



A survey of the biology, ecology and distribution of some cimicomorpha (Hemiptera, Heteroptera) species from Kazakhstan

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Abstract

A survey of the biology and natural history of the infraorder Cimicomorpha of Kazakhstan, based on fieldwork throughout the country between 2010 and 2020 and a review of the lead author's personal collection, identified 31 species from 17 genera belonging to 4 families. Of these, 19 species were zoophages, 1 species was a mycetophage, and 11 species were phytophages, divided into 3 subgroups: polyphages, broad and narrow oligophages. The majority, (26 species, 84%), overwintered in the adult stage, three species (10%) wintered as nymphs, and two species (6%) overwintered in the egg stage. Based on habitat moisture requirements, the following groups were identified: mesophiles (27 species), meso-xerophiles (1 species), xerophiles (1 species), hygro-mesophiles (1 species) and hygrophiles (1 species). Habitat structure requirements also divided the surveyed species into 9 groups: dendrobionts, tamno-dendrobionts, dendro-chortobionts, chorto-tamnobionts, chortobionts, herpetobionts, herpeto-chortobionts, epigeobionts and eurychortobionts. The species belonged to 12 zoogeographical regions: Holarctic (1), Trans-Paleartic (3), West Palearctic (3), Trans-Eurasian (10), West Eurasian (6), European-Kazakh (1), Iranian-Turanian (2), Turanian (1), Mid-eastern Tethyan (1), Turkestan (1), North Turkestan (1).

Keywords: hemiptera, heteroptera, biology, ecology, zoogeography, Kazakhstan

Introduction

Hemiptera inhabit a broad variety of environments and play an important role in biological processes within them (Henry 2017) ^[1]. Among the bugs there are many predatory or omnivorous species, but herbivorous forms predominate (Rabitsch 2010) ^[2]. Populations of some herbivorous species periodically erupt, causing significant harm to agricultural crops (grain, fodder, vegetables, fruits), as well as to pastures and forests (Schaefer and Panizzi 2000) ^[3]. Other Hemiptera species are predators that prey on and control pests of cultivated crops and forests.

While information on Hemiptera species composition, biology, ecology, distribution by habitat and elevation, and their economic importance in certain physical and geographical regions of Kazakhstan remains limited, additional information has recently been published. Esenbekova (2012 ^[4], 2015 ^[5]) described the feeding types of the Heteroptera of Kazakhstan. She further described the classification of their habitats by humidity (Esenbekova 2010a) ^[6] and habitat structure (Esenbekova 2011a) ^[7]. The zoogeographic regions of Kazakhstan are described by Emilyanov (1974) ^[8]; Esenbekova (2010b ^[9], 2011b ^[10]) describes how the Heteroptera of Kazakhstan align with this zoogeographic framework. Esenbekova (2010a, ^[6] 2010b ^[9], 2011a ^[7], 2011b ^[10]), Esenbekova *et al.* (2015) ^[11], Esenbekova *et al.* (2017) ^[12], and Yesenbekova and Homziak 2013 ^[13] review the habitats and life histories of Hemiptera of Kazakhstan and the Northern Tien Shan mountains.

Carnivorous Hemiptera inhabit various cultural and natural biocenoses and are found throughout the summer in all areas of Kazakhstan. They can suppress populations of harmful insects and mites by preying on eggs, larvae and adults, especially aphids, leafhoppers, leaf beetles, thrips, and larvae of sawflies, Lepidoptera, Hemiptera, Coleoptera), and are used in biological control of plant pests. Their numbers are higher in natural biocenoses than in man-altered environments (Esenbekova 2010a ^[6], 2010b ^[9]).

Despite their economic importance, species composition, biology, ecology, distribution and biogeography, and economic impacts of Hemiptera in Kazakhstan have not been sufficiently studied. This research aims to expand on previous work on Hemiptera in Kazakhstan to fill in some of these gaps. Specifically, it aims to identify the Cimicomorpha I (Kerzhner *et al.* 1996 ^[14]) fauna of the mountain ecosystems of Kazakhstan of Kazakhstan, their biology, ecological role, zoogeographic distribution and economic significance.

Materials and methods

The basis for this work were the authors' own collections and field observations in 2010-2020 of Hemiptera in the mountain ecosystems of Kazakhstan: Northern Tien Shan (Ileyskiy Alatau, Kungei Alatau, Zhetysuyskiy

Alatau), Western Tien Shan (Talaskiy Alatau, Karzhantau, Karatau, Ugam mountains). Information provided on Hemiptera feeding habits, life cycles and habitat preferences (moisture conditions, habitat structure) was based on observations made at the time of collection and on previous studies in the region (Esenbekova 2010a^[6] 2010b^[9], 2011a^[7], 2011b^[10], Esenbekova *et al.* 2015^[11], Esenbekova *et al.* 2017^[12], Yesenbekova and Homziak 2013^[13]).

For consistency with earlier and ongoing research in the region (e.g., Esenbekova 2021^[15]), the study used established regional methods (Kirichenko 1957^[16], Paliy 1970^[17], Fasulati 1971^[18]; Kulik 1978^[19], Kerzhner and Yachevsky 1964^[20]) to collect and observe specimens. The most common method of collection was sweeping selected vegetation 20-30 times with a standard entomological net, then selecting the specimens of interest. For trees and taller shrubs, a light-colored sheet was spread on the ground below and the branches beaten and the fallen insects collected. Flying individuals were collected with an entomological net. Species living on the soil surface, at the roots of plants, in forest leaf litter and under various objects (stones, woody debris) were collected by hand or with tweezers. Small individuals were collected from surfaces with an aspirator. These collection methods were used at night as well, with the collecting area illuminated by lights or flashlight. We also used sheet traps to collect at night, using ultraviolet light or car headlights to illuminate vertically hung sheets. This was especially successful on warm, windless, dark (moonless or cloudy) nights.

Results

An annotated list of identified species is given below, with brief descriptions of their biology, ecology, and distribution. The biological and ecological characteristics of the listed species are based on field data collected by senior authors unless otherwise noted.

Family Tingidae

Acalypta gracilis gracilis (Fieber, 1844)

Northern Tien Shan, Ileyskiy Alatau, Aksai gorge., 23.07.2010, 4♀, 3♂. Dzhungarskiy Alatau, Koyandytau Range, Uzynbulak gorge, 27.07.2017, 2♀, 3♂; Western Tien Shan, Ugam Range, Maylisay gorge. 22.07.2016. 3♀, 3♂; Karzhantau Range, Sairamsu gorge, 14.08.2007. 2♀, 3♂.

Habitat preference: Herpeto-chortobiont (among detritus, on mosses, on herbaceous plants: *Ajuga*, *Potentilla*, *Hieracium*, *Thymus*, *Sedum*) and mesophilic (sunny exposure in high-altitude steppes)

Feeding habit: Mycetophage

Life cycle: Monovoltine, overwinters as imago and instars

Chorotype: Trans-Eurasian

Comments: According to Puchkov (1974)^[21], it is often found on sands overgrown with young sparse pine forests.

Agramma (Agramma) confusum (Puton, 1879)

Northern Tien Shan, Ileyskiy Alatau, Aksai gorge, 20.06.2010, 2♀, 3♂. Western Tien Shan, Karzhantau Range, Sairamsu gorge, 08/14/2012, 3♂, 4♀. Sariaygir gorge, 13-14.08.2020, 3♀, 4♂.

Habitat preference: Hortobiont; mesophilic (in steppe region along the banks of water bodies and in damp meadows, in high-altitude steppes, in subalpine meadows 800–2000 m elevation) **Feeding habit:** broad oligophytophage (on rushes: *Juncus* and sedges: *Carex*, *Blysmus*, *Eriophorum*)

Life cycle: monovoltine; overwinters as imago

Chorotype: Western Eurasian species

Comments: Adults and instars most often restricted to the inflorescences of host plants (Roshko 1969)^[22].

Dictyla echii (Schrank, 1782)

Northern Tien Shan, Ileyskiy Alatau, Aksai gorge, 23.06.2011, 2♀, 3♂; Medeu village, 17.08.2012, 2♀, 2♂; 22.06.2020. 2♀, 1♂. Western Tien Shan, Karzhantau Range, Sariaygir gorge, 14.08.2017, 2♀, 2♂. Talaskiy Alatau, Kokbulak gorge (1050-1100 m), 14.07. 2019, 2♀, 1♂ + 2 immatures.

Habitat preference: Eurychortobiont; mesophilic (alpine-forest zone)

Feeding habit: broad oligophytophage (on *Symphytum*, *Echium*, *Pulmonaria*)

Life cycle: bivoltine; overwinters as imago.

Chorotype: Trans-Palaeartic species

Comments: Borage (Borraginaceae) are the principal host plants, but adults and instars are known to feed on the sap of more than 20 different plant species (Novak & Wagner 1951^[23]; Roshko 1969^[22]; Puchkov 1974^[21]).

Dictyla lupuli (Herrich-Schaeffer, 1837)

Western Tien Shan, Karatau Range, 23.06.2010, 4♀, 2♂. Northern Tien Shan, Ileyskiy Alatau, Medeu village, Butakovka gorge, 15.07.2016, 2♀, 1♂. Dzungarsky Alatau, Koyandytau Range, Uzynbulak and Kayindy gorges, 28-30.07.2017, 6♀, 7♂. Western Tien Shan, Kishi-Zhurt and Maylisay gorges, (2700-3000 m), 12.08.2018, 6♀, 5♂. Talaskiy Alatau, Kokbulak gorge (1050-1100 m), 14.07.2019. 2♀, 3♂. Sayramsus gorge, 14.08.2020. 3♀, 2♂.

Habitat preference: Hortobiont; hygro-mesophilic (foothill and subalpine meadows, up to 2500 m)

Feeding habit: narrow oligophytophage

Life cycle: monovoltine, overwinters as imago

Chorotype: West Eurasian species

Comments: forget-me-not *Myosotis palustris*, comfrey *Symphytum* (Boraginales) (Puchkov 1974 ^[21]).

***Galeatus sinuatus* (Herrich-Schaeffer, 1838)**

Northern Tien Shan, Zhetysu Alatau, Koyandytau Range, Uzynbulak gorge, 28.07.2013, 3♀, 4♂; Tulkili and Kayindy gorges, 20.08.2016, 2♀, 2♂. Zhetysu Alatau, Sholak Range, Taigak gorge, 27.06.2017, 1♀, 2♂. Western Tien Shan, Karzhantau Range, Sayramsu gorge, 14.08.2019, 2♀, 3♂; Sariaygir gorge, 13-14.08.2020, 3♀, 2♂.

Habitat preference: Hortobiont; mesophilic (in the steppe region it is limited to forest edges, brush thickets, river valleys and fallow lands, foothill and subalpine meadows, 1000–2000 m) Feeding habit: broad oligophytophage (on Boraginaceae, Lamiaceae)

Life cycle: bivoltine; overwinters as imago (in forest floor)

Chorotype: European-Kazakh species

Comments: According to some (Puchkov 1960 ^[24]; Asanova 1971 ^[25]), *Phlomis tuberosa* is the primary host for adults and instars; also reported to feed on dead-nettles (*Lamium*) and sage (*Salvia*).

***Lasiacantha capucina capucina* (Germer, 1837)**

Northern Tien Shan, Ileyskiy Alatau, Aksai gorge, 20.06.2017, 2♀, 3♂. Western Tien Shan, Karzhantau Range, Sairamsu gorge, 14.08.2011, 3♀, 4♂; Sariaygir gorge, 14.08.2017, 3♀, 2♂. Kishi-Zhurt and Maylisay gorges, 2700-3000 m 14.08.2019, 3♀, 2♂.

Habitat preference: Herpeto-chortobiont (on and under plants, among plant detritus); mesophilic (in steppe and occasionally semi-desert riparian zones and floodplains, steppe meadows, forest edges, on sandy and clayey soil on foothill slopes, river terraces and subalpine meadows at 800–2400 m)

Feeding habit: broad oligophytophage (on Lamiaceae: thyme *Thymus*, and others)

Life cycle: monovoltine (Puchkov 1974) ^[21] or bivoltine under favorable conditions (Péricart 1983 ^[26]); overwinters as imago

Chorotype: Western Eurasian species.

***Oncochila simplex* (Herrich-Schaeffer, 1830)**

Northern Tien Shan, Kungei Alatau, Kayindy gorge 15.05.2012, 4♀, 2♂; Taldybulak gorge, 17.05.2012, 3♀, 3♂. Western Tien Shan, Ugam Range, 1800-1900 m, 20.07.2016, 3♀, 4♂. Karzhantau Range, Sayramsu gorge, 14.08.2017, 1♀, 2♂. Zhetysu Alatau, Koyandytau Range, Uzynbulak gorge 22.05.2019, 2♀, 2♂; Tulkili gorge, 15.06.2020, 3♀, 2♂.

Habitat preference: Hortobiont; mesophilic (found in the steppe zone in wet depressions, river valleys, forest edges and forest glades, on riverine sands, and on dry clay slopes and stony talus in foothill and subalpine meadows, 1000–2000 m)

Feeding habit: narrow oligophytophage (on *Euphorbia*)

Life cycle: monovoltine; overwinters as imago and later instars (Puchkov 1974 ^[21])

Chorotype: Trans-Eurasian species.

***Physatocheila smreczynskii* China, 1952**

Western Tien Shan, Ugam Range, Kishi-Zhurt and Maylisay gorges, 22.07.2016, 3♀, 2♂. Talaskiy Alatau, Kokbulak gorge (1050-1100 m), 24.07.2019, 2 immatures. Northern Tien Shan, Zhetysu Alatau, Koyandytau Range, Uzynbulak gorge, 22.06.2016, 1♀, 2♂; Tulkili gorge, 15.07.2020, 2♀, 2♂.

Habitat preference: Tamno-dendrobiont (on shrubs and trees of the Rosaceae family); mesophilic (in sub-alpine and alpine forest habitats up to 900–1300 m) (Puchkov 1974) ^[21]

Feeding habit: broad oligophytophagous (family Rosaceae)

Life cycle: 2–3 generations per year; overwinters as imago

Chorotype: Trans-Eurasian species.

***Tingis (Neolasiotropis) pilosa* Hummel, 1825**

Western Tien Shan, Ugam Range, Kishi-Zhurt and Maylisay gorges, 22.07.2010, 7♀, 4♂. Talaskiy Alatau, Kokbulak gorge (1050-1100 m), 14.07.2019, 3♀, 2♂. Northern Tien Shan, Zhetysu Alatau, Koyandytau Range, Uzynbulak gorge, 21.07.2018, 4♀, 3♂; Tulkili gorge, 25.06.2020, 3♀, 2♂.

Habitat preference: Hortobiont; mesophilic (in the steppe and forest-steppe zones, in a broad variety of mesophytic habitats: floodplains, lower elevation meadows 800–1300 m, open forests, parks, gardens edges and other tree and bush shaded areas)

Feeding habit: polyphytophage (on various plants, more often on Lamiaceae: *Phlomis tuberosa*, *Lamium album*, *Galeopsis bifida*, etc.)

Life cycle: 2-3 generations per year; overwinters as imago

Chorotype: Trans-Eurasian species

Comments: Roshko (1969) ^[22] and Puchkov (1974) ^[21] report adults and instars feed on more than ten host plant species.

***Tingis (Tingis) leptochila* Horváth, 1906**

Western Tien Shan, Ugam Range, Kishi-Zhurt and Maylisay gorges, 22.07.2011, 5♀, 4♂; Karzhantau Range, Sayramsu gorge, 14.08.2017, 5♀, 3♂; Sariaygir gorge, 13-14.08.2019, 4♀, 6♂. Talaskiy Alatau, Kokbulak gorge, (1050-1100 m), 14.07.2019, 2♀, 2♂. Northern Tien Shan, Zhetysu Alatau, Koyandytau Range, Tulkili gorge, 25.06.2020, 3♀, 3♂. Ileyskiy Alatau, Medeu village, 21.07.2020, 3♀, 2♂.

Habitat preference: Hortobiont; mesophilic (floodplains in a semi-desert, foothill and subalpine meadows, 900–2000 m)

Feeding habit: broad oligophytophage (on Asteraceae)

Life cycle: monovoltine (Puchkov 1974) ^[21]; overwinters as imago

Chorotype: Iranian-Turanian species.

***Tingis (Tropidocheila) reticulata* Herrich-Schaeffer, 1835**

Western Tien Shan, Karzhantau Range, Sayramsu gorge, 14.08.2014, 3♀, 3♂; Sariaygir gorge, 13-14.08.2015, 4♀, 3♂; Karaoy gorge (2500-2700 m), 23.07.2018, 4♀, 4♂. Talaskiy Alatau, Kokbulak gorge (1050-1100 m), 14.07.2019, 2♀, 3♂; Taldybulak gorge, Maly and Bolshoi Kayindy lakes, 15.07.2020, 4♀, 3♂. Northern Tien Shan, Kungei Alatau, Saty Sayi, 29.07.2019, 4♀, 3♂; Kayindy gorge, 09.08.2020, 2♀, 3♂.

Habitat preference: Hortobiont; mesophilic (in steppe habitats and up to 2000–2500 m elevation)

Feeding habit: broad oligophytophage (on Asteraceae)

Life cycle: monovoltine; overwinters as imago

Chorotype: Western Eurasian species.

***Tingis (Tingis) angustata* (Herrich-Schaeffer, 1838)**

North Tien Shan, Kungei Alatau, First Kolsai Lake, 16.06.2012, 2♀, 1♂; Taldybulak gorge, 15.07.2013, 1♀. Zhetysu Alatau, Koyandytau Range, Uzynbulak gorge, 22.07.2016, 2♀, 3♂; Tulkili gorge, 25.07.2020, 3♀, 2♂. Western Tien Shan, Karzhantau Range, Sayramsu gorge, 14.08.2017, 2♀, 3♂; Sariaygir gorge, 13-14.08.2019, 4♀, 2♂. Ugam Range, Kishi-Zhurt and Maylisay gorges, 22.07.2020, 4♀, 3♂.

Habitat preference: Hortobiont; mesophilic (on low grass steppe meadows, in open forests, and on slopes up to 2000 m)

Feeding habit: a broad oligophytophage (on Asteraceae), Roshko (1969) ^[22] and Puchkov (1974) ^[21] identified thistle (*Cirsium setorum*) as the principal host

Life cycle: monovoltine; overwinters as imago

Chorotype: Western Eurasian species.

Family Nabidae***Himacerus (Aptus) maracandicus* (Reuter, 1890)**

Northern Tien Shan, Ilya Alatau, Aksai gorge, in orchard, 08.06.2014, 1♂, 2♀ + 1 immature stage II; 12.07.2016, 3♂, 4♀; 27.08.2017, 2♂, 2♀ + 1 immature stage III. Kungei Alatau, Kayindy gorge, 15.08.2019, 2♂, 3♀; Taldybulak gorge, 17.07.2020, 2♂, 2♀. Western Tien Shan, Ugam Range, Kishi-Zhurt and Maylisay gorges, 22.07.2015, 2♂, 3♀; Karaoy gorge (2500-2700 m), 20.07.2016, 4♂, 2♀. Talaskiy Alatau, Kokbulak gorge (1050-1100), 14.07.2020, 2♂, 1♀.

Habitat preference: Chorto-tamnobiont (prefer tall herbaceous plants, especially Umbelliferae, occasionally found on soil or on bushes); mesophilic (on tall grass meadows and in shrub thickets at altitudes from 400 to 3000 m) (Kerzhner 1981 ^[27])

Feeding habit: zoophage (flies, aphids, other bugs and their larvae)

Life cycle: monovoltine; winter as adults

Chorotype: Iranian-Turanian species.

***Nabis (Dolichonabis) nigrovittatus tianshanicus* (Kerzhner, 1981)**

Northern Tien Shan, Kungei Alatau, Karabulak and Kok-Zhazyk gorges, 14.07.2012, 2♂, 4♀; Sary-Nawa, 14.06.2015, 3♂, 2♀; Saty Sayı gorge, 10.08.2018, 2♂, 2♀; First Kolsai Lake, 16.08.2020, 3♂, 2♀. Western Tien Shan, Ugam Range, Kishi-Zhurt and Maylisay gorges, 22.07.2010, 2♂, 1♀. Northern Tien Shan, Zhetysu Alatau, Koyandytau Range, Uzynbulak gorge, 22.07.2016, 2♂, 3♀; Tulkili gorge, 15.08.2020, 4♂, 3♀.

Habitat preference: Hortobiont; mesophilic (in sub-alpine and alpine areas)

Feeding habit: zoophage (feeds on various insects: aphids, flies, wasps, eggs and bug larvae) (Kerzhner 1981 ^[27])

Life cycle: monovoltine; overwinter as eggs

Chorotype: Turkestan species.

***Nabis (Nabicula) flavomarginatus* Scholtz, 1847**

Northern Tien Shan, Kungei Alatau, Kayindy gorge, 19.06.2011, 2♂, 3♀; Taldybulak gorge, 27.07.2012, 3♂, 4♀. Zhetysu Alatau, Sholak Range, Kyzylauz gorge, 12.07.2016, 3♂, 4♀; Koyandytau Range, Uzynbulak gorge, 25.06.2017, 3♂, 4♀. Western Tien Shan, Ugam Range, Kishi-Zhurt and Maylisay gorges, 22.07.2013, 3♂, 2♀. Talaskiy Alatau, Kokbulak gorge, (1050-1100 m), 14.07.2019, 3♂, 3♀.

Habitat preference: Hortobiont; widespread in forests and the forest-tundra zone, prefers forest-meadows (forb meadows, forest edges, forest glades), also in subalpine and alpine meadows to 2000 m; mesophilic

Feeding habit: zoophage (feeds on small insects)

Life cycle: monovoltine; overwinter as eggs) (Kerzhner 1981^[27])

Chorotype: Holarctic species.

***Nabis (Nabis) brevis brevis* Scholtz, 1847**

Western Tien Shan, Ugam Range, Kishi-Zhurt and Maylisay gorges (2700-3000 m), 22.07.2015, 3♂, 4♀; Karaoy gorge, (2500-2700 m), 23.07.2006, 3♂, 2♀. Talaskiy Alatau, Kokbulak gorge (1050-1100 m), 14.07.2009, 2♂, 3♀; Taldybulak gorge, Maly and Bolshoi Kayindy Lakes, 15.07.2019, 4♂, 4♀; 07.08.2020, 2♂, 1♀.

Habitat preference: Hortobiont; eurytopic mesophile of mesophytic habitats to 3600 m

Feeding habit: zoophage (broadly polyphagous) (Kerzhner 1981^[27])

Life cycle: monovoltine; overwinters as imago

Chorotype: Trans-Eurasian species.

***Nabis (Nabis) brevis ferghanensis* Remane, 1964**

Western Tien Shan, Ugam Range, Maylisay gorge (2700-3000 m), 20.07.2013. 2♂, 3♀; Karaoy gorge (2500-2700 m), 13.08.2018, 3♂, 2♀. Talaskiy Alatau, Kokbulak gorge (1050-1100 m), 14.07.2020, 4♂, 4♀.

Habitat preference: Hortobiont; mesophilic (forests, including walnut, apple forests, in mesophytic areas, in sub-alpine and alpine zones, 1000 to 3600 m)

Feeding habit: zoophage

Life cycle: monovoltine; adults overwinter

Chorotype: Turanian sub-endemic species.

***Nabis (Nabis) ferus* (Linnaeus, 1758)**

Northern Tien Shan, Kungei Alatau, Karabulak and Kok-Zhazyk gorges, 14.0.2012, 1 ♂; First Kolsai Lake, 16.05.2012, 6♂, 5♀; Saty Sayı gorge, 05.07.2014, 3♂, 4♀; 14.07.2020. 5♂, 4♀. Western Tien Shan, Ugam gorge (1800-1900 m), 12.06.2016, 3♂, 4♀. Karzhantau Range, Sayramsu gorge, 14.08.2017, 2♂, 1♀. Talaskiy Alatau, Kokbulak gorge (1050-1100), 24.07.2018, 3♂, 4♀; Taldybulak gorge, Maly and Bolshoi Kayindy Lakes, 15.07.2019, 5♂, 4♀.

Habitat preference: Hortobiont; eurytopic mesophile (very common in the forest zone up to an altitude of 2500 m, mainly at springs, in riparian areas, and along sea and lake shores)

Feeding habit: zoophage (widely polyphagous, feeding on flies, aphids, cicadas, bugs and other insects)

Life cycle: monovoltine; adults overwinter. Attracted to lights (Esenbekova 2011b^[10])

Chorotype: Trans-Palaeartic species

Comment: most beneficial Hemiptera species for IPM in agriculture.

***Nabis (Nabis) punctatus punctatus* A. Costa, 1847**

Northern Tien Shan, Kungei Alatau, Karabulak and Kok-Zhazyk gorges, 17.06.2012, 3♂, 2♀; Saty Sayı gorge, 15.07.2020, 3♂, 4♀. Western Tien Shan, Ugam gorge (1800-1900 m), 20.07.2016, 4♂, 5♀. Karzhantau Range, Sayramsu gorge, 14.08.2020, 3♂, 2♀.

Habitat preference: Hortobiont (found on cereals, legumes and garden crops); a xerophile of steppe origin, it is a dominant Hemiptera species in the steppe zone, and its Range extends to xerophytic areas within the higher elevation forest zone (on dry areas of meadow vegetation), dry foothills and slopes in the Altai Mountains to 2500 m) (Kerzhner 1981^[27])

Feeding habit: zoophage

Life cycle: monovoltine; adults overwinter

Chorotype: Western Eurasian species.

***Nabis (Nabis) rugosus* (Linnaeus, 1758)**

Northern Tien Shan, Kungei Alatau, Karabulak and Kok-Zhazyk gorges, 24.05.2012, 3♂, 4♀; Algabas gorge, 13.07.2014, 4♂, 5♀; Saty Sayı gorge, 05.07.2015, 6♂, 5♀; Kayindy gorge, 19.08.2019, 3♂, 4♀. Western Tien Shan, Ugam Range, Kishi-Zhurt and Maylisay gorges, (2700-3000 m), 22.07.2016, 5♂, 5♀. Talas Alatau, Kokbulak gorge (1050-1100 m), 14.07.2019, 3♂, 2♀; Taldybulak gorge, Maly and Bolshoi Kayindy Lakes, 15.08.2020, 2♂, 3♀.

Habitat preference: Hortobiont (in various habitats on herbaceous vegetation, on forbs in shaded areas of deciduous forests, especially forest glades and forest edges); mesophilic

Feeding habit: zoophage (feeds on aphids, larvae of leafhoppers and horseflies, other insects) Life cycle: monovoltine; overwinter as adults

Chorotype: Trans-Eurasian species

Comments: reported from forest-steppe and forest zones up to about 2000 m elevation (Kerzhner 1981^[27])

Nabis (Philobatus) christophi Dohrn, 1862

Northern Tien Shan, Kungei Alatau, Karabulak and Kok-Zhazyk gorges, 29.05.2012, 2♂, 1♀; Kayindy gorge, 14.07.2019, 2♂, 1♀. Ileyskiy Alatau, Medeu village, 27.06.2020, 2♂, 3♀. Western Tien Shan, Karzhantau Range, Sayramsu gorge, 14.08.2017, 2♂, 2♀. Talaskiy Alatau, Kokbulak gorge (1050-1100 m), 14.07.2020, 4♂, 5♀.

Habitat preference: Herpetobiont (on the soil surface under shrubs such as *Atraphaxis*, *Clematis*, and others, under grasses and in plant debris); mesophilic (found along river banks and in riparian floodplain woodlands in semi-desert and desert regions, also occurs in steppe zone dry foothills into low mountains)

Feeding habit: zoophagy

Life cycle: monovoltine; overwinters as imago

Chorotype: Middle East Tethyan species

Comments: in Pakistan it was found at an altitude of about 2500 m (Kerzhner 1981^[27])

Family Anthocoridae***Acompocoris alpinus Reuter, 1875***

Northern Tien Shan, Kungei Alatau, Karabulak and Kok-Zhazyk gorges, 24.06.2012, 2♂, 1♀; First Kolsai Lake, 16.07.2019, 2♂, 3♀. Western Tien Shan, Karzhantau Range, Sariygyr gorge, 13.08.2016, 3♂, 3♀. Talaskiy Alatau, Kokbulak gorge (1050-1100 m), 14.07.2019, 2♂, 2♀. Zhetysusky Alatau, Koyandytau Range, Uzynbulak, Tulkili and Kayindy gorges, 10.07.2020, 3♂, 2♀.

Habitat preference: Dendrobiont (on coniferous trees: *Abies*, *Picea*, *Larix*, *Pinus*); mesophilic (in montane forest zone to 1200 m)

Feeding habit: zoophagy (primarily aphids)

Life cycle: monovoltine; adults overwinter

Chorotype: Trans-Eurasian species.

Acompocoris pilipes Štys, 1960

Northern Tien Shan, Kungei Alatau, Karabulak and Sary-Nawa gorges, 14.07.2012, 2♂, 2♀; Kayindy gorge, 25.06.2014, 3♂, 2♀; Taldybulak gorge, 17.08.2019, 3♂, 4♀. Western Tien Shan, Karaoy gorge (2500-2700 m), 23.07.2013, 3♂, 2♀. Karzhantau Range, Sariygyr gorge, 13.08.2015, 2♂, 1♀. Talaskiy Alatau, Kokbulak gorge (1050-1100 m), 14.07.2017, 3♂, 4♀. Zhetysu Alatau, Koyandytau Range, Uzynbulak, Tulkili and Kayindy gorges, 13.08.2020, 2♂, 3♀.

Habitat preference: Dendrobiont (on conifers); mesophilic (in montane forest zone to 2000 m) Feeding habit: zoophagy (small insects and mites)

Life cycle: monovoltine; adults overwinter

Chorotype: North Turkestan endemic.

Anthocoris flavipes Reuter, 1884

Northern Tien Shan, Ileyskiy Alatau, Medeu village, 12.07.2016, 1♂; Shymbulak gorge, 13.07.2018, 3♀, 5♂. Kungei Alatau, Karabulak and Kok-Zhazyk gorges, 30.05.2017, 1♀, 2♂; First Kolsai Lake, 16.08.2020, 3♀, 4♂. Western Tien Shan, Karzhantau Range, Sayramsu gorge, 13.08.2017, 2♀, 3♂. Zhetysusky Alatau, Koyandytau Range, Uzynbulak, gorge, 22.06.2018, 2♀, 4♂; Tulkili gorge, 15.06.2020, 2♀, 5♂.

Habitat preference: Dendro-chortobiont (on shrubs and large herbaceous plants), mesophilic (alpine at elevations of 1800–3000 m (Elov 1976^[28]))

Feeding habit: zoophagy

Life cycle: monovoltine; adults overwinter

Chorotype: Central Tethyan-Tibetan Mountain species.

Anthocoris nemorum (Linnaeus, 1761)

Northern Tien Shan, Kungei Alatau, Karabulak and Kok-Zhazyk gorges, 23.06.2010, 3♀, 4♂; First Kolsai Lake, 16.07.2012, 5♀, 4♂; Western Tien Shan, Karzhantau Range, Sayramsu gorge, 13.08.2017, 3♀, 4♂. Talaskiy Alatau, Kokbulak gorge (1050-1100 m), 14.07.2019, 3♀, 4♂. Zhetysu Alatau, Koyandytau Range, Uzynbulak, Tulkili and Kayindy gorges, 12.08.2020, 4♀, 5♂.

Habitat preference: Horto-dendrobiont found throughout the Palaearctic forest zone; mesophilic (mountain forests, alpine and subalpine meadows to 1000–3000 m, on *Myricaria*, sea buckthorn *Hippophae*) (Elov 1976^[28])

Feeding habit: zoophagy (broad polyphage, feeding on aphids, ticks, scale insects, thrips, moth eggs and caterpillars, eggs of Miridae) (Esenbekova 2015^[5])

Life cycle: 2–3 generations per year; adults overwinter

Chorotype: Trans-Eurasian species

Comments: also found in orchards, where it plays an important role in regulating apple pests) (Puchkov 1961^[29]).

***Tetrableps aterrima* (J. Sahlberg, 1878)**

Northern Tien Shan, Kungei Alatau, Karabulak and Kok-Zhazyk gorges, 14.06.2011, 2♀, 1♂; First Kolsai Lake, 16.07.2012, 5♀, 4♂. Zhetysusky Alatau, Sholak Range, Kyzylauyz gorge, 12.08.2016. 3♀, 2♂; Koyandytau Range, Kayindy gorge, 17.07.2007, 3♀, 4♂. Western Tien Shan, Karzhantau Range, Sayramsu gorge, 05.08.2017, 3♀, 4♂; Karzhantau Range, Sayramsu gorge, 13.08.2017, 3♀, 4♂; Karzhantau Range, Sayramsu gorge, 13.07.2020, 3♀, 3♂.

Habitat preference: Dendrobiont (in mixed montane forests and spruce woodlands, found on cedar elfin *Pinus pumila*, larch *Larix*, birch *Betula* and pine *Pinus*, reported on fir *Abies* (Péricart 1972^[30]); mesophilic (alpine forests to an altitude of 2700–2900 m)

Feeding habit: zoophagous (small insects, their larvae and eggs)

Life cycle: monovoltine; adults overwinter

Chorotype: Trans-Eurasian species.

***Orius (Heterorius) horvathi* (Reuter, 1884)**

Northern Tien Shan, Kungei Alatau, Karabulak and Kok-Zhazyk gorges, 29.05.2012, 3♀, 2♂; First Kolsai Lake, 16.07.2017, 3♀, 4♂. Western Tien Shan, Karzhantau Range, Sayramsu gorge, 14.08.2007, 3♀, 2♂. Zhetysu Alatau, Koyandytau Range, Uzynbulak gorge, 19.06.2018, 2♀, 1♂; Tulkili and Kayindy gorges, 29.07.2020, 3♀, 2♂.

Habitat preference: Hortobiont (found on various herbs: *Medicago*, *Trofolium*, etc.); mesophilic (from desert riparian areas to high alpine)

Feeding habit: zoophagous (aphids, leaf beetles, thrips, small caterpillars, ticks and their eggs, Elov 1976^[28]), and eggs of Hemipteran pest species *Notostira* and *Trigonotylus*)

Life cycle: 2-3 generations per year; adults overwinter

Chorotype: Trans-Palaeartic species.

***Orius (Heterorius) vicinus* (Ribaut, 1923)**

Northern Tien Shan, Ileyskiy Alatau, Medeu village, 06/18/2016, 3♀, 4♂; Aksai gorge 12.07.2018, 2♀, 1♂. Kungey Alatau, Karabulak and Kok-Zhazyk gorges, 14.05.2019, 2♀, 1♂; First Kolsai Lake, 05/16/2020, 2♀, 3♂. Western Tien Shan, Karaoy gorge (2500-2700 m), 23.07.2016, 2♀, 2♂; Karzhantau Range, Sairamsu gorge, 04.08.2019, 2♀, 1♂. Zhetysu Alatau, Koyandytau Range, Uzynbulak, Tulkili and Kayindy gorges, 17.08.2020, 3♀, 2♂.

Habitat preference: Tamno-hortobiont; mesophilic (cosmopolitan in appropriate habitat, such as birches, from deserts to high mountains up to 2000 m and greater (Kerzhner 1973^[31]))

Feeding habit: zoophagous (broad polyphagous, primarily scale insects, and other Sternorrhyncha)

Life cycle: bivoltine; overwinters as imago

Chorotype: Trans-Eurasian species.

Family Reduviidae***Peirates hybridus* (Scopoli, 1763)**

Northern Tien Shan, Ileyskiy Alatau, Bolshoi Almaty Lake, 23.07.2016, 2♀, 3♂; 17.08.2016, 3♀, 1♂. Western Tien Shan, Ugam Range, Maylisay gorge (2700-3000 m), 22.07.2017, 3♀, 2♂. Zhetysu Alatau, Sholak Range, Kyzylauyz gorge, 12.08.2016, 2♀, 1♂; Koyandytau Range, Kayindy gorge, 17.07.2020, 2♀, 3♂.

Habitat preference: Epigeobiont; hygrophilous, confined to damp areas, more often near the banks of water bodies, in tufts of dead grass and other debris, under stones, in crowns and at the bases of some plants (e.g., *Agropyron ruthenicum*), where burrows in loose surface soil; found in wet meadows into the alpine zone to 3000 m

Feeding habit: zoophagous

Life cycle: monovoltine; adults overwinter

Chorotype: West Palaeartic species

Comments: Found under stones in swampy areas in Bulgaria (Josifov 1964^[32]) and Turkey (Hoberlandt 1956^[33]).

***Coranus (Coranus) griseus* (Rossi, 1790)**

Western Tien Shan, Karzhantau Range, Sairamsu gorge, 24.07.2017, 2♀, 1♂; Sariaygir gorge, 13.08.2020, 2♀, 3♂.

Habitat preference: Epigeobiont (under stones, in plant detritus); meso-xerophilic (dry sunny slopes with sparse vegetation), in the Caucasus, Cyprus (Lindberg 1948^[34]) and Bulgaria (Josifov 1964^[32]), not usually found at higher elevations, but in Central Asia it occurs in places at altitudes of 2000 m and even higher (Kirichenko 1964^[35])

Feeding habit: zoophagous (feeding habits uncertain (Esenbekova 2010a^[6]))

Life cycle: the life cycle is poorly known (Esenbekova 2011a^[7], 2011b^[10]), probably overwinters as imago

Chorotype: West Palaeartic (polyzonal) species.

Rhynocoris (Rhynocoris) iracundus (Poda, 1761)

Northern Tien Shan, Ileyskiy Alatau, Medeu village, 12.07.2016, 2♀, 3♂; Shymbulak gorge, 02.08.2018, 2♀, 1♂. Kungei Alatau, Karabulak and Kok-Zhazyk gorges, 14.05.2019, 2♀, 3♂; First Kolsai Lake, 16.07.2020, 4♀, 3♂. Western Tien Shan, Ugam Range, Kishi-Zhurt and Maylisay gorges (2700-3000 m), 22.07.2016, 2♀, 3♂; Karzhantau Range, Sayramsu gorge, 14.08.2017, 4♀, 3♂. Zhetysu Alatau, Koyandytau Range, Uzynbulak, Tulkili and Kayindy gorges, 03.08.2020, 2♀, 3♂.

Habitat preference: Dendro-chortobiont; mesophilic (various vegetation zones: from steppe valleys and sun exposed, sparsely forested slopes in foothills and low mountains, to subalpine meadows and alpine forest glades up to 2000 m, in the steppes it is found on trees, shrubs and herbaceous vegetation)

Feeding habit: zoophage (opportunistic ambush predators on tall flowering plants, feeds on most insects of suitable size, from leaf beetles to wasps and bees to caterpillars and butterflies)

Life cycle: one generation a year; adults and older instars overwinter (Asanova and Iskakov 1977^[36]; Puchkov 1987^[37])

Chorotype: West Palaearctic species.

Discussion

A survey of the Infraorder Cimicomorpha of the Northern and Western Tien Shan mountain ecosystems identified 31 species from 17 genera in 4 families (Table 1), and described their known biological and ecological characteristics (Table 2).

The diet of the collected Hemiptera was extremely diverse. There is much information, from fragmentary to quite complete, on the feeding habits and food sources of a large number of Hemiptera species globally (Koschel 1971^[38]; Readio 1927^[39]; Harris 1928^[40]; Miller 1953^[41], 1971^[42]; Dispons 1955^[43]; Fewkes 1960^[44]; Thompson 1929^[45], 1951^[46]), but the information is scattered in often difficult to access publications. The feeding types of the recorded Cimicomorpha species is shown in Table 3. There were 19 species of zoophages, 1 mycetophage species, and 11 species are phytophages, divided into 3 groups according to the breadth of specialization: polyphages, broad and narrow oligophytophages.

Hemiptera have incomplete transformation and characteristically overwinter at different stages of development. In the Northern and Western Tien Shan mountains, winter diapause occurs in the adult stage for 26 of the 31 identified species (84%, Table 4), with a few species overwintering in the egg and/or larval stage. We noted that the first species to appear in the spring were those that overwintered as adults (Esenbekova 2011b^[10]), and that mass emergence in the spring was associated with ambient temperatures, which differed with altitude and slope orientation (unpublished data). The same species emerged at later dates at higher mountain elevations than in the lower steppe zone in the region. We also noted that emergence was earliest on slopes with southern exposure.

The seasonal development of Hemiptera in Kazakhstan is heterodynamic (Esenbekova 2011b^[10]), meaning the adults appear for a limited time during a season, while one part of the life cycle stays dormant throughout the winter. Voltinism reflects the number of annual generations realized by the population in a particular part of the species Range. Identified species fall into one of four annual generational groups (voltinism, Table 5). Monovoltine - one generation/year, bivoltine - two generations/year, mono-bivoltine - one or two generations/year, polyvoltine - multiple generations/year.

Identified species have differing habitat moisture requirements which affect their distribution. Habitat moisture preferences of identified species can be grouped as the following: mesophiles (27 species), meso-xerophiles (1 species), xerophiles (1 species), hygro-mesophiles (1 species), hygrophiles (1 species).

How species use habitat structure divides identified species into 9 groups: dendrobionts, tamno-dendrobionts, dendro-chortobionts, chorto-tamnobionts, chortobionts, herpetobionts, herpeto-chortobionts, epichortobionts. Among the identified species, over half of the total fauna - 16 species (53%), are found in grassy vegetation (chortobionts).

An analysis of the zoogeographic distribution of identified species revealed 12 chorotypes (Table 7): family Tingidae: Trans-Eurasian (4 species), West Eurasian (5 species), Trans-Palaearctic (1 species), European-Kazakhstan (1 species), Iranian-Turanian (1 species); family Nabidae: Iranian-Turanian (1 species), Turkestan (1 species), Holarctic (1 species), Trans-Eurasian (2 species), Turanian (1 species), Trans-Palaearctic (1 species), West Eurasian (1 species), Middle East Tethyan (1 species); family Anthocoridae: North Turkestan (1 species), Middle Tethyan-Tibetan (1 species), Trans-Eurasian (4 species), Trans-Palaearctic (1 species); family Reduviidae: West Palaearctic (3 species).

Table 1: Species richness of Hemiptera (Heteroptera, Cimicomorpha I) of Kazakhstan, by family

Family	Number of genera	Number of species	%
Tingidae	8	12	39
Nabidae	2	9	29
Anthocoridae	4	7	22
Reduviidae	3	3	10
Total number of families: 4	17	31	100

Table 2: Feeding types and life history characteristics of identified Cimicomorpha species

Species	Biology and ecology
<i>Acalypta gracilis gracilis</i> (Fieber, 1844)	mycetophage, herpeto-chortobiont, mesophilic, monovoltine, overwinters as imago and instars
<i>Agramma (Agramma) confusum</i> (Puton, 1879)	Broad oligophytophage, chortobiont, mesophilic, monovoltine, overwinters as imago
<i>Dictyla echii</i> (Schrank, 1782)	broad oligophytophage, eurychortobiont, mesophilic, bivoltine, overwinters as imago
<i>Dictyla lupuli</i> (Herrich-Schaeffer, 1837)	narrow oligophytophage, chortobiont; hygro-mesophilic, monovoltine, overwinters as imago
<i>Galeatus sinuatus</i> (Herrich-Schaeffer, 1838)	broad oligophytophage, chortobiont, mesophilic, bivoltine, overwinters as imago
<i>Lasiacantha capucina capucina</i> (Germer, 1837)	broad oligophytophage, herpeto-chortobiont, mesophilic, monovoltine or bivoltine under favorable conditions, overwinters as imago
<i>Oncochila simplex</i> (Herrich-Schaeffer, 1830)	narrow oligophytophage, chortobiont, mesophilic, monovoltine, overwinters as imago and older instars
<i>Physatocheila smreczynskii</i> China, 1952	broad oligophytophage, tamno-dendrobiont, mesophilic, polyvoltine, overwinters as imago
<i>Tingis (Neolasiotropis) pilosa</i> (Hummel, 1825)	polyphytophage, hortobiont, mesophile, polyvoltine, overwinters as imago
<i>Tingis (Tingis) leptochila</i> Horváth, 1906	broad oligophytophage, chortobiont, mesophilic, monovoltine, overwinters as imago
<i>Tingis (Tropidocheila) reticulata</i> Herrich-Schaeffer, 1835	broad oligophytophage, chortobiont, mesophilic, monovoltine, overwinters as imago
<i>Tingis (Tingis) angustata</i> Herrich-Schaeffer, 1838	broad oligophytophage, chortobiont, mesophilic, monovoltine, overwinters as imago
<i>Himacerus (Aptus) maracandicus</i> (Reuter, 1890)	zoophage, chorto-tamnobiont, mesophilic, monovoltine, overwinters as imago
<i>Nabis (Dolichonabis) nigrovittatus tianshanicus</i> (Kerzhner, 1981)	zoophage, chortobiont, mesophilic, monovolt, overwinter as eggs
<i>Nabis (Nabicula) flavomarginatus</i> Scholtz, 1847	zoophage, chortobiont, mesophilic, monovoltine, overwinter as eggs
<i>Nabis (Nabis) brevis brevis</i> Scholtz, 1847	zoophage, chortobiont, mesophilic, monovoltine, overwinters as imago
<i>Nabis (Nabis) brevis ferghanensis</i> Remane, 1964	zoophage, chortobiont, mesophilic, monovoltine, overwinters as imago
<i>Nabis (Nabis) fesus</i> (Linnaeus, 1758)	zoophage, chortobiont, mesophilic, monovoltine, overwinters as imago
<i>Nabis (Nabis) punctatus punctatus</i> A.Costa, 1847	zoophage, chortobiont, xerophilic, monovoltine, overwinters as imago
<i>Nabis (Nabis) rugosus</i> (Linnaeus, 1758)	zoophage, chortobiont, mesophilic, monovoltine, overwinters as imago
<i>Nabis (Philobatus) christophi</i> Dohrn, 1862	zoophage, herpetobiont, mesophilic, monovolt, overwinters as imago
<i>Acompocoris alpinus</i> Reuter, 1875	zoophage, dendrobiont, mesophilic, monovoltine, overwinters as imago
<i>Acompocoris pilipes</i> Stys, 1960	zoophage, dendrobiont, mesophilic, monovoltine, overwinters as imago
<i>Anthocoris flavipes</i> Reuter, 1884	zoophage, dendro-chortobiont, mesophilic, monovoltine, overwinters as imago
<i>Anthocoris nemorum</i> (Linnaeus, 1761)	zoophage, dendro-chortobiont, mesophilic, polyvoltine, overwinters as imago
<i>Tetraphleps aterrima</i> (J.Sahlberg, 1878)	zoophage, dendrobiont, mesophilic, monovoltine, overwinters as imago
<i>Orius (Heterorius) horvathi</i> (Reuter, 1884)	zoophage, chortobiont, mesophilic, polyvoltine, overwinters as imago
<i>Orius (Heterorius) vicinus</i> (Ribaut, 1923)	zoophage, tamno-chortobiont, mesophilic, bivoltine, overwinters as imago
<i>Peirates hybridus</i> (Scopoli, 1763)	zoophage, epigeobiont, hygrophilic, monovoltine, overwinters as imago
<i>Coranus (Coranus) griseus</i> (Rossi, 1790)	zoophage, epigeobiont, meso-xerophilic, life cycle is not clear,

	overwinters as imago
<i>Rhynocoris (Rhynocoris) iracundus</i> (Poda, 1761)	zoophage, dendro-chortobiont, mesophilic, monovoltine, overwinters as imago and later instars

Table 3: Food specialization of Hemiptera Cimicomorpha I species in Kazakhstan

Feeding types		Number of species	%
Zoophages		19	61
Mycetophages		1	3
Phytophages	Polyphages	1	3
	Broad oligophages	8	26
	Narrow oligophages	2	7
Total		31	100

Table 4: Overwintering life stages of Hemiptera Cimicomorpha I in Kazakhstan

Overwintering stage	Number of species	%
Egg	2	6
Instars and imago	3	10
Imago only	26	84
total:	31	100

Table 5: Number of generations per year for Hemiptera infraorder Cimicomorpha I of Kazakhstan

Generational group	Number of species	%
Monovoltine	22	71
Bivoltine	3	10
Mono-bivoltine	1	3
Polyvoltine	4	13
Unknown	1	3
Total:	31	100

Table 6: Habitat structure preferences of Hemiptera Cimicomorpha I species of Kazakhstan

Habitat structure groups	Number of species	%
Dendrobionts	3	10
Dendro-tamnobionts	1	3
Dendro-chortobionts	3	10
Chorto-tamnobionts	2	6
Chortobionts	16	53
Herpetobionts	1	3
Herpeto-chortobionts	2	6
Epigeobionts	2	6
Eurychorthobionts	1	3
Total	31	100

Table 7: Distribution of species of Hemiptera Cimicomorpha I of Kazakhstan by Emilyanov's (1974)^[8] zoogeographic regions

Zoogeographic Region	Number of Species	%
Holarctic	1	3
Trans-Palaearctic	3	10
West Palaearctic	3	10
Trans-Eurasian	10	33
West Eurasian	6	20
European-Kazakh	1	3
Iranian-Turanian	2	6
Turanian	1	3
Mid-eastern Tethyan	1	3
Mid-Tethyan Tibetan	1	3
Turkestan	1	3
North Turkestan	1	3
Total:	31	100

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