Geographical distribution of Satyridae (Lepidoptera, Satyridae) of the Kurgan Oblast

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Abstract. An analysis of available literary sources showed that the main studies on the study of the species composition of butterflies of the Kurgan Oblast were carried out in the second half of the 20th century. According to literary data, the fauna of the Lepidoptera family Satyridae of the Kurgan Oblast is represented by 24 species. Conducted in 2000-2002 and 2014-2019 in the forest-steppe zone, their own collections and revision of the collection of Kurgan State University confirmed the data of literary sources. Of the 24 satirids species found in the Kurgan Oblast, the Holarctic range is characteristic of only one - C. tullia. The ranges of other species belong to the Palearctic group. Thus, the fauna of the satirids of the Kurgan Oblast by 96% consists of Palearctic species. Of the 23 satirids species with Palearctic ranges, 6 species (L. achine, C. glycerion, C. hero, E. ligea, A. hyperantus, M. dryas) are characterized by a trans-Eurasian temperate-subtropical range, 1 species (L. petropolitana) is assigned to the trans-Eurasian temperate type of the range, 3 (L. maera, C. pamphilus, M. jurtina) have western-central palearctic temperate-subtropical ranges, Euro-Siberian-Central Asian temperate-subtropical range has only 1 species (O. tarpeja), 1 species (E. medusa) is assigned to Euro-Siberian-Central Asian type of range, 8 (C. leander, H. lycaon, H. lupina, P. atra, A. arethusa, C. briseis, C. persephone, M. russi) have Euro-Kazakhstan temperate-subtropical ranges, 1 species (E. aethiops) is characterized by a Euro-Baikal temperate-subtropical range, the Euro-Baikal subboreal range has 1 species (H. autonoe), the Western Palearctic range is characterized by 1 species (C. arcania). Thus, the fauna of the satirids of the Kurgan region by 96% consists of Palearctic species.

1. Introduction
The first information about butterflies of the Kurgan Oblast is contained in the works of Y.M. Kolosov [1] and V.A. Schuko [2]. Much later, already in the middle of the last century, the study of the butterflies of the region was continued by N.M. Voskresenskiy [3-5]. For 7 years, N.M. Voskresenskiy in the region conducted collecting Lepidoptera, which allowed him to publish a list of 72 species of day butterflies, which included 10 species of the Satyridae family. Later, the study of the region's satirids was carried out by Y.P. Korshunov [6-8], V.P. Starikov and N.A. Utkin [9-11]. The most complete and detailed information about the fauna and ecology of Lepidoptera in the Kurgan Oblast, including satirids, is presented in the work of N.A. Utkin [12]. Analysis of literary data showed that the Satyridae family in the Kurgan Oblast is represented by 24 species.

The purpose of our work is to study the current state of fauna and the geographical distribution of Lepidoptera of the Satyridae family living in the Kurgan Oblast.
2. Research materials and methods
The authors' collections were held in 2000-2002 and in 2014-2019 in the forest-steppe zone of the Kurgan Oblast (Ketovsky, Mishkinsky, Kargapolsky districts). In addition, the materials of the collections of the Department of Zoology and Bioecology of the Kurgan State University were analyzed. In total, 2743 satirids individuals were collected as a result of their own research and processed from the collection fund. The determination of species affiliation was carried out according to the tables compiled by Y.P. Korshunov [13]. When finding out the habitats of the studied species of satirids, their own data and literary sources were used [13-25]. The names of the areas are adopted according to the terminology of K.B. Gorodkov [26], although in a number of cases the geographic distribution of satirids did not fit any of the types of habitats he proposed. In this case, we assigned the species to the closest type and explained their distribution. The habitats of some species of satirides in Eurasia have not been sufficiently studied, therefore, a certain element of convention was taken into account when clarifying their ranges.

3. Results and discussion
As a result of the studies, 24 species of Lepidoptera of the Satyridae family were confirmed to live in the Kurgan Oblast [27-28]. Of these, only one species - *Coenonympha tullia* (Muller, 1764) is a holarct, the remaining 23 belong to the group of palearcts.

The circumtemperate range of *C. tullia* covers North America and temperate Eurasia and north in places to the southern tundra and south to the mountains of South Siberia and Mongolia, with the exception of insulated sections of semi-deserts and deserts of Central Asia (figure 1).

![Figure 1. Circumtemperate type of range of *C. tullia*.](image)

The trans-Eurasian temperate-subtropical type includes the ranges of 6 species of satirids: *Lopinga achine* (Scopoli, 1763), *Coenonympha glycerion* (Borkhausen, 1788), *Coenonympha hero* (Linnaeus, 1761), *Erebia ligea* (Linnaeus, 1758), *Aphantopus hyperantus* (Linnaeus, 1758), *Minois dryas* (Scopoli, 1763). *C. glycerion* inhabits temperate Eurasia (except the British Isles) north to the middle taiga, Caucasus and Transcaucasia.

The ranges of *C. hero* and *A. hyperantus* cover temperate Eurasia north to the middle taiga, Sakhalin, South Kuril Islands and Japan, China, Korea, in Europe the range of *A. hyperantus* is somewhat narrower than that of *C. hero*, it is not found on the Iberian and Apennine Peninsula and islands of the Mediterranean Sea (figure 2).

*E. ligea* lives in the forest zone of Eurasia (except for the continental regions of northern Siberia), adjacent mountain countries, on Sakhalin, the Southern Kuril Islands and in Japan.
The ranges of *L. achine* and *M. dryas* are somewhat older than previous species. *L. achine* inhabits temperate Eurasia north to the middle taiga, Sakhalin, Kuril Islands, Japan, Korea. The range of *M. dryas* is located slightly south of *L. achine*: the temperate and subtropical zones of Eurasia in the north to the subzone of the southern taiga, Sakhalin, Kuril Islands, Japan, Caucasus, Transcaucasia, China, Korea.

![Figure 2](image2.png)

**Figure 2.** Trans-Eurasian temperate-subtropical type of range of *A. hyperantus*.

The Trans-Eurasian temperate type of the range is characteristic only of *Lasiommata petropolitana* (Fabricius, 1787). This species inhabits the forest zone of Eurasia and adjacent mountain countries, China, Sakhalin.

The western-central palearctic temperate-subtropical type includes habitats of 3 species: *Lasiommata maera* (Linnaeus, 1758), *Coenonympha pamphilus* (Linnaeus, 1758) и *Maniola jurtina* (Linnaeus, 1758). *C. pamphilus* inhabits North Africa, Europe, Crimea, Caucasus, Transcaucasia, Front and Central Asia, Kazakhstan, Middle and Southern Urals, the Southern Trans-Urals, the south of Western and Central Siberia, Altai, Kuznetsk Highlands and Sayan (figure 3).

![Figure 3](image3.png)

**Figure 3.** Western-central palearctic temperate-subtropical type of range of *C. pamphilus*.

The range of *L. maera* compared to the previous species is more elongated and captures the south of Siberia east to the basin of Angara. *M. jurtina* has a narrower distribution: Canary Islands, North Africa,
Central and Southern Europe, Crimea, Small and Central Asia, Caucasus, Transcaucasia, Kazakhstan, Middle and Southern Urals, Southern Trans-Urals, the south of Western Siberia.

The Euro-Siberian-Central Asian temperate-subtropical type of range is characteristic only of *Oeneis tarpeja* (Pallas, 1771). This species is distributed in South-Eastern Europe, Caucasus, Middle and Southern Urals, Southern Trans-Urals, southern Siberia east to Southeast Transbaikalia, Kazakhstan, Mongolia and Northern China.

The range of only one species is assigned to the Euro-Siberian-Central Asian type – *Erebia medusa* (Denis et Schiffermuller, 1775). It covers the south of the forest zone and the forest-steppe from Western Europe to Kamchatka, Caucasus, Transcaucasia, Altai, the mountains of southern Siberia and Mongolia, Northern China.

The Euro-Kazakhstan temperate-subtropical type of range is characteristic of 8 species: *Coenonympha leander* (Esper, 1784), *Hyponephele lycaon* (Rottemburg, 1775), *Hyponephele lupina* (Costa, 1836), *Proterebia afra* (Fabricius, 1787), *Arethusana arethusa* (Denis et Schiffermuller, 1775), *Chazara briseis* (Linnaeus, 1764), *Chazara persephone* (Hübner, 1805), *Melanargia russiae* (Esper, 1784).

The range of *C. briseis* covers North Africa, Southern and Central Europe, Crimea, Caucasus, Transcaucasia, Front and Central Asia, Afghanistan, Kazakhstan, Southern Urals, Southern Trans-Urals, the south of Western and Central Siberia, Altai, northwest China. The distribution of *M. russiae* is similar to the previous species with the exception of North Africa.

*A. arethusa* inhabits North Africa, Southern Europe, Caucasus, Transcaucasia, Front Asia, North and East Kazakhstan, the strip of the steppes of the Urals, South Trans-Urals and Western Siberia, Altai, Tien Shan.

The habitat of *H. lycaon* covers the south of the forest and forest-steppe zones from Western Europe and Asia Minor to Transbaikalia and Eastern Mongolia, Caucasus, Transcaucasia, Crimea, Israel, Libya, Northwest China.

The distribution of *H. lupina* is somewhat narrower than that of the previous species: the strip of forest-steppe and steppe from Western Europe to the Southern Baikal region, Mongolia, Caucasus, Transcaucasia, Crimea, but the southern border of the range captures North Africa.

*P. afra* inhabits the south of Central and Eastern Europe, Balkan Peninsula, Front and Asia Minor, locally the Caucasus and Transcaucasia, Greece, Turkey, the mountains of Crimea, South Urals and the adjacent regions of the Trans-Urals, the south of the West Siberian Plain, North and West Altai, South and East Kazakhstan, foothills of southern Uzbekistan.

*C. persephone* has a narrower distribution compared to the previous species: Southeast Europe, Crimea, Caucasus, Transcaucasia, Southern and locally Middle Urals, Southern Trans-Urals, the south of Western Siberia, Altai, Front Asia, North Kazakhstan. The narrowest range of this type in *C. leander*. It covers the south of Central and Eastern Europe, Front and Lesser Asia, Caucasus, Transcaucasia, Southern Urals and Trans-Urals, the south of Western Siberia, North-Western Kazakhstan.

The Euro-Baikal subboreal type of range is characteristic only of *Hipparchia autonoe* (Esper, 1784), which inhabits a strip of forest-steppes and steppes from the Volga region to the Priamurye (Zeya River basin), Mongolia, China, Korea.

Only *Coenonympha arcania* (Linnaeus, 1761) has a Western palearctic type of range from the satirids of the Kurgan region. This species is distributed in Europe (except the north), Western Asia, Middle and Southern Urals and in the adjacent regions of the Trans-Urals.

The fauna of the Lepidoptera of the Satyridae family of the region is dominated by species with the Euro-Kazakhstan temperate-subtropical (8 species) and trans-Eurasian temperate-subtropical (6 species) types of ranges (figure 4).
Figure 4. Zoogeographic characteristics of the Satyridae family of the Kurgan region.

4. Conclusion
Of the 24 species of the Satyridae family living in the Southern Trans-Urals, 1 species has a Holarctic range, 6 Trans-Eurasian temperate-subtropical, 1 species is assigned to the Trans-Eurasian temperate type of the range, 3 are characterized by Western-Central Palearctic temperate-subtropical ranges, Euro-Siberian-Central Asian temperate-subtropical range has only 1 species, 1 species is assigned to Euro-Siberian-Central Asian type of range, 8 have Euro-Kazakhstan temperate-subtropical ranges, 1 species is characterized by the Euro-Baikal temperate-subtropical range, the Euro-Baikal subboreal range has 1 species, the Western Palearctic range is characterized by 1 species.
Thus, the fauna of the satirids of the Kurgan Oblast by 96% consists of Palearctic species.

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