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ARBOREAL HEMIPTERA (HETEROPTERA) OF MOUNTAIN ECOSYSTEMS OF SOUTH-EASTERN KAZAKHSTAN

The fauna of arboreal hemiptera of mountain ecosystems of south-eastern Kazakhstan includes 51 species from 10 families: Tingidae, Nabidae, Anthocoridae, Reduviidae, Miridae, Aradidae, Lygaeidae, Coreidae, Acanthosomatidae, Pentatomidae. According to trophic specialization, they are divided into 4 groups: mycetophages (3 species), phytophages (22 species), zoophytophages (8 species); zoophages (18 species), and according to life forms they are distributed into 5 groups: dendrobiont (28 species), dendro-tamnobiont (8 species), dendro-tamno-hortobiont (4 species), dendro-hortobiont (10 species); eurybiont (1 species), according to the number of generations per year, arboreal hemiptera are divided into 6 groups: monovoltine (37 species), bivoltine (5 species), 2-3 generations per year (3 species), polyvoltine (2 species), acyclic (3 species), the number of generations is unknown (1 species). Among the arboreal hemiptera of Kungei Alatau, 29 species hibernate in the imago stage, 13 species in the egg stage, 7 species in the larval and imago stages, and 2 species in the larval stage. There are 2 ecological groups in the woody hemipterofauna of mountain ecosystems of south-eastern Kazakhstan: meso-xerophiles (2 species), mesophiles (49 species). Economically, the fauna of arboreal hemiptera includes both harmful and beneficial species. Most of the harmful species belong to the families Tingidae, Miridae, Aradidae, Lygaeidae, Coreidae, Acanthosomatidae, Pentatomidae. Predatory species (Nabidae, Anthocoridae, Reduviidae, Pentatomidae, subfamilies Asopinae) are useful for humans, as they regulate the number of harmful insects in biocenoses. Analysis of the geographical distribution of the hemiptera of mountain ecosystems of south-eastern Kazakhstan allowed us to identify 17 types of species ranges. The fauna is based on species of hemiptera with Holarctic, trans-Palearctic, Western Palearctic, Trans-Eurasian, Western Eurasian habitats.

Key words: arboreal hemiptera, of mountain ecosystems of south-eastern Kazakhstan, mycetophages, phytophages, phytophages, zoophages.

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Оңтүстік-Шығыс Қазақстанның тау экожүйелерінің ағаш жартылай қаттықанаттылары (Heteroptera)

Оңтүстік Шығыс Қазақстанның тау экожүйелерінің ағаш жартылай қаттықанаттылар фаунасы 10 тұқымдасқа: Tingidae, Nabidae, Anthocoridae, Reduviidae, Miridae, Aradidae, Lygaeidae, Coreidae, Acanthosomatidae, Pentatomidae жататын 51 түрден тұрады. Олар қоректік байланысы жағынан 4 топқа бөлінеді: мицетофагтар (3 түр), фитофагтар (22 түр), зоофитофагтар (8 түр); зоофагтар (18 түр), ал тіршілік ортасына қарай 5 топқа бөлінеді: дендробионттар (28 түр), дендро-тамнобионттар (8 түр), дендро-тамно-хортобионттар (4 түр), дендро-хортобионттар (10 түр); эврибионт (1 түр), ағаш жартылай қаттықанаттылары жылына беретін ұрпақ санына қарай 6 топқа бөлінеді: моновольтинді (37 түр), бивольтинді (5 түр), жылына 2-3 рет ұрпақ беру (3 түр), поливольтинді (2 түр), ацикліді (3 түр), ұрпақ саны белгісіз (1 түр). Оңтүстік Шығыс Қазақстанның тау экожүйелерінің ағаш жартылай қаттықанаттылары арасында ересек дарасы күйінде 29 түр, жұмыртқа сатысында – 13 түр, ересек дарасы және дернәсілдері сатысында – 7 түр, дернәсілдері сатысында – 2 түр қыстайды. Күнгей Алатаудың ағаш гемиптерофаунасы 2 экологиялық топқа

бөлінеді: мезо-ксерофилдер (2 түр), мезофилдер (49 түр). Шаруашылық тұрғыдан алғанда, ағаш жартылай қаттықанаттылар фаунасы зиянды да, пайдалы да түрлерді қамтиды. Зиянды түрлердің көпшілігі мына тұқымдастарға жатады: Tingidae, Miridae, Aradidae, Lygaeidae, Coreidae, Acanthosomatidae, Pentatomidae. Жыртқыш түрлер (Nabidae, Anthocoridae, Reduviidae, Pentatomidae, Asopinae тұқымдас тармағы) адам үшін пайдалы түрлер болып табылады, өйткені биоценоздардағы зиянды жәндіктердің санын реттейді. Оңтүстік Шығыс Қазақстанның тау экожүйелерінің ағаш жартылай қаттықанаттыларының географиялық таралуын талдау нәтижесінде олардың 17 таралу аймағына бөлінетіні анықталды. Фаунаның негізін голарктикалық, транспалеарктикалық, батыспалеарктикалық, трансеуразиялық, батысеуразиялық таралу аймақтары бар жартылай қаттықанаттылар түрлері құрайды.

Түйін сөздер: ағаш жартылай қаттықанаттылары, Оңтүстік Шығыс Қазақстанның тау экожүйелері, мицетофагтар, фитофагтар, зоофитофагтар, зоофагтар.

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Древесные полужесткокрылые (Heteroptera) горных экосистем Юго-Восточного Казахстана

Фауна древесных полужесткокрылых горных экосистем Юго-Восточного Казахстана включает 51 вид из 10 семейств: Tingidae, Nabidae, Anthocoridae, Reduviidae, Miridae, Aradidae, Lygaeidae, Coreidae, Acanthosomatidae, Pentatomidae. По трофической специализации они подразделяются на 4 группы: мицетофаги (3 вида), фитофаги (22 вида), зоофитофаги (8 видов); зоофаги (18 видов), а по жизненным формам распределяются по 5 группам: дендробионт (28 видов), дендро-тамнобионт (8 видов), дендро- тамно-хортобионт (4 вида), дендро-хортобионт (10 видов); эврибионт (1 вид), по числу поколений в год древесные полужесткокрылые разделяются на 6 групп: моновольтинный (37 видов), бивольтинный (5 видов), 2-3 поколения в год (3 видов), поливольтинный (2 вид), ацикличный (3 вида), число поколений неизвестно (1 вид). Среди древесных полужесткокрылых горных экосистем Юго-Восточного Казахстана в стадии имаго зимуют 29 видов, в стадии яйца – 13 вида, в стадии личинки и имаго – 7 видов, в стадии личинки – 2 вида. В древесной гемиптерофауне горных экосистем Юго-Восточного Казахстана выделяются 2 экологических групп: мезо-ксерофилы (2 вида), мезофилы (49 видов). В хозяйственном отношении фауна древесных полужесткокрылых включает как вредные, так и полезные виды. Большинство вредных видов принадлежат семействам Tingidae, Miridae, Aradidae, Lygaeidae, Coreidae, Acanthosomatidae, Pentatomidae. Хищные виды (Nabidae, Anthocoridae, Reduviidae, Pentatomidae, подсемейство Asopinae) являются полезными для человека, так как регулируют численность вредных насекомых в биоценозах. Анализ географического распространения полужесткокрылых горных экосистем Юго-Восточного Казахстана позволил выделить 17 типов видовых ареалов. Основу фауны составляют виды полужесткокрылых с голарктическими, транспалеарктическими, западнопалеарктическими, трансевразиатскими, западноевразиатскими ареалами.

Ключевые слова: древесные полужесткокрылые, горные экосистемы Юго-Восточного Казахстана, мицетофаги, фитофаги, зоофитофаги, зоофаги.

Introduction

Hemiptera are one of the most peculiar orders of insects inhabiting a wide variety of biotopes and playing an important role in biological processes in biogeocenoses. There are many predatory or mixed-food species among bedbugs, but herbivorous forms predominate; periodically multiplying in large numbers, they cause significant harm to forest and agricultural crops. Some hemiptera, being predators, exterminate pests of forests and cultivated crops [1, 2].

In Kazakhstan, despite the important economic importance of hemiptera, their species composition, biology, ecology, distribution by natural zones and vertical belts and economic importance in certain physical and geographical regions of the republic are insufficiently studied, which determines the relevance of this study.

The purpose of this work is to clarify the fauna of woody hemiptera of mountain ecosystems of Southeastern Kazakhstan, their biology, ecological and zoogeographic distribution and economic significance.

Material and methods of research

The materials were collected by the authors in the mountain ecosystems of Southeastern Kazakhstan from 2019 to 2022. When collecting the material, standard entomological techniques were used – bedbugs were collected from herbaceous plants, shrubs and tree branches with a net; species living on the soil surface, at the roots of plants, in the forest litter, under the bark of trees and various shelters were caught with an exhauster or tweezers [3, 4]. For species identification of species, clarification of their taxonomic position, biology, economic significance and distribution, sources from the literature list were used [5-17].

For the first time, an inventory and a comprehensive analysis of the fauna of woody hemiptera of mountain ecosystems of Southeastern Kazakhstan were carried out. Based on our own research, generalization of literature data and study of collection materials stored at the Institute of Zoology of the MES RK, an annotated list of woody hemiptera of mountain ecosystems of Southeastern Kazakhstan was compiled for the first time.

Research results and their discussion

Below is a list of identified species of woody hemiptera of mountain ecosystems of Southeastern Kazakhstan.

Family Tingidae

Physatocheila smreczynskii China, 1952. Tamno-dendrobionts (on shrubs and trees from the family. Rosaceae); mesophyll (in forest biotopes, in mountains up to 900-1300 m [6]; wide oligophytophagus (family Rosacea); 2-3 generations per year; imago overwinter. Trans-Palearctic species.

Family Nabidae

Himacerus mirmicoides (O. Costa, 1834). Horto-tamno-dendrobiont (in various herbaceous and herbaceous-shrubby, woody communities, mostly well-warmed and moderately mesophilic); mesophile (in forest clearings, under the canopy of a rare forest, in gardens, parks, meadows); zoophage (small insects: aphids, butterfly caterpillars, horsefly bugs, etc. [7]; monovoltine; imago overwinters (under plants, in litter). Western Palearctic species.

Family Anthocoridae

Acompocoris alpinus Reuter, 1875. Dendrobiont (on coniferous trees: Abies, Picea. Larix, Pinus), rises to the mountains up to 1200 m above sea level; mesophile (in the forest zone, mostly in the mountains); zoophage (mainly feeds on aphids); monovoltine; imago overwinters [8]. Trans-Eurasian species.

Acompocoris pilipes Stys, 1960. Dendrobiont (on coniferous trees); mesophyll (in the forest zone, mostly in the mountains up to 2000 m above sea level); zoophage (small insects and mites) [8]; monovoltine; imago overwinters. The North Turkestan endemic.

Anthocoris flavipes Reuter, 1884. Dendro-hortobiont (on shrubs and large herbaceous plants), mesophyll (in the mountains at an altitude of 1800-3000 m) [8]; zoophage; monovoltine; imago overwinters. Middle Tibetan-Tibetan mountain species.

Anthocoris nemorum (Linnaeus, 1761). Dendrohortobiont (on various herbaceous, shrubby and woody plants), less often on grass; mesophyll (mountain forests, alpine and subalpine meadows, up to 1000-3000 m above sea level, found in gardens, where it plays an important role in regulating the number of pests of apple trees [17]; zoophage (wide polyphage, feeds on aphids, ticks, worms, thrips, eggs and caterpillars of the scoop, eggs of Miridae; 2-3 generations per year; imago overwinters. It is distributed throughout the Palearctic, mainly in the forest zone. In Tajikistan, it was collected on Caragana arborescens (in a colony of larvae of Psylla vera leafhopper), Myricaria, sea buckthorn [8]. Trans-Palearctic species.

Anthocoris pilosus (Jakovlev, 1877). Dendrohortobiont (in the mountains it is found in large numbers on herbaceous plants, shrubs and deciduous trees: Populus, Salix, fruit trees), mesophyll; zoophage (feeds on aphids, larvae of leafhoppers, Miridae, thrips, eggs and caterpillars of butterflies, mites), is one of the main enemies of different species of aphids on woody and shrubby breeds; polyvoltine 4-5 generations per year; imago overwinters. This species is the most effective in reducing the number of apple aphids in the Almaty fruit-growing zone [18]. Trans-Eurasian species.

Tetraphleps aterrima (J.Sahlberg, 1878). Dendrobiont (in mixed forests and spruce woodlands lives on cedar woodland, larch, birch and pine); mesophyll (in mountains up to a height of 2700-2900 m); zoophage (small insects, their larvae and eggs); monovoltine; imago overwinters. In the literature, it is mentioned from fir [19]. Trans-Eurasian species.

Orius horvathi (Reuter, 1884). Dendro-hortobiont (on various herbaceous plants: Medicago, Trofolium, etc.); mesophyll (from deserts to highlands, in floodplains of rivers); zoophage (aphids,

leafhoppers, thrips, small caterpillars of butterflies, ticks and their eggs, eggs of a harmful turtle, bread bug); 2-3 generations per year; imago overwinters. Feeding on aphids (Aphis pomi), tobacco thrips and mites was noted [8]. Trans-Palearctic species.

Orius vicinus (Ribaut, 1923). Tamno-hortobiont (on the flowers and leaves of various herbaceous plants, shrubs, trees); mesophyll (on different stations, from deserts to highlands up to 2000 m or more); zoophage (a wide polyphage, mainly with scutes and other small insects); bivoltine; imago overwinter. It was found on a birch tree in Tuva [20]. Trans-Eurasian species.

Family Reduviidae

Empicoris culiciformis (De Geer, 1773). Eurybiont (doesn't have a clear station and tiered confinement and can be found in a wide variety of moderately moistened biotopes); mesophile (a wide variety of moderately moistened biotopes, on soil and on bushes, on bark and under bark, sometimes in bird nests); zoophage (blood-sucking mosquitoes, book and dust lice, barn pests, hay eaters: *Liposcelis divinatrium, Trogium pulsatorium*); the number of generations is unknown; adults and larvae of older ages overwinter. Birds' nests, bark cracks, tree hollows, piles of dry leaves and grasses are used as winter shelters [21]. Flying into the light. Holarctic species.

Rhynocoris annulatus (Linnaeus, 1758). Dendro-hortobiont (on trees: pine, spruce, juniper, birch, hazel, alder, oak, aspen; on various shrubs and herbaceous vegetation: umbelliferous, leguminous, compound-flowered); mesophyll (forest, forest-steppe zones, riverine forests); omnivorous zoophage (leaf beetles, wasps, bees, butterfly caterpillars and others); one generation per year; larvae of IV-V ages overwinter. Overwintering of larvae is proved by field observations [22]. West Eurasian species.

Rhynocoris iracundus (Poda, 1761). Dendrohortobiont; mesophyll (various natural zones: from settled valleys and hot, sparsely wooded slopes of foothills and low mountains to high-altitude forest clearings and subalpine meadows up to 2000 m, on plains on trees, shrubs and herbaceous vegetation); zoophage (they lie in wait for prey on tall flowering plants and willingly catch various insects: leaf beetles, wasps, bees, butterfly caterpillars, etc.); one generation per year; older larvae overwinter [21]. It overwinters in the larval and imago stages [23]. Western Palearctic species.

Family Miridae

Deraeocoris olivaceus (Fabricius, 1777). Dendrobiont (on various broad-leaved trees and shrubs); mesophyll; zoophytophagus; monovoltine; imago overwinter. Trans-Eurasian species.

Agnocoris rubicundus (Fallen, 1807). Dendrobiont (on deciduous, fruit trees and shrubs, more often on eve); mesophyll (mixed forest, in floodplains, in mountains 800-2300 m); polyphytophagus (feeds on seeds of willow *Salix*, maple, etc.); monovoltine; winter imago. It is listed among the pests of fruit crops [23, 24], which, apparently, does not correspond to reality. Holarctic species.

Apolygus limbatus (Fallen, 1807). Dendrobiont; mesophyll (forest zone); polyphytophagus (mainly on willows, as well as on birch and alder); bivoltine; eggs overwinter. Trans-Eurasian species.

Dichrooscytus consobrinus Horvath, 1904. Dendrobiont (on juniper); mesophyll (on steep rocky slopes); narrow oligophytophagus (Juniperus sp.); monovoltine [25]; imago hibernate. Altai-Alatava mountain type.

Dichrooscytus pseudosabinae Reuter, 1896. Dendro-hortobiont; mesophyll (apple forest, clearings, subalpine meadow, up to 2400 m); polyphytophagus (on juniper and grassy plants); monovoltine; imago overwinter. Turkestan-Alatava mountain type.

Pinalitus rubricatus (Fallen, 1807). Dendrobiont (in the crown of coniferous trees), mesophyll; zoophytophagus; bivoltine; eggs overwinter. Western Palearctic species.

Blepharidopterus angulatus (Fallen, 1807). Dendrobiont (on hardwoods of Alnus, Betula, Salix, Corylus and other fruit trees); mesophyll (in valley mixed forests and mountain stream near the upper border of the forest); zoophytophagus (feeds on aphids); monovoltine; eggs overwinter. Trans-Palearctic species.

Malacocoris chlorizans (Panzer, 1794). Dark dendrobiont (on fruit, deciduous trees and shrubs). Rosaceae); mesophyll; zoophytophagus (small insects and other invertebrates); bivoltine; eggs overwinter. West Eurasian species.

Orthotylus melanotylus Kerzhner, 1962. Dendrobiont (on deciduous trees); mesophyll (mixed forest, on Salix, on the floodplain on Tamarix, Myricaria, in the mountains at an altitude of 800-1200 m); zoophytophagus; monovoltine; eggs overwinter. Flying into the light. Altai-Turkestan-North Turanian species.

Orthotylus oshanini Reuter, 1883. Dendrobiont (on Spiraea); mesophyll (steppe, floodplain meadows, in the mountains 800-1500 m); zoophytophagus; monovoltine; eggs overwinter. Middle East Eurasian species.

Campylomma verbasci (Meyer-Dur, 1843). Dendro-hortobiont; mesophyll (steppe, wasteland, low–mountain meadow, 700-1200 m); zoophytophagus (on various deciduous, including fruit trees – apple trees, pears, suckers; on grasses: Verbascum, Carduus, where Psylla mali and other small insects, mites and their eggs feed); polyvoltine; eggs overwinter [26]. Trans-Palearctic species.

Compsidolon alatavicum (Kerzhner, 1962). Dendrobiont; mesophyll (mixed forest, upper border of coniferous woodlands, 1000-2400 m); narrow oligophytophagus (Picea schrenkiana); monovoltine; eggs hibernate (Kerzhner, 1962). Alatava is endemic.

Psallus anticus (Reuter, 1876). Dendrotamnobiont (on willow, oak, spiraea and karagana (Esenbekova, 2008); mesophyll (steppes, deciduous forests, meadows, in valleys of mountain rivers, in mountains up to 900-1500 m); zoophytophagus; monovoltine; eggs overwinter [27]. Srednetetiskie species.

Sacculifer rufinervis (Jakovlev, 1880). Dendrobiont; mesophyll (steppes, steppe slopes, in mountains up to 900-1100 m); narrow oligophytophagus (on Spiraea hypericifolia) [27]; monovoltine; eggs overwinter. Turkestan-Turan species.

Family Aradidae

Aradus aterrimus Fieber, 1864. Dendrobiont (on Pinus pine); mesophyll (in the mountains rises to a height of 2300-2500 m above sea level); mycetophagus; feeds on mushroom juice; acyclic; overwinters imago and larvae of all stages. Trans-Eurasian species.

Aradus cinnamomeus Panzer, 1794. Dendrobiont (on young pines); mesophyll; mycetophagus, feeds on mushroom juice; acyclic; imago and larvae of all stages overwinter [28]. West Eurasian species.

Aradus lugubris Fallen, 1807. Dendrobiont (on the tinder of coniferous trees in the mountains); mesophyll, mycetophagus, feeds on mushroom juice [12]; acyclic; imago and larvae of all stages overwinter. Holarctic species.

Family Lygaeidae

Arocatus roeselii (Schilling, 1829). Dendrobiont (on coniferous trees under the bark, alder fruits Alnus); mesophyll; polyphytophagus; monovoltine, winter imago. Western Palearctic species.

Orsillus depressus (Mulsant & Rey, 1852). Dendrobiont (on coniferous, more often on juniper); mesophyll (subalpine meadow); wide oligophytophagus; monovoltine; eggs overwinter. Western Palearctic species.

Orsillus maculatus Fieber, 1861. Dendrobiont (in pine cones, cypress and juniper); meso-xerophile; wide oligophytophagus; monovoltine; eggs overwinter. In Cyprus, Cupressus sempervirens has been recorded in cones [11]. West Eurasian species.

Kleidocerys resedae resedae (Panzer, 1797). Dendro-tamnobiont (almost everywhere where there is birch and alder); mesophyll (forest-steppe, in the mountains up to 2000 m above sea level); polyphytophagus (Betula, Fraxinus, Alnus, Ledum, Spiraea, Corylus); monovoltine; imago overwinter, larvae of V age – under the bark, in hollows, in rolled up dry leaves. Mainly on birch trees, as well as on other trees and shrubs. Sometimes it is noted in large populations and then sucking pedicels, birch catkins causes their massive fall and actually destroys the harvest of birch seeds. Damaged leaves bend the edges to the lower side [23]. Trans-Eurasian species.

Oxycarenus modestus Fallen, 1829. Dendrobiont (trophically related to alder Alnus); mesophyll (in the mountains up to 1500 m); narrow oligophytophagus (on Alnus glutinosa, A. incana); monovoltine; imago and larvae of different ages overwinter (in old alder cones, under the bark of different trees [11]. West Eurasian species.

Gastrodes grossipes grossipes (De Geer, 1773). Dendrobiont (in cones of spruce, pine and fir; under bark scales); mesophyll (coniferous forests); broad oligophytofage (seeds of Pinus, Abies, Larix and other trees); bivoltine, winter imago. Trans-Eurasian species.

Family Coreidae

Gonocerus patellatus Kiritshenko, 1916. Dendrobiont (inhabitant of tree species: Rosa, etc.); mesophyll; polyphytophagus; monovoltine; imago hibernate [30]. Iranian-Turanian species.

Gonocerus juniperi Herrich-Schaffer, 1839. Dendrobiont (inhabitant of tree species: on Juniperus, as well as Cupressus, Pinus, Picea, Guercus, etc.); meso-xerophile; wide oligophytophagus (mainly on juniper and other conifers); monovoltine; imago hibernate under the bark of trees and in the forest litter [31]. Western Palearctic species.

Family Acanthosomatidae

Acanthosoma spinicolle Jakovlev, 1880. Dendrobiont (on deciduous and coniferous trees); meso-

phyll (in forests: mixed forest, 900-1000 m); polyphytophagus; monovoltine; imago overwinter [11, 32]. East Palearctic species.

Elasmucha ferrugata (Fabricius, 1787). Dendro-tamnobiont (on *Ribes* currant, *Lonicera* honeysuckle, etc.); mesophyll (in forests, in valleys of rivers and streams, in mountains up to 1500 m); polyphytophagus (noted as a pest of berry bushes, on red currant [33]; monovoltine; imago overwinter. Trans-Palearctic species.

Family Pentatomidae

Arma custos (Fabricius, 1794). Dendro-hortobiont (on single trees and shrubs, on the slopes of dry hills and mountains, edges, parks, shaded wet and swampy forest areas, in floodplain forests, especially on *Salix* willow and alder *Alnus*); mesophile (mixed mesophilic forests, in the mountains up to 900-1300 m); zoophage (feeds on various small arthropods, more often by larvae of leaf beetles, actively looking for prey); monovoltine; imago overwinter [10, 34]. Trans-Eurasian species.

Jalla dumosa (Linnaeus, 1758). Dendro-hortobiont (on various woody and herbaceous plants); mesophyll (forest-steppe zone, in the mountains within the limits of subalpine meadows, ecologically associated with mesophytic areas of sparse forests, forest meadows); zoophage (feeds on various small arthropods); monovoltine; winter imago. In the literature [10] it is also noted that bedbugs and larvae feed on the juices of aromatic plants, such as oregano (Oryganum), mint (Mentha). Trans-Eurasian species.

Picromerus bidens (Linnaeus, 1758). Dendrobiont (forest zone, forest-steppe, mountain-forest belt, sometimes enters the steppes, broad-leaved, mixed and coniferous forests, rises into the mountains to the upper border of the forest); mesophyll (forest meadows, clearings, tree-shrub vegetation of river valleys, birch-aspen spikes, occasionally on deposits and fields); zoophage (various small arthropods, can occasionally feed on vegetable juice); monovoltine; eggs overwinter [32, 35]. Holarctic species.

Rhacognatus punctatus (Linnaeus, 1758). Dendrobiont (forest zone, forest-steppe, mountain-forest belt, in mixed forests, on Salix, Betula, aspen, raspberry, nettle, etc. plants); mesophyll (moistened forest meadows, river valleys with woody and shrubby vegetation); zoophage (various small arthropods); monovoltine; winter imago. The imago of the new generation appears in mid-August [36]. Trans-Palearctic species.

Zicrona caerulea (Linnaeus, 1758). Horto-tamno-dendrobiont; mesophyll (on floodplains in the steppe, in forests, tree plantations and near them, often on grasses, meadows on Polygonum sp. and others, in mountains up to 800-2600 m, on subalpine meadows); zoophage (feeds on various small arthropods, destroys larvae of leaf beetles Haltica spp.); monovoltine; imago overwinter [10]. Holarctic species.

Chlorochroa juniperina juniperina (Linneaus, 1758). Dendrobiont; mesophyll (foothills, subalpine belt); wide oligophytophagus (on larch, scots pine, b.h. juniper Juniperus nana); monovoltine; winter imago. A new generation in early August [36]. Trans-Palearctic species.

Chlorochroa pinicola (Mulsant & Rey, 1852). Dendrobiont (on coniferous: juniper, spruce, b.h. on pine); mesophyll (forest zone, forest-steppe, mountain-forest belt); narrow oligophytophagus (species of the genus Pinus); monovoltine; imago overwinter [37]. Euro-Siberian-Kazakh species.

Palomena prasina (Linnaeus, 1761). Dendro-tamno-hortobiont (on trees, imago, after leaving wintering, fly off to open places, including cultural fields, later they return to forests, but mainly keep to the edges; larvae develop on herbaceous plants and shrubs); mesophyll (apple and mixed forest); polyphytophagus (more often on shrubs and trees: Ribes, Rubus, Rosa, Quercus, Crataegus, Prunus, Sorbus, Acer, Fraxinus, Tilia, Betula, Alnus, etc.); monovoltine; winter imago. A new generation in early August [36]. Western Palearctic species.

Palomena viridissima (Poda, 1761). Dendro-tamnobiont (on trees and shrubs from the family. Rosaceae); mesophyll; polyphytophagus (more often-on deciduous trees [10]; monovoltine; imago overwinter. Trans-Palearctic species.

Pentatoma rufipes (Linneaus, 1758). Dendro-tamnobiont; typically forest (mostly in deciduous forests, rises to a height of up to 1700 m above sea level); mesophyll; polyphytophagus (on various trees and shrubs: Quercus, Fagus, Tilia, Betula, Acer, Alnus, Corylus, Cornus and others; sucks vegetative and generative parts [10]; monovoltine; larvae overwinter. Trans-Eurasian-oriental view.

Piezodorus lituratus (Fabricius, 1794). Dendro-tamno-hortobiont; mesophyll (steppe, tall grass meadows, floodplain forest, edges, clearings, rises into the mountains to a height of 1500 m above sea level); wide oligophytophagus (on various Leguminosae Leguminosae: Vicia, Caragana, etc., young imagos are often found on many types of trees and shrubs [10]; monovoltine; imago overwinter. Western Palearctic species.

The following is a list of identified species of arboreal hemiptera (Heteroptera) Mountain ecosystems of South-Eastern Kazakhstan (Table 1).

Table 1 – Taxonomic composition of woody hemiptera (Heteroptera) of mountain ecosystems of Southeastern Kazakhstan

Family	Species	Quantity	%
Tingidae	*Physatocheila smreczynskii* China, 1952	1	2
Nabidae	*Himacerus mirmicoides* (O.Costa, 1834)	1	2
Anthocoridae	*Acompocoris alpinus* Reuter, 1875	8	16
	Acompocoris pilipes Stys, 1960		
	Anthocoris flavipes Reuter, 1884		
	Anthocoris nemorum (Linnaeus, 1761)		
	Anthocoris pilosus (Jakovlev, 1877)		
	Tetraphleps aterrima (J.Sahlberg, 1878)		
	Orius horvathi (Reuter, 1884)		
	Orius vicinus (Ribaut, 1923)		
Reduviidae	*Empicoris culiciformis* (De Geer, 1773)	3	6
	Rhynocoris annulatus (Linnaeus, 1758)		
	Rhynocoris iracundus (Poda, 1761)		
Miridae	*Deraeocoris ventralis* Reuter, 1904	14	27
	Agnocoris rubicundus (Fallen, 1807)		
	Apolygus limbatus (Fallen, 1807)		
	Dichrooscytus consobrinus Horvath, 1904		
	Dichrooscytus pseudosabinae Reuter, 1896		
	Pinalitus rubricatus (Fallen, 1807)		
	Blepharidopterus angulatus (Fallen, 1807)		
	Malacocoris chlorizans (Panzer, 1794)		
	Orthotylus melanotylus Kerzhner, 1962		
	Orthotylus oshanini Reuter, 1883		
	Campylomma verbasci (Meyer-Dur, 1843)		
	Compsidolon alatavicum (Kerzhner, 1962)		
	*Psallus anticus (*Reuter, 1876)		
	Sacculifer rufinervis (Jakovlev, 1880)		
Aradidae	*Aradus aterrimus* Fieber, 1864	3	6
	Aradus cinnamomeus Panzer, 1794		
	Aradus lugubris Fallen, 1807		
Lygaeidae	*Arocatus roeselii* (Schilling, 1829)	6	12
	Orsillus depressus (Mulsant & Rey, 1852)		
	Orsillus maculatus Fieber, 1861		
	Kleidocerys resedae resedae (Panzer, 1797)		
	Oxycarenus modestus Fallen, 1829		
	Gastrodes grossipes grossipes (De Geer, 1773)		
Coreidae	*Gonocerus patellatus* Kiritshenko, 1916	2	4
	Gonocerus juniperi Herrich-Schaffer, 1839		
Acanthosomatidae	*Acanthosoma spinicolle* Jakovlev, 1880	2	4
	Elasmucha ferrugata (Fabricius, 1787)		
Pentatomidae	*Arma custos* (Fabricius, 1794)	11	21
	Jalla dumosa (Linnaeus, 1758)		
	Picromerus bidens (Linnaeus, 1758)		
	Rhacognatus punctatus (Linnaeus, 1758)		
	Zicrona caerulea (Linnaeus, 1758)		
	Chlorochroa juniperina juniperina (Linneaus, 1758)		
	Chlorochroa pinicola (Mulsant & Rey, 1852)		
	Palomena prasina (Linnaeus, 1761)		
	Palomena viridissima (Poda, 1761)		
	Pentatoma rufipes (Linneaus, 1758)		
	Piezodorus lituratus (Fabricius, 1794)		
10		51	100

Conclusion

The fauna of woody hemiptera (Heteroptera) of the mountain ecosystems of Southeastern Kazakhstan includes 51 species from 10 families: Tingidae (1), Nabidae (1), Anthocoridae (8), Reduviidae (3), Miridae (14), Aradidae (3), Lygaeidae (6), Coreidae (2), Acanthosomatidae (2), Pentatomidae (11) (diagram 1).

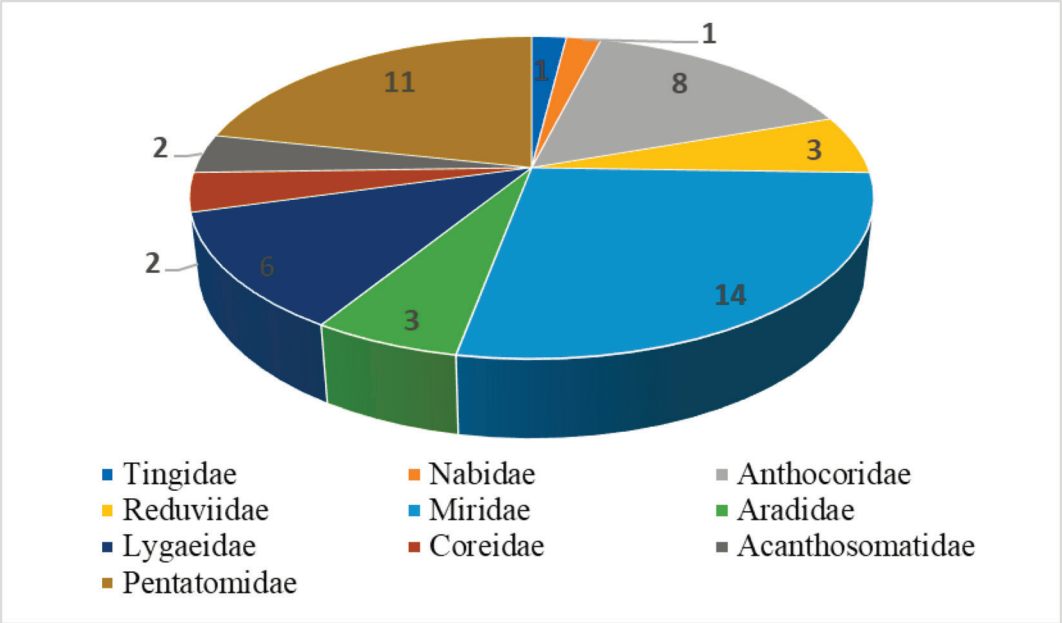

Diagram 1 – Distribution of species by family

According to trophic specialization, woody hemiptera of mountain ecosystems of Southeastern Kazakhstan are divided into 4 groups: mycetophagus (3 species); the main core of the fauna consists of phytophages (22 species): narrow oligophytophagus (5 species), wide oligophytophagus (6 species), polyphytophagus (11 species), zoophytophages (8 species); zoophages (18 species).

According to life forms, woody hemiptera of mountain ecosystems of Southeastern Kazakhstan are divided into 5 groups: dendrobiont (28 species), dendro-tamnobiont (8 species), dendro-tamno-hortobiont (4 species), dendro-hortobiont (10 species); eurybiont (1 species).

According to the number of generations per year, woody hemiptera of mountain ecosystems of Southeastern Kazakhstan are divided into 6 groups: monovoltine (37 species), bivoltine (5 species), 2-3 generations per year (3 species), polyvoltine (2 species), acyclic (3 species), the number of generations is unknown (1 species).

Among woody semi-hard–winged mountain ecosystems of Southeastern Kazakhstan, 29 species hibernate in the imago stage, 13 species in the egg stage, 7 species in the larval and imago stages, and 2 species in the larval stage.

In the hemipterofauna of woody hemiptera of mountain ecosystems of Southeastern Kazakhstan, 2 ecological groups are distinguished: meso-xerophiles (2 species), mesophiles (49 species).

Economically, the fauna of woody semi-hard-winged mountain ecosystems of Southeastern Kazakhstan includes both harmful and beneficial species. Most harmful species are pests of forestry and agriculture [27, 28]. They mainly belong to the families Tingidae, Miridae, Aradidae, Lygaeidae, Coreidae, Acanthosomatidae, Pentatomidae. Predatory species (Nabidae, Anthocoridae, Reduviidae, Pentatomidae, subfamilies Asopinae) are useful for humans, as they regulate the number of harmful insects in biocenoses [28, 29].

Analysis of the geographical distribution of semi-hard-winged mountain ecosystems of Southeastern Kazakhstan allowed us to identify 17 types of species ranges. The fauna is based on species of hemiptera with Holarctic (5 species), trans-Palearc-

tic (9 species), Western Palearctic (8 species), trans-Eurasian (12 species), Western Eurasian (5 species) habitats. In the remaining species ranges, only one species is known: East Palearctic (1 species), Middle Tethyan (1 species), Iranian-Turan (1 species); Turkestan-Turan (1 species), Central Tibetan-Tibetan mountain (1 species), Altai-Alatava mountain (1 species), Turkestan-Alatava mountain (1 species), Altai-Turkestan-North Turan (1 species), Central East Eurasian (1 species), Euro-Siberian-Kazakhstan (1 species), trans-Eurasian-oriental (1 species), Alatava endemic (1 species).

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