; winter as adults. West Palearctic species.

3.14 Family Miridae

***Deraeocoris punctulatus* (Fallen):** Found on shrubs and trees at 800-2300 m, from forest steppe region to higher elevation forests and subalpine meadows; omnivore; 2-3 generations per year; adults over winter. Holarctic species.

***Deraeocoris scutellaris* (Fabricius):** Found on various herbaceous plants, rarely trees; in mixed grass meadows, forest understory; omnivore; one generation per year; eggs overwinter. Trans-Eurasian species.

***Deraeocoris ruber* (Linnaeus):** Prefers herbaceous plants, rarely trees; found at forest edges, in meadows, and in river floodplains; omnivore; one generation per year; eggs overwinter. Neotropical-Holarctic species.

***Brachycoleus decolor* Reuter:** Found on a variety of forbs at altitudes of 800-1400 m, ranging from the forest steppe region to lower elevation forest meadows; herbivore feeding on a broad range of seeds and pollen; one generation per year; eggs overwinter. West Eurasian species.

***Capsus cinctus* (Kolenati):** Found on grasses in lower elevation steppes, and flood plains and mid elevation forest openings; specialist herbivore on graminoids; one generation per year; eggs overwinter. Holarctic species.

***Adelphocoris lineolatus* (Goeze):** On forbs at lower and mid elevations, from steppe regions and floodplains to mid elevation meadows; semi-generalist herbivore (Asteraceae, Chenopodiaceae and Fabaceae); 2-3 generations per year; eggs overwinter. Trans-Paleartic species.

***Adelphocoris vandalicus* (Rossi):** Found in the steppe, forest steppe and open forest to altitudes of 1500 m; generalist herbivore; two generations per year; eggs overwinter. West Palearctic species.

***Apolygus lucorum* (Meyer-Dur):** Found on a variety of forbs (e.g. *Artemisia*, *Tanacetum*, *Urtica*, etc.) in the steppe zone, in floodplains and in dry steppe forest meadows of the foothills; generalist herbivore; two generations per year; eggs overwinter. Holarctic species.

***Apolygus spinolae* (Meyer-Dur):** Found on shrubs and in moderately moist forested areas of slopes, valleys and floodplains; generalist herbivore; two generations per year; eggs overwinter. Trans-Eurasian species.

***Agnocoris rubicundus* (Fallen):** Occurs on deciduous trees and bushes (often on willow) in a mixed forest in the flood plains of rivers, and in the mountains at 800-2300 m; herbivore/seed predator on *Salix*, *Acer*, other plants; one generation per year; over winter as adults. Holarctic species.

***Capsodes gothicus gothicus* (Linnaeus):** Occurs on various forbs in the steppes, steppe forest into the low mountain and subalpine meadows at altitudes of 1300-2300 m; herbivore on a range of plant species (*Galium*, *Hypericum*, *Epilobium*, etc.); one generation per year; eggs overwinter. Trans-Eurasian species.

***Charagochilus gyllenhalii* (Fallen):** On a variety of forbs in steppes and in mixed grass meadows of forested mountains and subalpine meadows at altitude 900-2500 m; herbivore specialized on flower parts and seeds; one generation per year; adults overwinter. West Palearctic species.

***Stenodema calcarata* (Fallen):** On grasses in wet meadows, floodplains, forest edges and openings; herbivore on various graminoids; two generations per year; adults overwinter. Trans-Paleartic species.

***Stenodema holsata* (Fabricius):** On grasses in floodplains, forest edges and meadows; herbivore on various graminoids; one generation per year; adults overwinter. Trans-Eurasian species.

***Stenodema virens* (Linnaeus):** On grasses and herbaceous vegetation in meadows, forest edges and openings throughout the mountains to the subalpine zone up to 2400 m.; herbivore on various graminoids; one generation per year; adults overwinter. Trans-Eurasian species.

***Lygus pratensis* (Linnaeus):** Found in floodplains, steppes, low mountain mixed forests and subalpine meadows at altitudes of 800-2000 m; generalist herbivore; two generations per year; adults overwinter. Trans-Paleartic species.

***Lygus punctatus* (Zetterstedt):** On various forbs in all habitats from steppe to subalpine meadows; generalist herbivore; two generations per year; adults overwinter. Trans-Eurasian species.

***Lygus gemellatus* (Herrich-Schaffer):** Found in shrubs from the steppe through dry mixed forests in the mountains at an altitude of 800-1100 m; generalist herbivore on *Artemisia* and other herbaceous plants; two generations per year; adults overwinter. Trans-Paleartic oriental species.

***Lygus rugulipennis* Poppius:** Found on many forbs and shrubs throughout the preserve; herbivore/seed predator on a variety of plants, commonly Apiaceae; two generations per year; adults overwinter. Holarctic species.

***Liocoris tripustulatus* (Fabricius):** Found on forbs in steppe zone, apple and mixed forests, forb meadows and grassland slopes at altitudes of 900-1300 m); generalist herbivore on *Urtica*, *Artemisia* and others; one generation per year; adults overwinter. West Eurasian species.

***Plagiognathus chrysantemi* (Wolff):** On herbaceous vegetation from steppes and river valleys to forests and forb-grass meadows in the mountains at altitudes of 800-1300 m;

herbivore on young leaves, buds, immature seeds, and flowers of Asteraceae, Fabaceae and other herbaceous plants; one generation per year; eggs overwinter. Holarctic species.

***Plagiognathus bipunctatus* Reuter:** Found in mixed grass from steppes into the mountains at altitudes of 750-950 m; herbivore on Fabaceae, Asteraceae and Lamiaceae; one generation per year; eggs overwinter. West Eurasian species.

***Psallopsis similis* Wagner:** Found on vegetation throughout the preserve; generalist herbivore on herbaceous plants; one generation per year; eggs overwinter. Central Mediterranean (Tethys) species.

***Polymerus brevicornis* (Reuter):** Found on sandy and rocky soil in the drier steppe, at dry forest edges and openings; herbivore specialized on *Galium* and other Rubiaceae; 2-3 generations per year; eggs overwinter. Holarctic species.

***Polymerus cognatus* (Fieber):** Found in steppe and foothills, up to 850 m; generalist herbivore on Fabaceae, Brassicaceae, Compositae (*Artemisia*) and *Chenopodium*; up to 4 generations per year; eggs overwinter. Holarctic species.

***Polymerus unifasciatus* (Fabricius):** Found in steppe and forest steppe, and in mixed grass meadows of forest openings in the mountains at altitudes of 800-1300 m; generalist herbivore on Rubiaceae and other annual or perennial herbs; two generations per year; eggs overwinter. Holarctic species.

***Chlamydatus pullus* (Reuter):** Found throughout, from steppes through the foothills, to mountain meadows; generalist herbivore on Fabaceae and other Asteraceae; up to 3 generations per year; eggs overwinter. Holarctic species.

***Chlamydatus pulicarius* (Fallen):** Found on various forest herbs in meadows, steppes, forest edges and openings, glades and near the shores of water bodies up to 1000-1500 m; generalist herbivore on Fabaceae, Asteraceae and other herbaceous plant; up to 3 generations per year; eggs overwinter. Trans-Eurasian species.

***Plagiognathus chrysantemi* Wolff:** Found in steppes, river valleys, forests, and forb-grass meadows in the mountains at altitudes of 800-1300 m; generalist herbivore on young leaves, buds, flowers, and immature seeds of Asteraceae, Fabaceae, Poaceae and other herbaceous plants; one generation per year; eggs overwinter. Holarctic species.

***Orthops campestris* Linnaeus.** Found throughout on various herbaceous plants, from lower elevation steppes to the mountains at altitudes of 800-2300 m; herbivore specialized on Apiaceae; two generations per year; overwinter as adults. West Palearctic species.

***Orthops kalmi* (Linnaeus):** Found throughout on various forbs in the steppes, low mountain and subalpine meadows at altitudes of 950-2300 m; herbivore specialized on Apiaceae; two generations per year; overwinter as adults. West Palearctic species.

***Notostira elongata* (Geoffroy):** On meadow grasses at forest edges, in floodplains, and other open areas, from the steppes to mountain meadows at altitudes of 850-2400 m; herbivore on leaves and stems of grasses (Poaceae), rarely on flowers or

seeds; up to 3 generations per year; overwinter as adults. Trans-Palearctic species.

***Myrmecophyes variabilis* Drapolyuk:** Found on various plants in mixed grass-herb open areas throughout the preserve; generalist herbivore on meadow herbaceous plants; one generation per year; eggs overwinter. Pontic-Iranian-Turanian species.

***Orthocephalus brevis* (Panzer):** Found on a variety of plants in mountains (meadow, forest edge, and other openings); herbivore on meadow grasses (Poaceae) and Asteraceae; one generation per year; eggs overwinter. West Eurasian species.

***Trigonotylus caelestialium* (Kirkaldy):** Found on grasses of steppes, meadows and floodplains; specialized herbivore (graminoids); multiple generations per year; eggs overwinter. Holarctic species.

***Trigonotylus brevipes* Jakovlev:** On grasses and halophytes in drier areas with saline soils; specialized herbivore on a limited suite of grasses (*Aleuropus littoralis* and others); two generations per year; eggs overwinter. West Palearctic species.

***Trigonotylus ruficornis* (Geoffroy):** On various herbaceous plants, principally in floodplain meadows; herbivore on a broad range of graminoids; multiple (2-3) generations per year; eggs overwinter. Trans-Palearctic species.

***Phytocoris varipes* Boheman.** In the steppe zone among grasses; functional predator and herbivore; two generations per year; eggs overwinter. West Eurasian species.

***Phytocoris insignis* Reuter:** Found associated with legumes (Fabaceae), primarily in the steppe zone and more arid areas; functional predator and herbivore; two generations per year; overwinter as adults. Trans-Eurasian species.

***Phytocoris ulmi* (Linnaeus):** Found on deciduous trees (principally *Ulmus*, *Acer*, *Prunus*, *Fagus*, *Salix*); throughout the forested regions of the reserve; functional predator and herbivore; two generations per year; eggs overwinter. West Eurasian species.

3.15 Family Tingidae

***Galeatus inermis* (Jakovlev):** On vegetation in dry, primarily saline (solonchak) habitats; herbivore principally on Boraginaceae and Phrymaceae; 2-3 generations per year; overwinter as adults. Central Mediterranean (Tethys) species.

***Tingis angustata* Herrich-Schaffer:** Found in short grass steppe, steppe forest and in open meadow-forest slopes up to 2000 m; herbivore on Asteraceae and, especially, thistle (*Cirsium setorum*); one generation per year; adults overwinter. West Eurasian species.

***Tingis pilosa* (Hummel):** Found in shaded areas on trees and shrubs in steppe, forest steppe, floodplains and low-mountain meadows at altitudes of 800-1300 m; herbivore on plants of various families, often on Labiatae; 2-3 generations per year; overwinter as adults. Trans-Eurasian species.

3.16 Family Lygaeidae

***Lygaeus equestris* (Linnaeus):** Found in dry, open spaces on the ground among grasses and under various plants; generalist herbivore on fallen seeds and stems of various plants, prefers Asclepiadaceae; one generation per year; adults overwinter. Trans-Palaearctic species.

***Drymus sylvaticus* (Fabricius):** Found on ground, under debris and among vegetation in meadows and edges of mountain deciduous forests to elevations of 2000-2500 m; generalist herbivore on mature seeds and on stems of a wide variety of plants, also feeds on some mosses and fungi; one generation per year; adults overwinter. Trans-Eurasian species.

***Beosus maritimus* (Scopoli):** Found among plant debris in steppes, steppe forest, riparian forests and along forest edges and openings into the foothills; generalist herbivore on stems and fallen seeds of many herbaceous and woody species; one generation per year; adults overwinter. West Palaearctic species.

***Nysius ericae groenlandicus* (Zetterstedt):** Found on herbaceous vegetation from the steppe zone through high altitude forest meadows, in flood plains, and grassland areas; generalist herbivore on a variety of herbaceous plants; two generations per year; adults overwinter. Holarctic species.

***Nysius graminicola graminicola* (Kolenati):** Found on grasses and associated xerophytic vegetation, under plant debris and on the ground in dry steppe and steppe forest habitats; generalist herbivore on graminoids, Asteraceae and other herbaceous plants; two generations per year; adults overwinter. Trans-Palaearctic species.

***Nysius thymi thymi* Wolff:** Found on sparse vegetation of sandy soil habitats including dry meadows and steppe areas, floodplains, forest edges and clearings up to 1800 m; herbivore on seeds and vegetative parts of Brassicaceae, Polygonaceae, Asteraceae, Rosaceae, a number of grasses (*Phleum*, *Festuca*, *Agropyron*) and on spring ephemerals; one generation per year; eggs overwinter. Holarctic species.

***Ischnodemus sabuleti* (Fallen):** Found on grasses in steppe areas, meadows, floodplains, and in open areas along the shores of lakes and ponds; herbivore on graminoids (*Agropyrum*, *Elymus*, *Glyceria*, *Calamagrostis*, *Phragmites*) and Typhaceae; one generation per year; adults overwinter. Trans-Palaearctic species.

***Peritrechus geniculatus* (Hahn):** Found on plant debris in areas of wet, sandy soils, including forest edges and clearings, floodplains and upland meadows in foothills and low mountains; herbivore on basal parts of plants, and on immature and fallen seeds; one generation per year; adults overwinter. West Palaearctic species.

***Pterotmetus staphyliniformis* (Schilling):** Found in moderately moist meadows, forest edges and openings; generalist herbivore; one generation per year; adults overwinter. Trans-Eurasian species.

***Trapezonotus arenarius* (Linnaeus):** Found primarily on sandy and limestone soils on the ground and in plant debris, at dry forest edges, dry meadows in the mountain and subalpine regions to the 2000-3500 m; generalist herbivore, also feeds

on mature seeds of many plants; two generations per year; adults overwinter. Trans-Eurasian species.

***Orsillus depressus* (Mulsant & Rey):** Found on conifers, often on juniper, in subalpine meadows; generalist herbivore on a broad variety of plants; one generation per year; eggs overwinter. West Palaearctic species.

***Heterogaster affinis* Herrich-Schaeffer:** Found in the foothills and in dry and moderately dry forest edges and other open areas the mountains at altitudes up to 3000 m; herbivore on Labiatae; one generation per year; adults overwinter. West Palaearctic species.

***Heterogaster artemisiae* Schilling:** Primarily a steppe species, it is found on forbs in most dry habitats (rocky mountain slopes, talus, clay soils) ranging up to alpine meadows; generalist herbivore, especially *Artemisia* and Labiatae (*Thymus*); one generation per year; adults overwinter. West Palaearctic species.

***Heterogaster urticae* Fabricius:** Associated with nettles (*Urtica*); found in damp areas with rich calcareous soils, in floodplains and moist open forests; specialist herbivore on *Urtica dioica*, *U. irens*; one generation per year; adults overwinter. West Palaearctic species.

***Raglius alboacuminatus* (Goeze):** Found in open areas among rocks, litter, and on vegetation in floodplains and along forest edges and openings from foothills to the rocky slopes of the mountains; herbivore on mature, fallen seeds of a broad range of species; up to 3 generations per year; adults overwinter. West Palaearctic species.

***Ischnocoris punctulatus* Fieber:** Found under stones and plant detritus in steppes, dry meadows and other dry habitats in the mountains up to 1000 m; specialist herbivore on *Artemisia* (*A. nitrosa*, *A. schrenkiana*); two generations per year; overwinter as both adults and larvae. Trans-Eurasian species.

***Spilostethus pandurus* Scopoli:** Found on the ground and under plant debris in a variety of habitats; generalist herbivore on fallen seeds of many plants and on vegetation (esp. Labiatae); one generation per year; adults overwinter. Mediterranean (Tethys)-Turanian species.

***Ischnodemus sabuleti* (Fallen):** Found on grasses in open areas: steppe, meadows, floodplains, and along shores of lakes and ponds; herbivore specialized on graminoids (*Agropyrum*, *Glyceria*, *Elymus*, *Calamagrostis*, *Phragmites*, others) and Typhaceae; one generation per year; adults overwinter. Trans-Palaearctic species.

***Kleidocerys resedae* (Panzer):** Found almost everywhere where there is a birch (*Betula*) and alder (*Alnus*), in forest steppe and forested mountains up to 2000 m; herbivore on *Betula*, *Fraxinus*, *Alnus*, *Ledum*, *Spiraea*, *Corylus*; one generation per year; adults and stage V larvae overwinter. Trans-Eurasian species.

***Cymus glandicolor* Hahn:** Found in wet and marshy meadows of floodplains and forests; herbivore on graminoids; one generation per year; adults overwinter. Trans-Eurasian species.

***Pezocoris apicimacula* (Costa):** Found under *Astragalus* and other shrubs, among plant debris, under moss; prefers drier areas of steppes and sandy areas of floodplains and foothills, often in association with sedge (*Carex*); seed herbivore on mature fallen seeds of many species; two generations per year; adults overwinter. West Palearctic species.

***Lamprodema maura* (Fabricius):** Found on the ground under plants and leaf litter; prefers drier areas: steppes, forest steppe and dry meadows to more than 3500 m; herbivore on fallen seeds and vegetation of many plant species; 2-3 generations per year; adults overwinter. Trans-Palearctic species.

***Rhyarochromus pini* (Linnaeus):** Found on bare soil in a variety of moderately shaded habitats, from steppe forest to mountains, at forest edges, in mixed grass meadows, to 3000-3500 m; adults are herbivores on fallen seeds of many plant species, larvae feed on various plants (e.g. nettles, chicory, crucifers, berry and fruit bushes); one generation per year; adults overwinter. Trans-Palearctic species.

***Rhyarochromus vulgaris* (Schilling):** Found in open areas in plant litter, as well as on forbs in forests, forest edges and meadow areas moderately shaded by trees and bushes; adults herbivores on fallen seeds of many plant species, larvae feed on nettles, crucifers, fruiting trees and shrubs; one generation per year; adults overwinter. West Eurasian species.

***Emblethis denticollis* Horvath:** Found in the upper tiers of herbaceous vegetation in a wide range of habitats, from arid steppe zone to the subalpine mountains, often in large numbers on sandy soils; herbivore specialized on *Lepidium*, *Alyssum*, and others; 2-3 generations per year; adults and larvae overwinter. Trans-Palearctic species.

***Emblethis ciliatus* Horvath:** Found under plant litter in dry areas from the steppe region to dry basins and saline (solonetz) areas in the mountains to the alpine zone at altitudes up to 3200 m; seed herbivore (fallen seeds of *Thymus marschalianus*, *Euphorbia uralensis*, others); 2-3 generations per year; adults overwinter. West Palearctic species.

***Aellopus atratus* (Goeze):** On host vegetation and on nearby soils in forested areas of hillsides, floodplains, and in birch and aspen groves in the mountains to the heights of 2000-2300 m; generalist herbivore (*Cynoglossum*, *Echium*, *Lappula*, *Verbascum*, *Potentilla*, Boraginacea); 2-3 generations per year; adults overwinter. West Palearctic species.

3.17 Family Rhopalidae

***Rhopalus subrufus* (Gmelin):** Found on forbs in the steppe zones, forest steppes, in forest edges and openings, and in sparse forest stands up to 2500 m; herbivore on Labiatae (some Fabaceae and other plant families); 2-3 generations per year; adults overwinter. Trans-Palearctic species.

***Rhopalus maculatus* (Fieber):** Found on forbs in the forest zone and in wet areas: meadows, shaded gullies and depressions, marshy floodplains; generalist herbivore; one generation per year; adults overwinter. Trans-Palearctic species.

***Rhopalus parumpunctatus* Schilling:** On meadow vegetation in open forest and forest steppe areas; herbivore on various forbs, including Brassicaceae, Lamiaceae, Caryophyllaceae and Asteraceae; 2 generations per year; adults overwinter. Trans-Palearctic species.

***Stictopleurus abutilon* (Rossi):** On vegetation from steppes and foothills to sunny slopes with lush vegetation in the subalpine zone at altitudes of 800-2400 m; herbivore on Asteraceae (*Artemisia*, *Achillea*, *Tanacetum*, *Senecio*, others); 2-3 generations per year; adults overwinter. Trans-Palearctic species.

***Stictopleurus punctatonervosus* (Goeze):** In open forest habitats; herbivore on Asteraceae; 2-3 generations per year; adults overwinter. Trans-Palearctic species.

***Stictopleurus crassicornis* (Linnaeus):** Found on vegetation in open forest, flood plains, forest meadows and edges from the lowlands to subalpine meadows at altitudes of 800-2400 m; seed herbivore (Brassicaceae, Labiatae, and Asteraceae); 2-3 generations per year, overwinter as adults. Trans-Palearctic species.

***Maccvethus errans errans* (Fabricius):** Found in foothills and mountains to the subalpine zone at altitudes up to 3000 m; herbivore on Asteraceae; one generation per year; adults overwinter. West-Central Mediterranean (Tethys) species.

***Corizus hyoscyami hyoscyami* (Linnaeus):** Found in meadows, forest edges and other open habitats with moderate moisture; generalist herbivore that feeds in spring on flowers and young shoots of evergreen and deciduous trees and shrubs, later shifting to a variety of forbs; two generations per year; adults overwinter. Trans-Palearctic species.

***Corizus fenestella subsimilis* Horvath.** In open habitats in foothill and mountain areas; herbivore on Labiatae and Compositae; 2-3 generations per year; overwinter as adults. East Mediterranean (Tethys)-Oriental species.

***Brachycarenum tigrinus* (Schilling):** From steppes through foothills to alpine meadows up to 2400 m; seed herbivore on Asteraceae, Brassicaceae and other families; 2-3 generations per year; overwinter as adults. Trans-Palearctic species.

***Chorosoma schillingii* (Schilling):** In bright, dry, sandy open areas in steppe and steppe forest zones, and in disturbed areas in the mountains to an altitude of 3300 m; herbivore on grasses (*Festuca*, *Poa*, *Koeleria*, *Stipa* and others); two generations per year; overwinter as eggs. Western Palearctic species.

3.18 Family Alydidae

***Alydus calcaratus* (Linnaeus):** Found on the surface of the soil and in the upper part of grasses in dry, well-warmed and sheltered areas, floodplains and meadows; herbivore on Fabaceae, feeding on buds, flowers and shoots); two generations per year; over winter as eggs and larvae. Holarctic species.

***Camptopus lateralis* (Germar):** In forest edges, meadows and other open areas; herbivore on Fabaceae; two generations per year; adults overwinter. West Palearctic species.

3.19 Family Coreiidae

***Coreus marginatus marginatus* (Linnaeus):** On Polygonaceae in meadows, forest edges, clearings and in other similar habitats; herbivore, adults feed in spring on *Malus*, *Pyrus*, *Rubus*, *Salix* and others, then switching to other forbs, larvae feed on grasses (*Polygonium*, *Rumex*, *Rheum*); two generations per year; adults overwinter. Trans-Palearctic species.

***Syromastus rhombeus* (Linnaeus):** On various forbs, often on species of Caryophyllaceae, Caryophyllaceae, in meadows, forest edges and clearings, dry slopes and similar places; herbivore on *Arenaria*, *Cerastium*, *Silene*, *Alyssum* and other forbs; one generation per year; adults overwinter. West Palearctic species.

***Bathysolen nubilus* (Fallen):** On various forbs and in plant detritus in meadows and open areas from the steppes to alpine meadows, generalist herbivore; one generation per year; adults overwinter. West Eurasian species.

***Spathocera lobata* (Herrich-Schaffer):** Found in steppe grasslands, meadows, and sunny rocky and sandy areas in the mountains; seed herbivore of *Spiraeanthus* and Polygonaceae (*Rumex confertus*, *Poligonum patulum*); one generation per year; adults overwinter. Trans-Palearctic species.

3.20 Family Pyrrhocoridae

***Pyrrhocoris apterus* (Linnaeus):** Inhabits forest edges and clearings, and open forests; on vegetation, among plant litter and on the ground in sunny areas, often in large colonies; carnivore-scavenger and herbivore on both seeds and plants (*Malva neglecta*, *Alcea rosea*, *Lavatera thuringiaca*, *Caragana arborescens*); one-two generations per year; overwinter as adults. Trans-Palearctic species.

3.21 Family Plataspidae

***Coptosoma scutellatum* (Geoffroy):** Found in lowland forest and steppe zones, in clearings and under open forest canopy, up to 1000 m; herbivore of perennial Fabaceae; one generation per year; larvae overwinter as instars III-IV. Trans-Palearctic species.

3.22 Family Cydnidae

***Tritomegas bicolor* (Linnaeus):** Found from steppes, steppe forest, and hillsides to the subalpine zone up to 2000 m; herbivore on Labiatae; one generation per year; overwinter as adults. Trans-Palearctic species.

***Sehirus luctuosus* Mulsant & Rey:** Inhabits the upper layers of a variety of soil types to a depth of 2.5-3 cm; prefers forest edges and disturbed areas; herbivore on seeds, stems of Boraginaceae (*Lappula echinata*, *Myosotis*, *Echium vulgare*, *Anchusa*); one generation per year; overwinter as adults. Trans-Palearctic species.

3.23 Family Acanthosomatidae

***Acanthosoma forcipatum* Reuter:** Found in the mountains on various trees and shrubs, especially fruit-bearing species (e.g. *Prunus*); herbivore; one generation per year; overwinter as adults. Central Mediterranean (Tethys) species.

***Elasmotherus interstinctus* Linnaeus:** Found throughout in forests, on host plants: birches (*Betula*), willows (*Salix*), alder (*Alnus*), and aspen (*Populus*); one generation per year; overwinter as adults. Holarctic species.

***Elasmucha fieberi* (Jakovlev):** Found in mixed forests in river valleys and other depressions; herbivore on birch (*Betula*) and other deciduous trees; one generation per year; overwinter as adults. Trans-Eurasian species.

***Elasmucha grisea grisea* (Linnaeus):** Found in forests wherever there are birches or alders; herbivore on all *Betula*, *Alnus*; one generation per year; overwinter as adults. Trans-Eurasian species.

3.24 Family Scutelleridae

***Odontotarsus purpureolineatus* Rossi:** Found in the semi-arid areas, from the steppe and forest steppe zones through mountains and subalpine meadows to 800-2300 m; herbivore on flowers, buds and forming seeds of Asteraceae, Poaceae and many other plants (*Salvia*, *Phlomis tuberosa*, *Carduus*, *Pyrethrum*, *Centaurea*, *Hieracium*, *Scabiosa*, *Ajuga*, others); one generation per year; overwinter as adults. Western Palearctic species.

***Eurygaster maura* (Linnaeus):** Found in open, well-warmed dry meadows, forest edges and clearings in the hill and mountain forest zones, at altitudes up to 1000 m; herbivore on a broad range of grasses; one generation per year; overwinter as adults. Western Palearctic species.

***Eurygaster integriceps* Puton:** Prefers open, more arid areas from lower elevation flood plains and disturbed areas into dry hill areas to an altitude of 800 m; herbivore on grasses (*Hordeum*, *Poa*, *Dactylus*, *Elytrigia*, and *Agropyron*); one generation per year; overwinter as adults. Trans-Palearctic species.

***Eurygaster testudinaria testudinaria* (Geoffroy):** Found primarily in hydric habitats: bottomlands, wetlands and shaded areas; herbivore primarily on sedges and grasses; one generation per year; overwinter as adults. Trans-Palearctic-Oriental species.

3.25 Family Pentatomidae

***Carpocoris fuscispinus* (Boheman):** Found on a variety of herbaceous plants at forest edges and meadows, floodplains; herbivore on a broad range of herbaceous plants and grasses; one generation per year; overwinter as adults. Trans-Palearctic species.

***Carpocoris purpureipennis* (De Geer):** Found in meadows, forest edges and other areas with grasses from the steppe forest zone and river valleys into the mountains up to 700-1000 m; herbivore on Asteraceae, Apiaceae, Labiatae, graminoids; one generation per year; overwinter as adults. Trans-Eurasian species.

***Carpocoris pudicus* (Poda):** Found at lower elevations in meadows, forest edges and other areas with grasses, including wet meadows; herbivore on various plants (*Phlomis tuberosa*, *Myricaria*, *Caragana*, *Abies sibirica*, *Raponticum* sp.); one generation per year; overwinter as adults. Western Palearctic species.

***Desertomenida quadrimaculata* (Horvath):** Found in dry areas at lower elevations, especially in areas with saturated soils, on reeds, tamarisks and Polygonaceae; generalist herbivore; one generation per year; overwinter as adults. Turanian-Gobi species

***Dolycoris baccarum* (Linnaeus):** Ubiquitous, it inhabits a variety of habitats, except for damp and heavily shaded areas; generalist herbivore: adults feed on shoots and buds of many woody species, switching to the contents of seeds and fruits in the fall; one generation per year; overwinter as adults. Trans-Palearctic species.

***Dolycoris penicillatus* Horvath:** Found in a variety of habitats from lowlands to subalpine meadows at altitudes of 800-2400 m; herbivore on many herbaceous plants; one generation per year; overwinter as adults. Iranian-Turanian species.

***Eurydema dominulus* (Scopoli):** Found in meadows and open areas in the mountains; herbivore on Brassicaceae; two generations per year; overwinter as adults. Trans-Palearctic species.

***Eurydema maracandica* Oshanin:** Found in dry areas at lower elevations through foothills, especially in hydric habitats (springs, wetlands, floodplains and shores of waterbodies); herbivore on Brassicaceae; two generations per year, overwinter as adults. Eastern Mediterranean (Tethys) species.

***Eurydema oleracea* (Linnaeus):** Found at moist depressions in steppe zone, to floodplains and forest edges and meadows at altitudes of 800-2400 m, the); herbivore on Brassicaceae; two generations per year, overwinter as adults. Trans-Palearctic species.

***Eurydema ornata* (Linnaeus):** Found in wooded areas, clearings, meadows and other humid habitats from steppe forest through the foothills to an elevation of 900 m; herbivore on Brassicaceae; two generations per year, overwinter as adults. Trans-Palearctic-Ethiopian species.

***Antheminia lunulata* (Goeze):** Found in grasslands, floodplains and open, dry slopes at altitudes 800-1300 m; herbivore on Asteraceae and Apiaceae; one generation per year, overwinter as adults. Trans-Palearctic species.

***Aelia furcula* Fieber:** Found in dry, open areas at elevations from 800 to 1600 m, very common; herbivore on grasses (Poaceae); one generation per year, overwinter as adults. Western Eurasian-Oriental species.

***Aelia sibirica* Reuter:** Found on grasses in open areas in a variety of habitats throughout the preserve, very common in steppe zone; herbivore on Poaceae, feeding on both seeds and leaves; one generation per year, overwinter as adults. Trans-Eurasian species.

***Jalla dumosa* (Linnaeus):** Found on various woody and herbaceous plants in meadows and areas of sparse forests, from the forest steppe zone through sub-alpine meadows; predatory on small arthropods; one generation per year, overwinter as adults. Trans-Eurasian species.

***Zicrona caerulea* (Linnaeus):** Frequently found in meadows on grasses (e.g. *Polygonum* sp. and others) in lowland floodplains, and at forest edges and meadows to subalpine meadows at altitudes of 800 to 2600 m: predatory on small arthropods and beetle larvae (*Halitica*); one generation per year, overwinter as adults. Holarctic species.

***Piezodorus lituratus* (Fabricius):** Found in many kinds of trees and shrubs, from steppeforest and floodplain forests, to forest edges and meadows in the mountains to an elevation of 1500 m; herbivore on different legumes (*Vicia*, *Caragana* and others); one generation per year, overwinter as adults. Western Palearctic species.

***Graphosoma lineatum* (Linnaeus):** Ubiquitous in both lowland and mountain areas, prefers floodplain meadows and other moderately moist habitats in the mountains at altitudes from 900 to 2400 m; herbivore on buds, flowers and developing seeds of Apiaceae; one generation per year, overwinter as adults. Trans-Palearctic species.

***Graphosoma consimile* Horvath:** Found throughout, from lowland steppes to alpine regions, to altitudes of 3000-3500 m; herbivore on reproductive parts of Apiaceae; one generation per year, overwinter as adults. Central Mediterranean (Tethys) species.

***Sciocoris micropthalmus* Flor:** Found around roots of various graminoids, Fabaceae, *Artemisia* and others on drier, sandy soils in the steppe and forest steppe zones, and in mountain meadows and forest edges at altitudes of 1400-2500 m; generalist herbivore (*Ranunculus*, *Trollius*, *Thymus*, *Echium*, *Bromus*, *Scabiosa* and others); one generation per year, overwinter as adults. Holarctic species.

***Holcostethus strictus vernalis* (Wolff):** Found in the steppe and forest steppe zones, into the mountains in dry, sunny, well warmed habitats at forest edges and meadows at altitudes of 850-2300 m; generalist herbivore, but after wintering adults are common on forested areas on trees (*Alnus*, *Acer*) and various berry bushes, larvae then feed largely on Asteraceae, Brassicaceae, Apiaceae and various graminoids in more open spaces; one generation per year, overwinter as adults. Trans-Eurasian species.

***Holcostethus manifestus* Kiritschenko:** Found on deciduous trees and shrubs, as well as herbaceous plants in a broad range of habitats; generalist herbivore; one generation per year, overwinter as adults. Turanian species.

***Stagonomus bipunctatus* (Linnaeus):** Found in forest openings and edges, from foothills to mountains, often on sandy soils; herbivore on Labiatae, Scrophulariaceae, Plantaginaceae and similar species; one generation per year, overwinter as adults. Western Palearctic species.

***Codophila varia* (Fabricius):** Found on various herbaceous plants, in open, sunny drier areas up to 1000 m; generalist herbivore on Brassicaceae, *Verbascum*, *Achillea*, *Centaurea*, *Lepidium*, *Echium*, *Salvia*, and many others; two generations per year; overwinter as adults. Western Palearctic species.

***Palomena prasina* (Linnaeus):** Adults found on trees, primarily at edges of apple and mixed forests, larvae found on herbaceous plants and shrubs in forest openings; herbivore on a broad range of trees and shrubs (e.g. *Rubus*, *Rosa*, *Quercus*, *Prunus*, *Acer*, *Fraxinus*, *Betula*, *Alnus*, others), one generation per year, overwinter as adults. Western Palearctic species.

***Pentatoma rufipes* (Linnaeus).** Common forest species, mostly in deciduous forests in the mountains to an altitude of 1700 m; herbivore on various trees and shrubs (*Quercus*,

Fagus, Tilia, Betula, Acer, Alnus, Corylus, Cornus, and others); one generation per year; larvae overwinter.

4. Discussion

This is the first survey of the hemipteran fauna of the Sairam-Ugam SNNP, Kazakhstan. The present study recorded 161 species belonging to 25 families, with one new species record for Kazakhstan, *Prostemma gutula*.

By trophic specialization, the Hemiptera of Sairam-Ugam SNNP was divided into 3 groups: herbivores, with 110 species, predators, with 32 species, and herbivore-predators, with 12 species. The majority of the fauna were herbivores, which can be further broken down by breadth of preferred host preferences: 72 species were broad generalists and 38 can be termed oligophages, limited to a narrower range of host plants. The oligophages can be further sub-divided into two sub-groups. 34 species were “broad” oligophages which were specialized to feed broadly on one or more plant families, and 4 species of “narrow” oligophages that feed on a very small number of plant species.

Using the life form definitions proposed by Rác [16, 17], the Hemiptera of Sairam-Ugam SNNP can also be divided into 8 groups by habitat preference: 95 species occur in the near-ground herb/grasses stratum (chortobionts), 7 species were primarily tree dwellers (dendrobionts), 13 species were principally found on shrubs (tannobionts), 3 species live at the ground level surface (herpetobionts), 8 species were found in both the herb/grass layer and on the surface of the ground (herpeto-chortobionts), and 3 geobiont species were found almost exclusively in the soil and under stones. Another 29 species were aquatic and 3 were semi-aquatic, found principally in wet environments along the margins of water bodies.

Of the Hemiptera of Sairam-Ugam SNNP 116 species overwinter as adults, 5 as either larval instars or adults, 34 spend the winter as eggs, 5 species overwinter as larval instars, and 1 species overwinters as either egg or larval instar. 91 species have one generation per year, 36 species have two generations and 34 have three or more.

Using the zoogeographic scheme proposed by Emeljanov [14], the present study identified 19 types of species distributions for the Hemiptera of Kazakhstan. The core fauna includes species with affinities to the Holarctic (26 species), Trans-Palaearctic (40 species), Western Palaearctic (31 species), Trans-Eurasian (27 species), Western Eurasian (15 species), Mediterranean or Tethys (9 species) and Turanian (5).

Several previous studies suggest that the Heteroptera of the mountain regions of Central Asia may be highly diverse [18, 19], a reflection of the high plant diversity in the region and wide variety of vegetation types [20, 21]. Vegetation increases Heteroptera diversity [22, 23]; with vegetation structure and flower abundance identified as key factors in Heteroptera species richness, abundance and community composition [24]. Because the distribution of Heteroptera is strongly influenced by climate and vegetation [25], as well as geology and soil types and vegetation characteristics, it makes them valuable as indicator species [24]. This study found a fairly species rich Heteroptera assemblage in the undisturbed/revegetated areas of the park. While the study encompassed a range of habitats, from steppe and steppe forest at lower elevations to forest and meadow and on to tree line at the highest elevations, the diversity Heteroptera was closely associated with one vegetation type. Of the 129 terrestrial species (the total number excluding the aquatic and semi-aquatic species), 103 species, or 79.8%, were associated with the herbaceous /grass vegetation layer.

Assuming that the Heteroptera are a valid indicator of broader arthropod biodiversity [24, 25], this result suggests that biodiversity conservation efforts focus on maintaining the mosaic of woodland and open areas in the park. Because these mosaics are the product of disturbance events, including fire and grazing [26], it is important to understand the events and how they function to maintain open steppe forest and forest-meadow environment. Strict fire suppression may increase shrub vegetation and canopy cover, leading to a loss of herbaceous and grass layer vegetation. On the other hand, opening additional areas to grazing or permitting larger numbers of domestic animals to graze in the park may degrade native steppe and meadow environments [27, 28] and lead to the loss of arthropod biodiversity. Similarly, the significant number (32) of aquatic or semi-aquatic species of Heteroptera indicates the importance of native aquatic habitats in the park to arthropod biodiversity. These areas also need to be strictly protected from tourism development, water abstraction or increasing access to domestic animals.

5. Conclusion

A study of the Heteropteran fauna in the recently established Sairam-Ugam National Nature Park in Kazakhstan collected specimens from steppe and forest steppe habitats, through forest and forest meadow to subalpine meadows, at elevations ranging from 400m to 3600m. Only undisturbed and restored areas were sampled. A moderately diverse Heteropteran fauna of 161 species belonging to 25 families was reported. The fauna was heavily dominated by Heteroptera closely associated with the herbaceous-grass vegetation layer (103 species, or 79.8 %). Aquatic species (29) and those associated with wetlands (3 species) were the second most numerous group. Because Heteroptera may be a useful indicator group, these results suggest that overall arthropod diversity may be high in the herbaceous-grass open areas, and in the wetlands and riparian areas of the park. While this needs to be confirmed with more detailed studies, it is recommended that park management should identify and manage factors responsible for maintaining the open mosaic of forest-meadow and forest steppe, and protect sensitive aquatic and wetlands areas, especially from tourism development and cattle grazing.

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