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Biting Midge Fauna (Diptera: Simuliidae) Across Russia

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ABSTRACT

Blood-sucking midges from the Simuliidae family are small dipteran insects belonging to the Nematocera suborder. They inhabit various landscapes and geographical zones throughout the Russian Federation and play an important role in medical and epidemiological contexts as hematophagous insects and disease vectors affecting both humans and animals. The species composition and population size of midges in aquatic habitats are influenced by hydrological conditions and environmental factors that influence the blood-feeding behavior of adult females. This study provides regional data on the diversity of blood-sucking midges. Globally, approximately 1,600 species in 81 genera have been identified, and their ecological traits are studied concerning climatic conditions. However, systematic research on the distribution and population density of the main disease vectors in Russia remains limited or is conducted only in select regions, making it challenging to assess the risk of pathogen introduction and spread. Climate change may facilitate the expansion of highly adaptable blood-sucking arthropods into northern areas, directly affecting the epizootology and epidemiology of vector-borne diseases. Continuous monitoring of biota diversity, detecting species shifts, correlating them with environmental changes, analyzing trends, and implementing necessary biodiversity conservation measures are essential to understanding the broader impacts of global climate shifts on insect populations.

Keywords: Affinity of species composition, Biting midges, Fauna, Release

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Introduction

Midges belong to the “gnus” complex of insects, with Simuliids being widely distributed across various landscape-geographical zones of the Russian Federation. These insects are of major epidemiological and medical significance due to their blood-feeding behavior and role as vectors of diseases affecting both humans and animals. However, systematic studies on the distribution and population density of key infection carriers in Russia remain limited, being conducted only in certain regions, which complicates the evaluation of infection risks. With global warming, the most adaptable blood-sucking arthropods may extend their range into northern areas, directly influencing the epizootology and epidemiology of vector-borne diseases [1, 2]. The International Convention on Biological Diversity, adopted during the 1992 UN General Assembly conference in Rio de Janeiro, mandates biodiversity monitoring on both international and national levels. This paper reviews published research on blood-sucking midges found in Russia and their significance as disease vectors.

Biting midges from the Simuliidae family are small dipteran insects classified under the Nematocera suborder. Their preimaginal development occurs in fast-moving rivers and streams with suitable oxygen levels and hydrological conditions, where they attach to aquatic macrophytes, decomposing leaves, stones, and artificial

surfaces. The hydrological dynamics of water bodies, along with environmental factors, influence both the species diversity and population size of midges in these habitats, as well as the blood-feeding activity of emerging females [3].

As a component of the “gnus” insect complex, Simuliids are found across all landscape-geographical regions of the Russian Federation. Their epidemiological and medical significance is substantial, as they serve as blood-feeding insects and vectors of diseases affecting both humans and animals. However, research on their distribution and population density in Russia is either lacking or conducted in only a few regions, making it challenging to assess the risks of disease transmission and introduction. With ongoing global climate change, highly adaptable blood-sucking arthropods may expand their range into northern territories, which could significantly influence the epidemiology and epizootology of vector-borne diseases [1, 2].

The International Convention on Biological Diversity, adopted during the 1992 UN General Assembly conference in Rio de Janeiro, mandates biodiversity monitoring at both international and national levels. This includes continuous assessment of biota diversity, tracking ecological shifts, correlating these changes with environmental fluctuations, analyzing trends, and implementing necessary conservation measures to mitigate the effects of global environmental changes [4]. Given these concerns, this study aims to consolidate existing literature on biting midges prevalent in Russia and their role as vectors of pathogens.

The global fauna currently includes approximately 1,600 species of midges distributed across 81 genera [5]. Research on the biting midge fauna in Russia was predominantly conducted during the latter half of the twentieth century. Since that time, significant revisions have been made to the taxonomy of the Simuliidae family [5]. Consequently, in the table summarizing species composition based on published studies, modern names for species and genera are provided, with previously used names indicated in parentheses. This study provides regional data on the diversity of blood-sucking midges.

Materials and Methods

This study examines both original findings and published data to assess the distribution of blood-sucking midges across Russia and their medical and epidemiological importance as hematophagous insects and vectors of diseases affecting humans and animals.

Results and Discussion

The most thorough records of biting midge species in Western Siberia and the Ural are found in the monographs by Rubtsov [6], Domatsky *et al*. [7], and Yankovsky [5]. Rubtsov [6] documented 18 species in Western Siberia, while Domatsky *et al*. [7] identified over 40 species in the region. However, Domatsky *et al*. [7] pointed out that the *S. morsitans* form described by Rubtsov does not appear in Siberia, suggesting that the species should be referred to as *S. longipalpe* Belt. or another closely related form instead of *S. morsitans*.

The first data on midge fauna in the Tyumen region came from Rubtsov's [3] monograph, with further systematic studies beginning in 1959 by scientists from the Biological Institute of the Siberian Branch of the USSR Academy of Sciences (currently the Institute of Animal Systematics and Ecology of the Siberian Branch of the Russian Academy of Sciences). The initial studies covered the entire Tyumen region, including the present-day Yamalo-Nenets and Khanty-Mansi Autonomous Okrugs, and the southern parts of the region. In this paper, we have divided the available literature on species composition by their discovery locations into three distinct regions.

Patrusheva *et al*. conducted studies on the biting midge species in the southern Tyumen region. In the Demyanskoe area, Kaplich *et al*. [8] documented eight species: *Cnetha verna* Macq., *Nevermannia angustitarsis* Lund., *Byssodon maculatus* Mg., *Eusimulium aureum* Fries, *Odagmia ornate* Mg., *Schoenbaueria pusilla* Fries, *S. (morsitans) longipalpe* Edw., and *Simulium rostratum* Lund., with *B. maculatus* being the most dominant. In Tyumen, Bukshtynov [9] reported 5 species: *B. maculatus*, *Boophthora erythrocephala* D.G., *Schoenbaueria nigra* Mg., *Argentisimulium noelleri* Fried., and *S. morsitans*. Further research by Mitrokhin in different climatic and natural zones of the southern Tyumen region [10-12] uncovered 11 species, adding *Simulium reptans* L. and *Parabyssodon transiens* Rubz. to the list. Domatsky *et al*. [7] also recorded *S. longipalpe* and *Simulium venustum* Say.

From 2003 to 2010, the All-Russian Research Institute of Veterinary Entomology and Arachnology recorded new cases of entomology and disinsection, resulting in the addition of *Schoenbaueria subpusilla* Rub. to the faunal list [13]. As a result, the biting midge fauna in the southern Tyumen region now includes 14 species across 10 genera.

In the Khanty-Mansiysk Autonomous Okrug, studies on the biting midge population were mainly conducted during the 1960s through 1980s. Domatsky *et al*. [7], and Ishmuratov [14] recorded eight species in the vicinity of Oktyabrskoye village, including *Cnetha silvestris*, *C. verna*, *Cnetha pugetensis* Dyar et Schan., *S. pusilla*, *B. maculatus*, *S. (morsitans) longipalpe*, *Argentisimulium (Simulium) palustre* Rubz., and *S. rostratum*. The dominant species in the area were *S. pusilla*. Ishmuratov and *B. maculatus* [15] reported 7 species in the region, introducing *S. venustum* and *B. erythrocephala* to the existing list. In the Surgut district, Zinovieva [16] documented 6 species of biting midges.

In the Surgut region, Zavyalov [17] recorded three species, while Kerbabaev *et al*. [18] identified six previously known species in the vicinity of the Samotlor oil field. In the Nefteyugansk suburbs, *S. pusilla* and *B. maculatus* [19] were the most abundant species. Mitrokhin [11], in his study of midge breeding sites along the lower Irtysh, discovered an additional species, *P. transiens*. By 1974, Mitrokhin [12] had documented 10 species in the region, including three new ones: *S. morsitans*, *S. nigra*, and *S. tuberosum*. In 1982, Domatsky *et al*. [7] contributed an additional species to the local midge fauna—*Gnus malyschevi* Dorog., Rubz et Vlas. According to available literature, the biting midge fauna of the Khanty-Mansiysk Autonomous Okrug consists of 15 species across 8 genera.

Research on blood-feeding dipteran insects, including midges, in the Yamalo-Nenets Autonomous Okrug mainly took place during the exploration of gas and oil fields in the second half of the twentieth century. In the vicinity of Labytnangi, Boldarueva [20] documented eight species: *B. maculatus*, *S. pusilla*, *Schoenbaueria rangiferina* Rubz., *O. ornata*, *Gnus corbis* Tw., *S. (morsitans) longipalpe*, *Archesimulium vulgare*, and *S. rostratum*. In the forest-tundra zone, Kaplich *et al*. [8] observed 8 species of blood-feeding midges and suggested that two additional species, *Schoenbaueria gigantean* and *Prosimulium hirtipes* Fries, recorded by Rubtsov [3] in the northern part of Western Siberia, should be considered, although she did not encounter them herself.

Kaplich *et al*. [8] identified *S. longipalpe* and *S. pusilla* as the most common species. In the Purovsky district's forest tundra, Petrozhitskaya [21] added two new species to the local list of blood-sucking midges: *S. venustum* and *B. erythrocephala*. In 1972, Patrusheva noted the presence of *Schoenbaueria tshernovskii* in the Polar Urals. Later, Mezenev and Patrusheva [22] discovered another species, *Simulium truncatum* Lund., and found larvae of four other species in nearby streams: *Cnephia pallipes* Fr., *Cnetha bicornis*, *Metacnephia tredecimata* Edw., and *C. verna*. In the area surrounding the village, Usova [23] recorded two species previously documented: *S. truncatum* and *C. pallipes*. Two years after that, Sharkov *et al*. [24] expanded the list by three species: *Metacnephia pectinata* Patr., *Metacnephia trigoniformis* Yank., and *Metacnephia korsacovi* Rubz. Domatsky *et al*. [7] also discovered nine new species for the region, including *Metacnephia edwarsiana* Rubz., *E. aureum*, *Metacnephia tabescentifrons* End., *C. silvestris*, *Parabyssodon transiens* Rubz., *C. pugetensis*, *Simulium posticatum* Mg., *Schoenbaueria brachyarthran* Rubz., and *Archesimulium tuberosum* Lund. Additionally, Yankovsky [25], in locations such as Cape Kamenny, the Neito lake system, and the middle reaches of the Boldarueva River, found 6 more species: *S. tuberosum*, *Prosimulium kolymensis* Patr., *Cnetha arcticum* Rubz., *Stegopterna trigoni* Lund., *Archesimulium tumulosum* Rubz., and *S. subpusilla*.

Ivantsova [26] confirmed the presence of a species previously recorded by Rubtsov [3] in the northern forest tundra of Yamal. A review of available literature revealed that the biting midge fauna of the Yamalo-Nenets Autonomous Okrug consists of 40 species across 16 genera. In contrast, the biting midge fauna of the Taimyr Autonomous Okrug remains underexplored. The most well-studied region of the district is the right bank of the Yenisei. Research conducted between 1965 and 1968 [27] led to the identification of 23 species of biting midges, including S. sp. from the venustum Say group, *S. subpusilla* Rubz., *Prosimulium alpestre* Dor. et Rubz., *Cnetha verna* Macquart (*Eusimulim latipes* Mgeigen), *G. cholodkovskii* Rubz., *S. rangiferina* Rubz., S. sp., *S. morsitans longipalpe* Belt., *B. maculatus*, *P. hirtipes* Fries, *Gymnopais trifistulatus* Rubz., *Schoenbaueria pusilla* Fries, *Cnephia pallipes* Fries (Cnephia lapponica End.), *Simulium vulgare* Rubz., *P. arcticum* Rubz. et Carls., *G. rostratum* Lundstr, *S. verecundum* St. et Jamnb., *S. rostratum* Lundstrom (*Simulium argyreatum* Meigen), *Stegopterna trigoni* End., *Helodon irkutensis* Rubz., *Cnephia* sp., and *S. duodecimata* Rubz.

Bobrova [28] considers the blackfly fauna of the European part of Russia to be thoroughly investigated. Research on the blackfly fauna of Karelia and the Murmansk region has been conducted by several scientists [3, 29-31]. Isimbekov and Madieva [32] identified 38 species across 10 genera. The collections were made in 7 districts of

the Murmansk region and 12 districts of Karelia. For the Murmansk region, 15 species were identified, including *Metacnephia biliniata* Rubz., *Prosimulium macropuga* Lundstrom, *Wilhelmia eguina* Lannaeus, *Helodon ferrugineus* Wahlberg, *Cnetha cryophila* Rubz., *C. curvans* Rubz. et Carlsson, *Schoenbaueria subpusilla* Rubz., *Odagmia argyreata* Mg., *O. bronchialis* Rubz., *Archesimulium tuberosum* Rubz., *Cnetha beltukovae* Rubz., *C. Bicorne* Dorogostajsky, Rubzov et Vlasenko, *O. laplandica* Chubarevae et Yankovsky, *C. silvestris* Rubz., and *O. ornata* Mg. In the Republic of Karelia, 29 species were recorded, including Simulium janzeni End., *Cnetha elburna* Rubz. et Carlsson, *Boophthora erythrocephala* D. G., *Simulium longipalpe* Belt., *C. Bicorne* Dorogostajsky, *Cnetha verna* Macq., *Hellichiella crassum* Rubz. (*Boreosimuluim crassum* Rubz.), *Odagmia argyreata* Mg., *O. frigida* Rubz., *O. fusca* Rubz., *Gnus corbis* Twinn (*Gnus murmanum* End.), *O. intermedia* Roubaud, *S. morsitans* Edw., *O. monticola* Fiederichs, *S. rostratum* Lund., *O. rotundata* Rubz., *S. rubzovi* Smart., *S. reptans* L., *S. posticatum* Mg., *S. paramorsitans* Rubz., *S. subpusilla* Rubz., *S. vulgare* Rubz., *Argentisimulium noelleri* Fried (*Simulium noelleri* Fried), *Archesimulium polare* Rubz., *C. silvestris* Rubz., *C. meigeni* Rubz. et Carlsson, *S. rangiferina* Rubz., and *Simulium tuberosum* Rubz.

The southeast region of Karelia had long been an unexplored area in terms of its entomofauna, despite its clear significance at the junction of the Baltic Shield and the Andoma Upland in Fennoscandia. Humala and Polevoy documented several species in this region, including Gnus corbis Twinn, *S. rostratum* Lund., *Cnetha bicorne* Dorogostajsky, Rubzov et Vlasenko, *C. verna* Macquart, *S. morsitans*, *S. reptans* L., and *Archesimulium tuberosum* Lund.

In Primorsky Krai, early research on the midges' fauna and ecology was first published by Denisov *et al*. [33], Petrozhitskaya [34], Taratutina *et al*. [35], Gogolev [36], Budaeva and Silina [37], and Rubtsov [3]. However, no further investigations on midges were conducted in the area in later years. A total of 24 species from 9 genera were recorded, which included *Gymnopais* sp., *H. alpestris* Dorogostajsky, *Helodon rubicundus* Rubz., Rubzov et Vlasenko (*Prosimulium alpestre* Dorogostajsky, Rubzov et Vlasenko), *Prosimulium macropuga* Lundstrom, *H. multicaulis* Popov. (*P. multicaulis* Popov.), *P. hirtipes* Fries. (*P. Hirtipes* diminutum Rubz.), *Stegopterna* sp., *P. irritans* Rubz., *Cnephia pallipes* Fries (*Metacnephia pallipes* Fries), *Byssodon* sp., *Eusimulium schogakii* Rubz., *E. latipes* Mg., *E. fontinale* Radz., *E. bicorne* Dor. et Rubz., *E. pygmeum amurense* Rubz., E. sp., *Gnus malyschevi albipes* Rubz., *G. rostratum* Lundstr., *G. subvariegatum* Rubz., *Simulium vulgare* Rubz., *S. tumulosum* Rubz., *S. venustum* Say, and *S. morsitans* [38].

In the Volgograd region of the Lower Volga zone, biting midges remain a relatively underexplored group of insects. According to Terteryan [39], five species from five different genera have been identified: *Byssodon maculatus* Schoenbaueria nigra Mg. (*Schoenbaueria behningi* End., *Schoenbaueria matthiesseni* Enderlein), Mg. (*Titanopteryx maculatus* Meigen), *Odagmia ornata* Mg., *Boophthora erythrocephala* D. G., and *S. morsitans*.

In the Kaliningrad region, research on zoobenthos led by Rubtsov [40] identified three species of midges: *Wilhelmia eduina* Linnaeus, *W. lineata* Mg., and *Simulium* spp. Studies on midges in St. Petersburg and the Leningrad region were carried out over different periods by Rubtsov, Usova, and Aibulatov. To date, 63 species from seventeen genera have been recorded in the region, with notable genera including *Cnetha*, *Eusimulium*, *Odagmia*, *Prosimulium*, *Schoenbaueria*, and *Simulium* [8]. There are 54 collection points from which midges have been documented in the area. Rubtsov [3] identified 17 species from ten genera in the Leningrad region without specifying collection points, including *Cnephia pallipes* Fries (*Metacnephia pallipes* Fries), *Schoenbaueria subpusilla* End., *S. rubzovi* Smart, *Simulium janzeni* End., *S. paramorsitans* Smart, *S. truncatum* Lundstrom, *Eusimulium angustipes* Rubz., *E. aureum* Rubz., *E. securiforme* Rubz., *Prosimulium luganicum* Rubz., *Stegopterna trigonia* Rubz., *Wilhelmia ivashentzovi* Rubz., *Nevermannia latigonia* Rubz., *Hellichiella annae* Rubz., *H. annulus* Lundstrom, *C. meigeni* Rubz. et Carlsson.

In Dementiev's study [41] on the midges of the Leningrad region, 48 species from 15 genera are recorded. For the first time in the area, Usov lists 37 species: *S. venustum* Say, *Odagmia frigida* Rubz., *Cnetha beltukovae* Rubz., *Prosimulium hirtipes* Fries. (*P. hirtipes diminutum* Rubz.), *S. reptans* L., *Stegopterna majalis* Rubz. et Carlsson, *Simulium abbreviatum* Rubz., *C. verna* Rubz., *A. vulgare* Dorogostajsky, Rubzov et Vlasenko (*Simulium vulgare* Dorog., Rubz. et Vlas.), *C. cryophila* Rubz., *Wilhelmia eduina* Linnaeus, *Parabyssodon transiens* Rubzov (*Byssodon transiens* Rubz.), *S. rostratum* Lund., *S. promorsitans* Rubz., *S. posticatum* Rubz., *O. rotundata* Rubz., *S. aemulum* Rubz., *S. hibernale* Rubz., *C. kuznezovi* Rubz., *O. pratora* Fried., *S. simulans* Rubz., *Schoenbaueria pusilla* Fries, *A. tuberosum* Lundstrom (*Simulium tuberosum* Lundstrom), *E. silvaticum* Rubz., *E. argentipile* Rubz., C. bicorne Dorogostajsky, Rubzov et Vlasenko, Nevermannia angustitarsis Lundstrom (Eusimulium

angustutarsis Lund.), *N. Lundstromi* Rubz., *E. silvaticum* Rubz., *Agentisimulium noelleri* Rubz., *A. tumulosum* Rubz., *Boophthora erythrocephala* D. G., C. curvans Rubz. et Carlsson, E. sp., and *S. curvistylus* Rubz.

In the Moscow region, Khazeeva [42] recorded 29 species and one subspecies of midges, representing 9 genera, with eighteen species and one subspecies identified for the first time. The midge fauna includes *Stegopterna duodecimata* Rubz., *S. trigoni* Lundström (*Stegopterna richteri* Enderlein), *Cnephia pallipes* End. (*Astega lapponica* End.), *Byssodon maculatus* Mg., *Parabyssodon transiens* Rubz., *Cnetha verna* Macq. (*Cnetha latipes* Mg.), *C. silvestris* Rubz., *Nevermannia angustitarsis* Lundstrom, *N. latigonia* Rubz., *N. volhynica* Ussova et Pavl., *Eusimulium aureum* Fries, *E. angustipes* Edw. (*E. latizonum* Rubz.), *Schoenbaueria nigra* Mg., *Wilhelmia eduina* Linnaeus, *Boophthora chelevini* Ivaschenko, *B. erythrocephala* D. G. (*B. mihalyii* Rubz., *B. sericata* Mg.), *Odagmia frigida* Rubz., *O. intermedia* Roubaud (*O. nitidifrons* Edw.), *O. ornata* Mg., *O. pratorum* Fried., *O. rotundata* Rubz., S. sp. aff. venustum Say (*Simulium verecundum* St. Et Jamnb), *Simulium posticatum* Mg. (*Simulium austeni* Edw.), *S. reptans* Linnaeus (*Simulium galeratum* Edwards), *Simulium janzeni* End., *S. longipalpe* Belt., *S. morsitans*, *Argentisimulium noelleri* Fried (*Simulium noelleri* Fried), *A. palustre* Rubz., and *Simulium truncatum* Lundstrom.

In Mordovia, Vorobets [43] presented new data on the midges' fauna, collected between 2009 and 2013. This study recorded 11 species from 8 genera: *Schoenbaueria nigra* Mg., *Wilhelmia eduina* Linnaeus, *Simulium paramorsitans* Rubz., *Boophthora erythrocephala* D. G., *Odagmia ornata* Mg., *Byssodon maculatus* Mg., *Stegopterna trigoni* Lundstrom, *Boreosimulium annulus* Lundstrom, *Odagmia pratora* Fried., *Wilhelmia balcanica* End., and *Argentisimulium noelleri* Fried.

The biting midge fauna of the central Non-Black-Soil Zone includes 15 species across ten genera: *Stegopterna trigoni* Lundström (Richteri Enderlein), *Byssodon maculatus* Mg., *Eusimulium aureum* Fries, *Schoenbaueria nigra* Mg., *S. dendrofila* Patrusheva, *Wilhelmia eduina* Linnaeus, *Boophthora erythrocephala* D. G., *Odagmia ornata* Mg., *S. morsitans*, *Argentisimulium noelleri* Fried (*Simulium noelleri* Fried), *S. paramorsitans* Rubz., *Simulium* sp. aff. *venustum* Say (*Simulium verecundum* St. et Jamnb), *Cnetha verna* Macq. (*Cnetha latipes* Mg.), *C. silvestris* Rubz., *Nevermannia angustitarsis* Lundstrom (*Chelocnetha angustitarsis* End.) [44].

The research conducted by Barashkova [45] in the Udora region of the Komi ASSR within the Komi Republic's administrative district revealed 14 species from 9 genera of midges. These species included *Boophthora erythrocephala* D.G., *Parabyssodon transiens* Rubzov (*Byssodon transiens* Rubz.), Cnetha verna Macquart (*Eusimulium latipes* Meigen), *Gnus rostratum* Lundstr., *Odagmia frigid* Rubz., *O. ornata* Mg., *Schoenbaueria* sp., *Simulium rostratum* Lundstrom (*Simulium argyreatum* Meigen), *Simulium reptans* Linnaeus (*Simulium galeratum* Edwards), *S. morsitans*, *S. venustum* Say, *S. vulgare* Rubz., *Cnephia* sp., and *Wilhelmia eguina* Linnaeus.

In the southwest part of Altai, Vlasov [46] noted that studies on midges were conducted [47]. The research in Altai documented 33 species, which included *Sulcicnephia ovtshinnikovi* Rubz. (*Cnephia ovtshinnikovi* Rubz.), *Cnephia curvans* Rubz. et Carlsson (*Eusimulium curvans* Rubz. et Carlsson), *Eusimulium macropyga* Lundstrom, *P. tridentatum* Rubz., *P. zaitzevi* Rubz. (*Prosimulium macropyga zaitzevi* Rubz.), *Helodon tungus* Rubz. (*Cnephia tungus* Rubz.), *Cnephia malyschevi* Dorogostajsky, Rubzov et Vlasenko, *G. Cholodkovskii* Rubz., *Prosimulium hirtipes deminutum* Rubz., *Cnephia arshanense* Rubz., *Metacnephia edwardsiana* Rubz. (*Cnephia edwardsiana* Rubz.), *P. hirtipes* Fries (*Prosimulium hirtipes*), *M. multifilis* Rubz. (*Cnephia multifilis* Rubz.), *Gymnopais rubzovi* Bobr., *Montisimulium schevjakovi* Dorogostajsky, Rubzov et Vlasenko (*Eusimulium schevjakovi comosum* Rubz.), *Cnephia verna* Macquart (Eusimulium latipes Meigen), *P. arshanense* Rubz., *Ahaimophaga alpestre* Dorogostajsky, Rubzov et Vlasenko (*Prosimulium alpestre altaicum* Rubz.), *Prosimulium macropyga* Lundstrom, *Cnephia pallipes* End., *C. bicornis* Dorogostajsky, Rubzov et Vlasenko (*Eusimulium bicornis* Dorogostajsky et Rubzov), *Argentisimulium palustre* Rubz. (*Simulium palustre* Rubz.), *S. morsitans*, *G. rostratum* Lundstr., *Odagmia ornata* Mg., *T. latimentum* Rubz., *S. tungus* Rubz. (*Cnephia tungus* Rubz.), *Cnephia verna* Macquart (*Eusimulium latipes* Meigen), and *T. alajense* Rubz.

Between 2004 and 2007, a study was conducted on midges in the maral breeding farms of OAO Aksu (Aksu, JSC) and TOO Yongu-Abzal (Yongu-Abzal, LLP) located in the southwestern Altai. These farms are situated on the maral pastures within the meadow-steppe and forest-meadow zones of the mountains, which are known for their harsh environmental conditions. Krutko *et al*. [48] recorded a total of 7 species, including *Boophthora erythrocephala* D. G., *Wilhelmia veltististshevi* Rubz., *Simulium reptans* Linnaeus, *Archesimulium vulgare* Dorogostajsky, Rubzov et Vlasenko, *Odagmia ornata* Mg., *Argentisimulium noelleri* Fried, and *Cnetha verna* Macquart.

Based on the research conducted by Palatov [49], and Patrusheva and Polyakov [50] and other literature sources, the midge fauna of Southern Altai now consists of 33 species from the genus *Simulium* across 7 subgenera. In the Greater and Lesser Yenisei basins, which contribute to the catchment area of the Upper Yenisei in Eastern Tuva, midges of 31 species from 5 different genera have been identified [51-53]. The diversity of midges in this region includes the following species: *Gnus cholodkovskii* Rubzov, *G. decimatum* Dorogostajsky, Rubzov et Vlasenko, *G. jacuticum* Rubzov, *G. malyschevi* Dorogostajsky, Rubzov et Vlasenko, *G. murmanum* End., *Odagmia ornata* Mg., *Simulium reptans* Linnaeus, *Archesimulium vulgare* Dorogostajsky, Rubzov et Vlasenko, *Simulium longipalpe* Belt., *S. rubzovi* Smart, *Wilhelmia eguinum* Linnaeus, *Gymnopais andrei* Vorobets, *G. trifistulatus* Rubz., *Helodon alpestris* Dorogostajsky, Rubzov et Vlasenko, *H. mesenevi* Patrusheva, *H. irkutensis* Rubzov, *Prosimulium arshanense* Rubzov, *P. hirtipes* Frie, *P. tridentatum* Rubzov, *P. candicans* Rubzov, *P. kolymense* Patrusheva, *P. intercalare* Rubzov, *P. pecticrassum* Rubzov, *Metacnephia amsheevi* Usova et Bazarova, *M. kirjanovae* Rubzov, *Eusimulim longitarse* Rubzov et Violovich, *M. sommermannae* Stone, *Nevermannia angustitarsis* Lundstrom, *N. longipes* Rubzov, and *C. verna* Macquart.

Research conducted by Patrusheva [54] in the Kachugsky district of the Irkutsk region from May to October 1965 marked the initiation of studies on midges in the upper Lena. In the Lena River, several bloodsucking species were found, including *Simulium reptans* Linnaeus (formerly *Simulium galeratum* Edwards), *Prosimulium jacuticum* Rubzov, and *S. morsitans* Edwards. Additionally, 12 other species were recorded, such as *Eusimulim* species gr. Latipes Mg., *C. bicornis* Dorogostajsky, *Eusimulim* species gr. Aureum Fries, Rubzov et Vlasenko (previously *Eusimulium bicornis* Dorogostajsky et Rubzov), *Odagmia ornata* Mg., *G. rostratum* Lundstrom, *Archesimulium vulgare* Dorogostajsky, Rubzov et Vlasenko (previously *Simulium vulgare* Rubz.), *Helodon alpestris* Dorogostajsky, *S. rostratum* Lundstrom (formerly *Simulium argyreatum* Meigen), *Argentisimulium noelleri* Fried (previously *Simulium noelleri* Fried), Rubzov et Vlasenko (previously *Prosimulium alpestre* Dorogostajsky, Rubzov et Vlasenko), *P. candicans* Rubzov, *Twinnia sedecimfistulata* Rubzov, and *Cnephia* sp.

In the Middle Volga region of the Republic of Mari El, Patrusheva [55] identified eleven species of biting midges across five genera: *Byssodon maculatus* Mg. (formerly *Titanopteryx maculates* Meigen), *Yrenieradogieli* Ussova, Cnetha verna Macquart (previously *Eusimulium latipes* Meigen), *C. silvestris* Rubzov (formerly *Eusimulium silvestris* Rubzov), *C. bicornis* Dorogostajsky, *Eusimulium aureum* Fries, Rubzov et Vlasenko (previously *Eusimulium bicornis* Dorogostajsky et Rubzov), *Schonbaueria pusilla* Fries, *Simulium longipalpe* Belt., *Odagmia ornata* Mg., *S. rostratum* Lundstrom (formerly *Simulium argyreatum* Meigen), and *Simulium reptans* Linnaeus (formerly *Simulium galeratum* Edwards).

Budaeva and Silina [37] noted that the midge fauna and their ecology had not been previously investigated in the Belgorod region. Fieldwork conducted from 2007 to 2012 identified 9 midge species: *Wilhelmia balcanica* End., *W. lineata* Mg., *Cnetha verna* Macquart, *N. latigonia* Rubz., *Nevermannia angustitarsis* Lundstrom, *Eusimulium angustipes* Edw., *Odagmia ornata* Mg., *Boophthora erythrocephala* D. G., and *Argentisimulium noelleri* Fried.

The study of midge fauna in the Caucasus region has been inconsistent, with the majority of research conducted during the second half of the twentieth century in Transcaucasia [56-58]. Rubtsov contributed to the knowledge of North Caucasus midge fauna through brief reports and broader faunistic surveys [3]. Currently, 22 midge species from 9 genera are present in Adygea, including *Prosimulium petrosum* Rubz., *P. pronevitshae* Rubz., *P. tomosvaryi* End., *Wilhelmia balcanica* End., *Cnetha angustata* Rubz., *W. pseudeguina* Seguy, *C. djafarovi* Rubz., *C. fontia* Rubz., *C. elata* Rubz., *C. geigelenais* Djafarov, *Cnetha verna* Macquart, *Nevermannia gomphocornis* Rubz., *Eusimulium aureum* Fries, *Obuchovia adornata* Rubz., *Paragnus bukovskii* Rubz., *O. caucasica* Rubz., *Odagmia baracornis* Smart, *O. fantana* Terteryan, *O. monticola* Fried., *O. monticoloides* Rubz., *O. ornata* Mg., and *Simulium tarnogradskii* Rubz.

Potapov *et al*.'s research [59] conducted between 1985 and 2012 across various fish farms and water bodies in Central Ciscaucasia, spanning from the Elbrus region to the Kuma-Manych depression, as well as the regions of Stavropol Territory, Karachay-Cherkessia, Kabardino-Balkaria, North Ossetia, Kalmykia, Ingushetia, and Chechnya, identified 40 midge species. These include: *Prosimulium gigas* Rubz., *P. rachiliense* Djafarov, *P. petrosum* Rubz., *Boophthora erythrocephala* De Geer, *Byssodon maculatus* Mg., *E. aureum* Rubzov, *Eusimilium angustipes* Edwards, *E. maritimum* Rubzov, *E. silvaticum* Rubzov, *Cnetha verna* Macquart, *Schoenbaueria nigra* Mg., *Montisimulium alizadei* Djafarov, *M. montium* Rubzov, *W. balcanicum* Enderlein, *Wilhelmia angustifurca* Rubzov, *W. dahestanicum* Rubzov, *W. eguina* Linnaeus, *W. lineatum* Mg., *Nevermannia angustitarsis* Lundstrom, *N. gomphocorne* Rubzov, *N. lundstromi* End., *Cnetha coctata* Friedrichs (formerly *Nevermannia coctata* Friedrichs), *C. cryophilum* Rubzov, *C. elata* Rubzov, *C. fontia* Rubzov, *C. verna* Macquart, *Obuchovia adarnata*

Rubzov, *Odagmia baracornis* Smart (formerly *Simulium baracornis* Smart), *O. fontana* Terteryan (formerly *Simulium fontana* Terteryan), *O. monticola* Friederichs (formerly *Simulium monticola* Friederichs), *O. monticoloides* Rubzov, *O. variegate* Meigen, *O. ornata* Meigen, *Tetisimulium bezzi* Corti, *O. schamili* Rubzov, *Simulium longipalpe* Beltukova, *S. tarnogradskii* Rubzov, *S. morsitans* Edwards, *S. paramorsitans* Rubzov, *S. simulans* Rubzov, *S. shevtshenkovae* Rubzov, and *Argentisimulium noelleri* Fried.

Alania National Park (NPA), situated on the northern slope of the Central Caucasus in the Urukh River basin, was first studied for its freshwater entomofauna by Khumala and Field [60], who identified two species of midges: *Odagmia ornata* Mg. and *O. caucasicum* Rubz. In the Voronezh region, notable hematophagous species include *Byssodon maculatus* Mg., *Schoenbaueria nigra* Mg., *S. morsitans*, and *S. paramorsitans* Rubz. From 1969 to 2006, midge surveys on the Crimean Peninsula were conducted, and research by Panchenko [61] resulted in the identification of 32 midge species. These species include: *P. petrosum* Rubzov, *P. rufipes* Meigen, *Cnetha verna* Macquart (formerly *Cnetha latipes* Meigen), *C. chodakovi* Panchenko, *C. brevidens* Rubzov, *C. fontia* Rubzov, *C. angustata* Rubzov, *C. gejgelense* Djafarov, *C. tauricum* Rubzov, *C. karajimae* Panchenko, *W. balcanica* Enderlein, *W. angustifurca* Rubzov, *W. paraeguina* Puri, *W. pseudeguina* Seguy, *W. veltistshevi* Rubzov, *N. lundstrami* Rubzov, *N. angustitarsis* Lundstrom (formerly *Eusimulium angustitarsis* Lundstrom), *N. volhynica* Ussova et Pavlov, *E. aureum* Rubzov, *E. angustipes* Edwards (formerly *Eusimulium latizonum* Rubzov), *E. velutinum* Santos Abreu, *E. krymense* Rubzov, *O. brevifilis* Rubzov, *Obuchovia auricoma* Meigen, *O. karasuae* Panchenko, *Paragnus bukovskii* Rubzov, *Odagmia pratora* Fried, *O. trifasciatum* Curtis, *O. ornata* Meigen, *O. baracornis* Smart, *A. noelleri* Fried (formerly *Simulium noelleri* Fried), Sim. lugense Yankovsky, and *Byssodon maculatus* Meigen (formerly *Titanopteryx maculatus* Meigen).

Research conducted in areas far from major rivers such as the Ob and Irtysh rivers took place over several years: in 1960 in Zonovo village, in 1962 in Karasuk, and 1964 near Novosibirsk, including the Maslyansky and Ordynsky districts of the Novosibirsk region. The following species were identified in the Novosibirsk region: *Cnetha meigeni* Rubzov et Carlsson (formerly Eusimulium pygmaeum Ztterstedt, sensu Rubzov), *Cnephia* species, *Byssodon maculatus* Meigen (formerly *Titanopteryx maculatus* Meigen), *S. pusilla* Fries, *Eusimulium aureum* Rubzov, *E. angustipes* Edwards, *E. latipes* Meigen, *E. silvaticum* Rubzov, *B. erythrocephala* De Geer, *S. morsitans* Edwards, *S. longipalpe* Beltucivae, *S. rostratum* Lundström (formerly *Simulium argyreatum* Meigen), *S. reptans* Linnaeus (formerly *Simulium galeratum* Edwards), *S. aemulum* Rubzov, *O. frigida* Rubzov, *Odagmia ornata* Meigen, *Parabyssodon transiens* Rubzov (formerly *Byssodon transiens* Rubz.), *A. noelleri* Fried (formerly *Simulium noelleri* Fried), and *Simulium vulgare* Rubzov.

The species composition of midges in the Tomsk region remains poorly understood. Popov's studies [62] reported eight species of biting midges in the region: *T. maculata* Meigen, *C. verna* Macquart (formerly *Cnetha latipes* Meigen), *E. aureum* Rubzov, *S. venustum* Say (formerly *Simulium verecundum* St. et Jamnb), *S. reptans* Linnaeus, *S. morsitans* Edwards, *S. tuberosum* Lund, and *S. pusilla* Fries. In the Aleksandrovsky district of Tomsk, Dariychuk [63] identified seven species, including 3 that had not been previously reported: *B. erythrocephala* De Geer, C. *verna* Macquart, and *E. aureum* Rubzov. According to Domatsky *et al*. [7], the following species were recorded for the region: *Byssodon maculatus* Meigen (formerly *Titanopteryx macularus* Meigen), *S. longipalpe* Beltucivae, *S. morsitans*, *S. rostratum* Lundström (formerly *Simulium argyreatum* Meigen), *S. rangiferina* Rubzov, *N. angustitarsis* Lundström (formerly *Eusimulium angustitarsis* Lundström), *O. ornata* Meigen, and *S. reptans* Linnaeus (formerly *Simulium galeratum* Edwards).

Research conducted in various regions of the Yana and Lena River basins revealed the presence of 59 species of midges from 18 different genera, as documented by Vorobets [43]. Among these, 29 species were reported for the first time in Yakutia. These include *Prosimulium candicans* Rubzov, *Gymnopais trifistulatus* Rubzov, *P. erythronotum* Rubzov, *P. hirtipes* Fries (formerly *Prosimulium hirtipes diminutum* Rubzov), *P. irkutense* Rubzov, *P. macropyga* Lundstrom, *P. jacuticum* Rubzov, *Helodon rubicundus* Rubzov, *H. alpestris* Dorogostajsky, Rubzov et Vlasenko (formerly *Prosimulium alpestri* Dorogostajsky, Rubzov et Vlasenko), *H. czekanowskii* Rubzov (formerly *Prosimulium czekanowskii* Rubzov), *H. Rhizomorphus* Rubzov (formerly *Prosimulium rhizomorphus* Rubzov), *Stegopterna asema* Rubzov, *S. majalis* Rubzov et Carlsson, *S. dentata* Rubzov et Carlsson, *S. decafilis* Rubzov, *Cnephia pallipes* Fries (formerly *Cnephia pallipes* Enderlein), *Metacnephia saileri* Stone (formerly *Metacnephia pallipes* Fries), *M. trigoniformis* Yankovsky (formerly *Metacnephia trigonium* Lunstrom), and *M. taimyrica* Patrusheva. Additional first-time records include *Sulcicnephia tungus* Rubzov, *Byssodon maculatus* Meigen (formerly *Byssodon macularus lenae* Rubzov), *Eusimulium aureum* Rubzov, *Cnetha chomustachi* Worobez (formerly *Gomphostilbia chomustachi* Worobez), *Schoenbaueria rangiferina* Rubzov, *S.*

pusilla Fries, *S. subpusilla* Rubzov, *S. brachyarthra* Rubzov, *S. gigantea* Rubzov (formerly *Hemicnetha gigantea* Rubzov), *Cnetha verna* Macquart (formerly *Cnetha latipes* Meigen), *C. silvestris* Rubzov, *C. bicornis* Dorogostajsky, Rubzov et Vlasenko, *C. pugetensis* Dyar et Shannon (formerly *Eusimulium longipile* Rubzov), *C. curvans* Rubzov et Carlsson, *Hellichiella baffinensis* Twinn (formerly *Cnetha baffinensis* Twinn), *Archesimulium tuberosum* Lunstrom (formerly *Simulium tuberosum* Lunstrom), *A. vulgare* Dorogostajsky, Rubzov et Vlasenko (formerly *Simulium vulgare* Rubzov), *Simulium venustum* Say, *S. trucatum* Lunstrom, *S. posticatum* Meigen (formerly *Simulium austeni* Edwards), *S. morsitans*, *S. paramorsitans* Rubzov, *S. longipalpe* Beltucovae, *S. rubzovi*, *S. aemulum*, *S. rostratum* (formerly *S. argyreatum*), *S. venustum* (formerly *S. verecundum*), S. sp., *Boophthora erythrocephala*, *Gnus malyschevi* Rubzov, *G. jacuticum* Rubzov, *G. cholodkovskii*, *G. decimarum*, *G. pavlovskii*, *G. rostratum*, *G. nakojapi*, *G. subvariegarum*, and *Parabyssodon transiens*.

Aibulatov [44] conducted a review of existing literature and combined it with field observations, contributing two additional species to the fauna of the region: *Cnephia angarensis* Rubzov and *Gymnopais frontatus* Yankovsky. Barashkova [45], in her research on the river basins of Lena, Vilyui, and Kolyma in the Republic of Sakha (Yakutia), identified 12 distinct species. In the case of Kunashir, the southernmost island of the Greater Kuril Ridge, the midge fauna is relatively scarce, with only three species across three genera: *Gomphostilbia makartshenkovi* Bodrova, *Cnetha* spp., and *Odagmia nishijimai* Ono [28].

Conclusion

The issue remains significant and calls for additional research, as these blood-sucking Diptera are known to transmit several parasitic and infectious diseases to both animals and humans.

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References

1. Markovich NY. Biota response to climate warming in Europe. Med Parasitol Parasite Dis. 2003;4:23-6.
2. Yasyukevich VV. Impact of climate change on the spread of malaria in the Russian federation. Med Parasitol Parasit Dis. 2003;4:27-33.
3. Rubtsov IA. Midges (family Simuliidae). Fauna of the USSR. Diptera. M.; L., 1956;6(6):680.
4. Yurtsev BA. Monitoring of biodiversity at the level of local floras. Bot J. 1997;82(6):60-9.
5. Yankovsky V. Key to midges (Diptera, Simuliidae) of Russia and adjacent territories (former USSR). St. Petersburg; 2002. 570 p.
6. Rubtsov IA. A brief guide to blood-sucking midges of the fauna of the USSR. Leningrd; 1962. 228 p.
7. Domatsky V, Fedorova OA, Siben AN. Epizootological and epidemiological significance of blood-sucking dipteran insects in the far north (review). Russ J Parasitol. 2018;12(4):73-6. doi:10.31016/1998-8435-2018-12-4-73-76
8. Kaplich VM, Zinovieva OE, Sukhomlin EB. On biological regulators of the number of blood-sucking midges (Diptera: Simuliidae) in the watercourses of the central non-Chernozem zone of Russia. Ecol Wildl. 2019;(1):9-14.
9. Bukshtynov VI. Fauna and ecology of blood-sucking dipterous insects in the south of the Tyumen region. Probl vet sanitation: Tr. VNIIVS. 1966;23:309-19.

10. Mitrokhin VU. Blood-sucking midges (family Simuliide) in the south of the Tyumen region. Vopr vet arachno-entomol Tyumen. 1969;(1):120-7.
11. Mitrokhin VU. Distribution and ecology of midge larvae (family Simuliide) in the water bodies of the Ob and Irtysh, Vopr. Vet arachno-entomol and vet sanitation Tyumen. 1972;4:22-36.
12. Mitrokhin VU. Blood-sucking midges (family Simuliidae) of the northern Trans-Urals [dissertation abstract]. Thesis... Dr. Biol. Sciences. Leningrad; 1974. 38 p.
13. Pavlova RP, Khlyzova TA, Fedorova OA, Cherednikov AI, Latkin SV. Species composition of blood-sucking mosquitoes and midges in the south of the Tyumen region. Russ J Parasitol. 2011;4:41-6.
14. Ishmuratov IN. Diptera blood-sucking insects of the Khanty-Mansiysk national district and features of their attack on fur-bearing animals in cages. Probl vet sanitation: Tr. VNIIVS. T. 1968;31:23-9.
15. Novitskaya SA. To the study of the fauna of the number of blood-sucking midges and the biological rationale for their control in the oil and gas regions of the Tyumen region. In: Problems of the fight against midges. Reports of the workshop of the Central Research Institute; 1969 Mar 11–14; 1970. p. 26–31.
16. Zinovieva OE. About blood-sucking midges (Diptera: Simuliidae) on the territory of the Russian federation. Vet Anim Sci Biotechnol. 2018:60-5.
17. Zavyalov EG. Diptera bloodsucking insects on pastures of the Middle Ob region. In: Materials on veterinary arachno-entomology and veterinary sanitation: proceedings of the scientific conference; 1971; Tyumen. 1971;(3):32–5.
18. Kerbabaev EB, Novitskaya SA, Machavariani NA. New species of midges (Diptera, Simuliidae) of Georgia. The study of midges in the middle Ob region and the larvicidal action of metathion. Mater Fauna Georgia. 1966;(1):193-6.
19. Shchepetkin VA. Blood-sucking dipterans and gadflies of the Yamalo-Nenets autonomous okrug of the Tyumen region and measures to protect reindeer from them [dissertation abstract]; 1974. 26 p.
20. Boldarueva LV. Midges (Diptera, Simuliidae) of the moss-lichen tundra of Yamal. [Useful and harmful insects of Siberia]. Academy of sciences of the USSR SO, BIN. Novosibirsk: Nauka; 1982. p. 180-4.
21. Petrozhitskaya LV. Midges of the northern forest-tundra of Yamal. Ecology and geography of arthropods of Siberia. Novosibirsk: Nauka; 1987. p. 251-3.
22. Mezenev NP, Patrusheva VD. About midges (Diptera, Simuliidae) of the Taimyr National District. Parasitology. 1970;1:74-81.
23. Usova ZV. Fauna of midges of Karelia and the Murmansk region (Diptera, Simuliidae). Moscow-Leningrad: Publishing House of the Academy of Sciences of the USSR; 1961. 286 p.
24. Sharkov AA, Lobkova MP, Usova ZV. Blood-sucking mosquitoes (family Culicidae) and mosquitoes (Simuliidae) of the European north of the USSR. Petrozavodsk; 1984. 151 p.
25. Yankovsky AV. Midges (Diptera, Simuliidae) of the Lapland state biosphere reserve and descriptions of a new species of argentisimulium. Entomol Rev. 2006;83(1):226-34.
26. Ivantsova EA. The influence of environmental factors on populations of dipteran insects of the family. Simuliidae. Results and prospects for the development of the agro-industrial complex: collection of materials of the international scientific and practical conference ; 2020 May 21–22; Solenoe Zaimishche. Solenoe Zaimishche: FGBNU Caspian Agrarian Federal Scientific Center of the Russian Academy of Sciences; 2020. p. 479–82. doi:10.26150/PAFNC.2019.45.557-21-479-482
27. Radzivilovskaya ZA. On the ecology of larvae and pupae of midges (Simuliidae) in the mountain regions of the South Ussuri taiga. Parasitol Sat Zool Inst Acad Sci USSR. 1950;(12):199–204.
28. Bobrova SI. Midges (Simuliidae) of altai: abstract of the thesis. Thesis, Cand Biol Sci Perm; 1967. 20 p.
29. Gusav AA, Guseva OD, Rudinskaya LV. Preliminary results of the study of the zoobenthos of the pre-estuary sections of some rivers of the Kaliningrad region. Samarskaya Luka: Probl Reg Glob Ecol. 2014;23(2):61-71.
30. Budaeva IA, Ruchin AB. To the fauna of midges (Diptera, Simuliidae) of the republic of Mordovia (Russia). Cau Entomol Bull. 2014;10(1):155-9.
31. Fedorova OA, Sivkova EI, Serkova MI. Dynamics of daily activity of various types of blood-sucking midges in the south of the Tyumen region. Bull Russ Agric Sci. 2021;2:64-6. doi:10.30850/vrsn/2021/2/64-66
32. Isimbekov ZM, Madieva KM. Species composition, numerical ratio and landscape confinement of blood-sucking dipterous insects in the southwestern Altai. Bull Altai State Agrar Univ. 2008;6(44):39-43.

33. Denisov AA, Ivantsova EA, Kholodenko AV, Zaliznyak EA. Fauna and distribution of blood-sucking midges of the Simuliidae family on the territory of Russia. Nat Syst Resource. 2018;8(4):38-47. doi:10.15688/nsr.jvolsu.2018.4.5
34. Petrozhitskaya LV. New data on the fauna of midges (Diptera, Simuliidae) of the Southern Altai (East Kazakhstan). Eur Entomol Mag. 2012;11(5):488-92.
35. Taratutina MN, Zubareva OV, Romasova EI, Melnikova GF. On the issue of combating blood-sucking dipterans during the preparation and holding of a mass event in Volgograd. Pop Health Habitat - ZNiSO. 2023;31(1):60-6. doi:10.35627/2219-5238/2023-31-1-60-66
36. Gogolev VB. Blood-sucking Diptera of the Middle Volga region (bioecological features, veterinary significance, protection of farm animals) [dissertation abstract]. Tyumen; 2001. 35 p.
37. Budaeva IA, Silina AE. To the study of the fauna and ecology of midges (Diptera, Simuliidae) of the Belgorod region. In: Modern problems of zoology and parasitology. Materials of the 5th International Scientific Conference “Readings in memory of Prof. I.I. Barabash-Nikiforov”; 2013. p. 20-5.
38. Gorbatkova MA, Bespalova NS. Anaplasmosis of domestic ruminants. Control and prevention measures. Scientific review. Pedagog Sci. 2019;2-4:14-6.
39. Terteryan AE. Midges (family Simuliidae) (Fauna of the Armenian SSR). Yerevan; 1968. 72 p.
40. Rubtsov IA. Midges (family Simuliidae). Fauna of the USSR. Diptera. Vol. 6, no. 6. Moscow-Leningrad: Academy of Sciences of the USSR; 1940. p. 1–535.
41. Dementiev MS. Biodiversity of midges (Simuliidae) of the central Ciscaucasia and adjacent mountainous areas. Parasitology. 2014;4(24):25-8.
42. Khazeeva LA. Freshwater invertebrates of the reservoirs of the Urukh River in the territory of the national park “Alania” (Basin of the Terek River). In: Problems of water entomology in Russia and neighboring countries; 2016. p. 184–95.
43. Vorobets EI. Midges (Diptera, Simuliidae) of the plains and foothills of Yakutia [dissertation abstract]. Novosibirsk; 1979. 21 p.
44. Aibulatov SV, Baryshev IA. On the fauna of midges (Diptera, Simuliidae) of Karelia and the Murmansk region. In: Problems of entomology in Russia and neighboring countries; 2016. p. 8-12.
45. Barashkova AI. Blood-sucking dipterous insects (Insecta, Diptera: Tabanidae, Culucidae, Simuliidae) of the Agrocenoses of Yakutia [dissertation]. Yakutsk; 2016. 256 p.
46. Vlasov SV. Fauna and ecology of midges (Diptera, Simuliidae) of the Moscow region [PhD dissertation]. Moscow; 1997. 20 p.
47. Burova OA, Zakharova OI, Toropova NN. The effectiveness of methods for catching insects - vectors-carriers of vector-borne animal diseases and their species composition. Agrar Sci Euro-North-East. 2021;22(5):761-9. doi:10.30766/2072-9081.2021.22.5.761-769
48. Krutko KS, Kinareikina AG, Serkova MI. Identification of genetic material of pathogens of viral animal diseases in blood-sucking dipteran insects of the Tyumen region. Russ J Parasitol. 2022;16(4):389-402. doi:10.31016/1998-8435-2022-16-4-389-402
49. Palatov DM. New data on the fauna of freshwater invertebrates of Kunashir Island. Read Mem Vlad. 2014;(6):509-22.
50. Patrusheva VD, Polyakov PE. On the fauna and ecology of Yakovlevich Levanilov midges in the Lower Ob region. Izv Sib Otd Acad Sci USSR. 1965;1(4):143-5.
51. Patrusheva VD. Blood-sucking midges of the Ob region. Results of the study on the problem of combating midges. Novosibirsk; 1967. p. 103-9.
52. Patrusheva VD. About midges (Diptera, Simuliidae) of south Yamal. Parasitology. 1974;2:138-46.
53. Patrusheva VD, Korshunov YP, Shchepetkin VA. To the fauna of midges (Diptera, Simuliidae) of the Polar Urals. Fauna of helminths and arthropods of Siberia. Novosibirsk; 1976. p. 291-300.
54. Patrusheva VD. New species of midges of the genus MetacnephiaGrasskey (Diptera, Simuliidae) from Yamal and Taimyr. News of the fauna of Siberia. Novosibirsk; 1976a. p. 162-7.
55. Patrusheva VD. On the morphology and systematic position of Schonbaueriadendrofila (Diptera, Simuliidae) (Patr.). Taxons of the fauna of Siberia. Novosibirsk; 1976b. p. 160-4.
56. Petrozhitskaya LV. Comparative analysis of the species composition and activity of midges in the Todzha basin of Tuva. Blood-sucking diptera and their control. Leningrad: ZIN AN SSSR; 1987. p. 107-10.

57. Petrozhitskaya LV, Rodkina VI, Zaika VV. Species diversity and community structure of midges (Diptera, Simuliidae) in the watercourses of the central and southern regions of Tuva. In: Natural conditions, history and culture of western Mongolia and adjacent regions: proceedings of the VII international conference, Kyzyl. Kyzyl: TuviKOPR SO RAN; 2005. p. 231–5.
58. Petrozhitskaya LV. Spatial and typological characteristics of midge communities (Diptera, Simuliidae) of eastern Tuva. Eurasian Entomol Mag. 2013;12(5):506-14.
59. Potapov AA, Bogdanova EN, Vladimirova VV. Fauna, seasonal and daily course of activity of blood-sucking dipterous insects in the Udora region of the Komi ASSR. Med Parasitol. 1972;41(1):21-5.
60. Khumala AE, Field AV. To the insect fauna of the south-east of Karelia. Tr. Karelian scientific. Cent Russ Acad Sci. 2009;4:53-75.
61. Panchenko AA. Midges (Díptera, Simuliidae) of the basin of the small river Karatysh (Ukraine). In: Mat. I Vseros. Confer. by blood-sucking insects. St. Petersburg; 2006. p. 154–6.
62. Popov VM. Blod-sucking ticks and insects of popov V.M. blood-sucking ticks and insects of western Siberia and their significance in the epidemiology of diseases with natural focality. Issues of regional pathology, phytoncides and the production of bacterial preparations. Tomsk; 1953. p. 45-61.
63. Dariychuk ZS. On the fauna and ecology of midges (Simuliidae) of the upper Lena River basin. Results of the ISSL. On probl. Fight against the midge. Novosibirsk: Nauka; 1967. p. 110-3.