Revision of blood-sucking mosquitoes’ fauna (Diptera: Culicidae) of Tyumen and Kurgan regions

T A Khlyzova

Tobolsk Complex Scientific Station of the Ural Branch of the Russian Academy of Sciences, 15, Acad. Yu. Osipova St, Tobolsk, 626152, Russia

E-mail: labdezinekcii@mail.ru

Abstract. As a result of the studies carried out in 2004–2020, the faunistic lists of blood-sucking mosquitoes were replenished in the south of Tyumen region with 7 new species for the region (Aedes rossicus Dolbeskin, Gorickaja et Mitrofanova, 1930, A. albescens (Edwards, 1921), A. subdiversus (Martini, 1926), A. implicatus (Vockeroth, 1954), A. mercurator (Dyar, 1920), Culiseta longiareolata (Macquart, 1838), C. ochroptera (Peus, 1935)), Yamalo-Nenets Autonomous Okrug 2 species (Aedes nigrinus (Eckstein, 1918), A. behningi (Martini, 1926)), Kurgan region - 2 species (Aedes pionips (Dyar, 1919), Culiseta bergrothi (Edwards, 1921)).

1. Introduction

In the world fauna, blood-sucking mosquitoes (Diptera: Culicidae) are represented by 3583 species [1], of which 106 species are found on the territory of the Russian Federation, according to P M Gornostaeva [2]. In the list given by the author, 4 species of mosquitoes (Aedes churchillensis Ellis et Brust, 1973, Culex pusillus Macquart, 1850, Culex martini Medschid, 1930, Culiseta fumipennis (Stephens, 1825)) mentioned in the works of N V Nikolaeva [3] and N V Nikolaeva and A V Gilev [4] for the Yamalo-Nenets Autonomous Okrug, Sverdlovsk, Orenburg and Kurgan regions. Taking into account these data, at present, the fauna of mosquitoes in Russia numbers at least 110 species. The most complete lists of blood-sucking mosquitoes fauna in Western Siberia and the Urals are in the works of L P Kukharchuk [5, 6], N V Nikolaeva [3], L S Nekrasova et al. [7], N V Redkina [8]. According to these authors, there are 46 species of the Culicidae family on the territory of Western Siberia, and 54 species in the regions of the Ural Federal District.

2. Material and research methods

Our own research was carried out in the south of the Tyumen region (Nizhnetavdinsky, Yalutorovsky, Tyumensky, Isetsky, Ishimsky, Tobolsky, Berdyuzhsky, Kazansky districts), in the Yamalo-Nenets Autonomous Okrug (Yamal, Tazovsky and Priuralsky districts) and in the Kurgan region (Kargapolsky district) in 2004 –2020 years. The Tyumen region has a complex system of administrative-territorial division: it includes the Yamalo-Nenets Autonomous Okrug (YaNAO), the Khanty-Mansiysk Autonomous Okrug (KhMAO) and the Tyumen region itself. To avoid confusion, the territory of the region without districts in this work we call the south of the Tyumen region. To collect the imago of blood-sucking mosquitoes, we used trapping with test tubes “on oneself” and an entomological net with removable bags [9]. In total, during the research period, 117864 female mosquitoes were captured and identified. When establishing the species composition, the identification tables of A V Gutsevich et al.
[10] and L P Kukharchuk [5] were used. Since the release of these keys, significant changes have taken place in the system of the Culicidae family; up to the present, the taxonomic composition of the genus Aedes Meigen, 1818 is the subject of scientific discussions. The given faunistic list of blood-sucking mosquitoes is compiled in accordance with the list of valid species names [1] and the system of the tribe Aedini proposed by R C Wilkerson et al. [11].

3. Results and discussion
South of the Tyumen region. Literary data on of blood-sucking mosquitoes’ fauna in the region are rather limited. As a result of L P Kukharchuk [12] studies in the north of the region near the border with the Khanty-Mansiysk Autonomous Okrug, 18 species were recorded (table 1).

Table 1. Blood-sucking mosquitoes species composition in Tyumen and Kurgan regions.

| Species | Region                                      |
|---------|---------------------------------------------|
|         | the south of the Tyumen region | Khanty-Mansiysk Autonomous Okrug | Yamalo-Nenets Autonomous Okrug | Kurgan region |
| Anopheles Meigen, 1818 |                       |
| A. messae Falleroni, 1926 | +     | +      | -  | +      |
| A. beklemishevi Stegni et Kabanova, 1976 | +     | +      | +  | +      |
| Aedes Meigen, 1818 |                       |
| A. cinereus Meigen, 1818 | +     | +      | +  | +      |
| A. rossicus Dolbeskin, Gorickaja et Mitrofanova, 1930 | +     | +      | -  | +      |
| A. vexans (Meigen, 1830) | +     | +      | -  | +      |
| A. communis (De Geer, 1776) | +     | +      | +  | +      |
| A. dorsalis (Meigen, 1830) | +     | +      | +  | +      |
| A. albescens (Edwards, 1921) | +     | -      | -  | -      |
| A. subdiversus (Martini, 1926) | +     | -      | -  | +      |
| A. alektorovi (Stackelberg, 1943) | -     | -      | -  | +      |
| A. behningi (Martini, 1926) | +     | +      | +  | +      |
| A. cantans (Meigen, 1818) | +     | +      | +  | +      |
| A. caspius (Pallas, 1771) | +     | +      | -  | +      |
| A. cataphylla (Dyar, 1916) | +     | +      | +  | +      |
| A. cyrius Ludlow, 1920 | +     | +      | +  | +      |
| A. detritus (Haliday, 1833) | -     | -      | -  | +      |
| A. diantaeus (Howard, Dyar et Knab, 1913) | +     | +      | +  | +      |
| A. euedes Howard, Dyar et Knab, 1913 | +     | +      | +  | +      |
| A. excrucians (Walker, 1856) | +     | +      | +  | +      |
| A. flavescens (Muller, 1764) | +     | +      | +  | +      |
| A. hexodontus (Dyar, 1916) | +     | +      | +  | +      |
| A. impiger (Walker, 1848) | +     | +      | +  | -      |
| A. implicatus (Vockereth, 1954) | +     | +      | +  | -      |
| A. intrudens (Dyar, 1919) | +     | +      | +  | +      |
| A. leucomelas (Meigen, 1804) | +     | +      | -  | +      |
### Blood-Sucking Mosquitoes of the Tyumen Region

| Number | Species                                      | Information                                                                                   |
|--------|---------------------------------------------|----------------------------------------------------------------------------------------------|
| 26     | *A. mercurator* (Dyar, 1920)                | + - - +                                                                                      |
| 27     | *A. nigrinus* (Eckstein, 1918)              | + + + -                                                                                      |
| 28     | *A. nigripes* (Zetterstedt, 1838)           | - + + -                                                                                      |
| 29     | *A. pionips* (Dyar, 1919)                   | + + + +                                                                                      |
| 30     | *A. pullatus* (Coquillet, 1904)             | + + + -                                                                                      |
| 31     | *A. punctor* (Kirby, 1837)                  | + + + +                                                                                      |
| 32     | *A. punctodes* (Dyar, 1922)                 | - - + -                                                                                      |
| 33     | *A. riparius* (Dyar et Knab, 1907)          | + + + +                                                                                      |
| 34     | *A. sticticus* (Meigen, 1838)               | + + - +                                                                                      |
| 35     | *A. stramineus* Dubitzyk, 1970              | - - - +                                                                                      |
| 36     | *A. churchillensis* Ellis et Brust, 1973     | - - + +                                                                                      |
| 37     | *C. modestus* Ficalbi, 1890                 | + + + -                                                                                      |
| 38     | *C. pipiens* Linnaeus, 1758                 | + + + +                                                                                      |
| 39     | *C. vagans* Wiedemann, 1828                 | + - - +                                                                                      |
| 40     | *C. territans* Walker, 1856                 | + - - +                                                                                      |
| 41     | *C. pusillus* Macquart, 1850                | - - - +                                                                                      |
| 42     | *C. longiareolata* (Macquart, 1838)         | + - - +                                                                                      |
| 43     | *C. morsitans* (Theobald, 1901)             | + + - -                                                                                      |
| 44     | *C. ochroptera* (Peus, 1935)                | + - - +                                                                                      |
| 45     | *C. alaskaensis* (Ludlow, 1906)             | + + + +                                                                                      |
| 46     | *C. bergrothi* (Edwards, 1921)              | + + - +                                                                                      |
| 47     | *C. fumipennis* Stephens, 1825              | - - - +                                                                                      |
| 48     | *C. richiardii* (Ficalbi, 1889)             | + + + +                                                                                      |
|        | **Total number of species:**                | **40 34 27 39**                                                                               |

**Notes:**

- In the same year, in the south of the region, V I Bukshtynov [13] identified 17 species, indicating in addition to those found by L P Kukharchuk 6 more species (*Anopheles maculipennis* Meigen, 1818, *A. dorsalis*, *A. euedes*, *C. modestus*, *C. pipiens*, *C. alaskaensis*). V V Popov and V I Taranov [14] provide data on the habitation of 30 species of mosquitoes in the south of the region, while adding 8 species to the faunistic list of the region (*A. behningi*, *A. impiger*, *A. nigrinus*, *A. sticticus*, *C. vagans*, *C. territans*, *C. bergrothi*, *C. morsitans*). As a result of cytogenetic studies of *A. maculipennis* [15], it was established that this species does not occur in the Asian part of Russia; all previous indications of *A. maculipennis* should be attributed to *A. beklemishevi*. In this regard, all the data on *A. maculipennis* from the regions located to the east of the Urals, including from the south of the Tyumen Region, mentioned in the literature, were assigned by us to *A. beklemishevi*. Thus, according to the literature, the region’s blood-sucking mosquitoes are represented by 32 species.

- In the course of our own research in the south of the Tyumen region, we found 32 species of blood-sucking mosquitoes, of which 7 are indicated for the region for the first time:

  - *A. albescens*, recorded in the Berdyuzhsky and Kazan districts of the Tyumen region. Previously, this species was registered in the Southern Urals, in Siberia - in the south of the
Tomsk, Omsk and Novosibirsk regions, as well as in the Kostanay region of the Republic of Kazakhstan.

- **A. subdiversus**, recorded in the Berdyuzhsky and Kazan districts of the Tyumen region. Previously, this species was registered in the European part of Russia, in the Southern Urals, in the Southern Trans-Urals, and in Siberia - in the Omsk, Novosibirsk, Tomsk and Kemerovo regions.

- **A. implicatus**, recorded in the Tobolsk district of the Tyumen region. Previously, this species was registered in the Yamalo-Nenets Autonomous Okrug, Khabarovsk Autonomous Okrug, Buryatia, Trans-Baikal and Khabarovsk Territories.

- **A. rossicus**, recorded in Nizhnetavdinskiy, Yalutorovskiy, Tyumenskiy and Isetskiy districts. Previously, this species was registered in the European part of Russia, in the Urals, in northern Kazakhstan, in Primorye, in Siberia - in the Khanty-Mansi Autonomous Okrug, Omsk, Tomsk and Novosibirsk regions.

- **A. mercurator**, recorded in Nizhnetavdinskiy, Yalutorovskiy, Tyumenskiy and Isetskiy districts. Previously, this species was registered in the European part of Russia, in the Urals and in the Southern Trans-Urals, in the Far East, in the south of Western Siberia (Novosibirsk region).

- **C. longiareolata**, recorded in Nizhnetavdinskiy, Yalutorovskiy and Tyumenskiy districts. Previously, this species was registered in the European part of Russia, in the Urals, in the Southern Trans-Urals, in the south of Western Siberia - in the Tomsk and Omsk regions, in Altai.

- **C. ochroptera**, recorded in the Nizhnetavdinsky region. Previously, this species was registered in the north of the European part of Russia, in the Urals, in the south of Western Siberia (Omsk, Tomsk and Novosibirsk regions) and in the Amur region.

According to literature data and materials of our research, the fauna of blood-sucking mosquitoes in the south of the Tyumen region is currently represented by 40 species. At present times, there are shifts in many insect species ranges boundaries, including blood-sucking dipterans. The registration of new species of blood-sucking mosquitoes for the region is due to a change in their habitats, which expand not only in the north, but also in the west.

Khanty-Mansiysk Autonomous Okrug. The first information about the district's mosquitoes is contained in the work of L V Popov [16], as a result of research by this author, 10 species were identified on the territory of the region. Further study of mosquitoes in the district was continued only in the 60s of the XX century, during the period of active development of new oil and gas regions. O N Vinogradskaya and A A Odinets [17] in 1965 in water bodies of Bely Yar village noted the development of preimaginal phases of 7 mosquito species, of which 4 were indicated for the first time in the Khanty-Mansiysk Autonomous Okrug: A. hexodontus, A. punctor, A. impiger, A. nigrinus. In the vicinity of Oktyabrskoye village, P E Polyakova [18] found in addition to the previously known 2 species - A. communis and A. intrudens. I N Ishmuratov [19] found 20 species of blood-sucking mosquitoes on the territory of Okrug, adding 7 species to the faunal list of the region (A. vexans, A. flavescens, A. nigripes, A. diantaeus, A. euedes, A. pullatus, C. ppiens). I N Pustovalov [20] registered the habitation of 16 species in the Khanty-Mansiysk region, while 5 species were new to the district: A. pionips, A. caspius, A. behningi, C. modestus, C. bergrothi. As a result of research carried out by R M Ermakova [21], two more species were added to the faunal list - A. rossicus and A. sticticus. In the Nizhnevartovsk region, L P Kukharchuk [6] registered 21 species of mosquitoes, of which 3 were new to the region - A. messeae, C. richiardii and A. leucomelas.

After publication of L P Kukharchuk works [5, 6], devoted to mosquitoes of Siberia and the Far East, there was a long break in the study of the Culicidae of this Okrug. In 2006, the results of research by N V Nikolaeva and A V Gilev [4], thanks to which it became known about the finds on the territory of the district A. implicatus. Thus, according to literature data, the blood-sucking mosquitoes of the Khanty-Mansiysk Autonomous Okrug are represented by 34 species. Until now, the fauna of mosquitoes in this Okrug, especially in its northern part, remains insufficiently studied.
Yamalo-Nenets Autonomous Okrug. The study of mosquitoes in the district was started by E F Kiseleva [22], as a result of her studies, 6 species were identified for the Taz Bay (Cape Povorotny). Further research of this group of insects on the territory of the district was continued in the 70s of the XX century. P E Polyakova [23, 24] found 17 mosquito species on the territory of the Yamalo-Nenets Autonomous Okrug, of which 14 (A. punctor, A. communis, A. hexodontus, A. pionips, A. pullatus, A. intrudens, A. dianaeus, A. impiger, A. cataphylla, A. cantans, A. flavescens, A. riparius, C. alaskaensis, C. richardi) were reported for the first time. As a result of research carried out by V A Shchepetkin [25, 26], one more species (A. nigripes) was added to the faunistic list of mosquitoes in the district. When studying the ecology of development preimaginal phases of blood-sucking mosquitoes in the Southern Yamal, N V Nikolaeva [27], in addition to species already known for the region, found larvae of Aedes euedes. Much later N V Nikolaeva and A V Gilev [4] in the course of research in the southern Yamal, registered 3 species not indicated by other researchers: A. churchillensis, A. punctodes, A. implicatus. According to the literature, the district's mosquito fauna is represented by 25 species.

As a result of our research, carried out in the tundra and forest-tundra zones of the district, 14 species of mosquito were registered, of which 2 were indicated for the region for the first time:

- A. nigrinus, recorded in the Yamal and Taz districts. Previously, this species was known in the European part of Russia, in the Urals, in Siberia - in the Tomsk, Novosibirsk regions, Khanty-Mansi Autonomous Okrug and the south of the Tyumen region.
- A. behningi, recorded in the Priuralsky district. The species is widespread and was previously known in the European part of Russia, in the Urals, in Siberia, in the north of the Republic of Kazakhstan. On the territory of Western Siberia, there is information about the finds of this species in the Tomsk and Novosibirsk regions, the Khanty-Mansi Autonomous Okrug and in the south of the Tyumen region.

Thus, at present, 27 species of mosquitoes are known to inhabit the territory of the Yamalo-Nenets Autonomous Okrug. At the same time, the mosquito fauna of the mainland and southern Yamal has been most fully studied, and the territories of the Yamal and Gydansky peninsulas remain practically unexplored.

In the northern regions of the Tyumen region, Khanty-Mansiysk Autonomous Okrug and Yamalo-Nenets Autonomous Okrug, 36 species live, of which 3 species (A. punctodes, A. nigripes, A. churchillensis) have not yet been found in the south of the region. Taking into account the species composition of mosquitoes in all three administrative entities of the Tyumen region, the faunistic list of mosquitoes in this region includes 43 species.

Kurgan region. On the territory of the region, the study of blood-sucking mosquitoes was started by V P Biryukov [28], as a result of research by this author, the habitat of A. maculipennis was established (as indicated above, according to modern data, the indications of this species for the Asian part of Russia are attributed to A. beklemishevi). Later, the study of mosquitoes was continued by Yu M Kolosov [29], who noted 6 more species for the region: A. cinereus, A. caspius, A. cataphylla, A. cyprius, C. pipiens, C. alaskaensis. G E Loginovskiy [30] supplemented the faunistic list of mosquitoes in the region with 4 more species: A. flavescens, A. excrucians, A. riparius, C. richardi. In 1977 A V Novikova [31] established the habitat of A. vexans in the region. N V Nikolaeva [3] in the summary of mosquitoes of the Ural Federal District indicates 33 species for the Kurgan region. L S Nekrasova et al. [32] supplemented the existing list with 4 new species for the region: A. intrudens, A. hexodontus, A. dianaeus and A. sticticus.

As a result of our own research carried out on the territory of the region, we registered 10 species of mosquitoes, of which 2 - C. bergrothi and A. pionips - were not indicated in the materials of previous researchers. Previously, they were known for other regions of the Urals and Western Siberia (the Republic of Komi and Bashkortostan, the Perm Territory, the Khanty-Mansi Autonomous Okrug, the south of the Tyumen, Orenburg, Chelyabinsk, Tomsk, Omsk and Novosibirsk regions). Currently, 39 species of blood-sucking mosquitoes are known for the region.
4. Conclusion
As a result of the studies carried out, the faunistic list of blood-sucking mosquitoes in the south of the Tyumen region was replenished with 7 new species for the region, 2 species in the Yamalo-Nenets Autonomous Okrug and 2 species in the Kurgan region. Analysis of literature data and materials of our own research showed that the Culicidae family in the Tyumen and Kurgan regions is represented by 48 species, of which 40 are found in the south of the Tyumen region, 34 - on the territory of the Khanty-Mansiysk Autonomous Okrug, 27 - on the territory of the Yamalo-Nenets Autonomous Okrug, 39 - in the Kurgan region.

Acknowledgements
The article was prepared with financial support from the Ministry of Science and Higher Education of the Russian Federation under the theme of Research, Development and Technological Work (NIOKTR) "Biodiversity of wetland ecosystems of the South of Western Siberia" (AAAA-A19-119011190112-5).

References
[1] Harbach R E 2021 Mosquito Taxonomic Inventory (edited on 05 February 2021) Retrieved from: http://mosquito-taxonomic-inventory.info/
[2] Gornostaeva R M 2009 New list of mosquitoes (Diptera: Culicidae) in Russia Medical parasitology and parasitic diseases 1 60-2
[3] Nikolaeva N V 2002 Revision of the fauna of blood-sucking mosquitoes (Diptera, Culicidae) of the Ural Federal District and adjacent territories of the Urals. In the book: Biodiversity and Biological Resources of the Urals and Adjacent Territories (Materials of the II International Conference. Orenburg: Publishing house of the OGPU, December 17-18, 2002) 177-9
[4] Nikolaeva N V and Gilev A V 2006 Ecological and epidemiological assessment of the biodiversity of blood-sucking mosquitoes (Diptera, Culicidae) in the Urals and Western Siberia. In the book: Entomological Research in North Asia (Materials of the 7th Interregional Meeting of Entomologists of Siberia and the Far East in the Framework of the Siberian Zoological Conference, Novosibirsk, September 20-24 2006) 411-3
[5] Kukharchuk L P 1980 Blood-Sucking Mosquitoes (Diptera, Culicidae) of Siberia. Systematics (Novosibirsk: Science) p 220
[6] Kukharchuk L P 1981 Ecology of Blood-Sucking Mosquitoes (Diptera, Culicidae) in Siberia (Novosibirsk: Science) p 232
[7] Nekrasova L S, Vigorov Yu L and Vigorov A Yu 2008 Ecological diversity of Blood-Sucking Mosquitoes in the Urals (Yekaterinburg: Ural Branch of the Russian Academy of Sciences) p 208
[8] Redkina N V 2008 Blood-Sucking Mosquitoes (Diptera, Culicidae) of Anthropogenic Territories in the Southeast of Western Siberia on the Example of the Cities of Tomsk and Stresevoy (Tomsk: Author’s abstract. Ph. D. Biology) p 20
[9] Rasnitsyn S P and Kosovskykh V P 1979 An improved method for recording the abundance of mosquitoes with a butterfly net around a person and comparing it with a dark bell Medical parasitology and parasitic diseases 1 18-24
[10] Gusievtch A V, Monchadskiy A S and Shtakelberg A A 1970 Fauna of the USSR. Diptera Insects 3(4) (Mosquitoes. Family Culicidae. L.: Science) 384
[11] Wilkerson R C, Linton Y-M, Fonseca D M, Schultz T R, Price D C and Strickman D A 2015 Making mosquito taxonomy Useful: A stable classification of tribe Aedini that balances utility with current knowledge of evolutionary relationships PLoS One 10(7) 1-26 Doi: 10.1371 /journal.pone.0133602
[12] Kukharchuk L P 1966 Blood-Sucking Mosquitoes (Culiciniae) of the Ob Region. In the book: Biological Bases of the Fight Against Gnat in the Ob Basin (Novosibirsk: Science) 9–52
[13] Bukshtynov V I 1966 Fauna and Ecology of Blood-Sucking Dipterans in the South of the Tyumen Region. In the book: Problems of Veterinary Sanitation: Works of RSRIFER vol 23 (Moscow:
Rosglavpoligrafprom Press Committee under the Council of Ministers of the RSFSR) 309-10
[14] Popov V V and Taranov V I 1969 To the fauna of blood-sucking mosquitoes (Diptera, Kulitsin) of the Tyumen region. In the book: Questions of Regional Infectious Pathology (Materials of the Scientific-Practical Conference Dedicated to the 30th Anniversary of the Teachings of Academician E N Pavlovsky, Tyumen) 47-9
[15] Stegny V N and Kabanova V M 1976 Cytoecological study of natural populations of the malaria mosquito on the territory of the USSR. Communication 1. Isolation of a new Anopheles species in the maculipennis complex by the method of cytodiagnostics Medical parasitology and parasitic diseases 2 192-8
[16] Popov L V 1932 Materials for the insect fauna of the Tobolsk north. In the book: Works of the Entomological Department of the Parasitological Department of the Sverdlovsk Sanitary-Bacteriological Institute is 1 (Sverdlovsk) 21-4
[17] Vinogradskaya O N and Odinets A A 1970 On the fauna and biology of blood-sucking mosquitoes in the vicinity of the village of Bely Yar, Tyumen region according to observations in 1965. Communication 1. Biology of aquatic stages Medical parasitology and parasitic diseases 3 329-34
[18] Polyakova P E 1968 Blood-sucking mosquitoes (Diptera, Culicinae) of the northern taiga subzones of the Ob and Yenisei Proceedings of the Siberian Branch of the USSR Academy of Sciences 10(2) 108-13
[19] Ishumuratov I N 1968 Diptera Insects of the Khanty-Mansiysk National Okrug and the Peculiarities of their Attack on Fur-Bearing Animals in Cages. In the book: Problems of Veterinary Sanitation: Works of RSRIFER vol 31 (Moscow: Rosglavpoligrafprom of the Press Committee under the Council of Ministers of the RSFSR) 23-9
[20] Pustovalov I N 1969 To the fauna of blood-sucking mosquitoes (Diptera, Kulitsine) of the Khanty-Mansiysk National Okrug. In the book: Questions of Regional Infectious Pathology (Materials of the Scientific-Practical Conference Dedicated to the 30th Anniversary of the Teachings of Academician E N Pavlovsky, Tyumen) 50-1
[21] Ermakova R M 1972 Mosquitoes (Fauna And Ecology) of Oil and Gas Producing Regions of the Tyumen Region and Ecological Substantiation of Measures to Combat Them (Moscow: Author’s abstract. Ph. D, Biology) p 16
[22] Kiseleva E F 1927 Towards the fauna of mosquitoes in the Taz Bay Russian Hydrobiological Journal 6 11-2
[23] Polyakova P E 1970 Materials on the fauna of blood-sucking mosquitoes (Diptera, Culicinae) in the North of Siberia. In the book: Fauna of Siberia: Collection of BIN RSA SSSR (Novosibirsk: Science) 132-7
[24] Polyakova P E 1973 To the fauna of blood-sucking mosquitoes (Diptera, Culicidae) of the North of Siberia. In the book: Results of Research Into the Wildlife of Siberia: Works of the Biological Institute (Novosibirsk: Science) 151-63
[25] Shchepetkin V A 1972 Mosquitoes (Diptera, Kulitsine) of the Yamalo-Nenets National District. In the book: Works Proceedings of the Research Institute of Agriculture of the Northern Trans-Urals is 4 (Questions of Veterinary Arachnoentomology and Veterinary Sanitation, Tyumen) 37-44
[26] Shchepetkin V A 1974 Blood-Sucking Dipterans and Gadflies of the Yamalo-Nenets National District of the Tyumen Region and Measures to Protect Reindeer from Them (Moscow: Author’s abstract. Ph. D, vet. Sciences) p 26
[27] Nikolaeva N V 1980 Ecology of the Larvae of Blood-Sucking Mosquitoes in South Yamal (Sverdlovsk: Preprint) p 66
[28] Biryukov V P 1926 Nature and Population of the Shadrinsky District of the Ural Region (Shadrinsk: Kommunotrest printing house) p 338
[29] Kolosos Yu M 1936 Catalog of Diptera of the Middle Urals (Sverdlovsk) p 27
[30] Loginovskiy G E 1974 Blood-sucking mosquitoes (Diptera, Culicinae) of the Kurgan region. In
the book: *Issues of Entomology of Siberia* (Novosibirsk: Science) 148-9

[31] Novikova A V 1977 *Faunistic Components of Natural Foci of Tularemia in the Kurgan Region (Materials of Landscape-Epidemiological Zoning)* (Sverdlovsk: Author’s abstract. Ph. D. Biology) p 25

[32] Nekrasova L S, Vigorov Yu L, Zakharova E Yu and Chibiryak M V 2016 Blood-sucking mosquitoes (Diptera, Culicidae) of the Kurgan region *Fauna of the Urals and Siberia* 1 75-87