Species composition and distribution of blood-sucking Diptera insects of the Tyumen region

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Abstract. As a result of the analysis of literature data and materials from many years of our research, 108 species and 1 subspecies of blood-sucking dipterous insects were found to live in the Tyumen region. The horsefly fauna consists of 35 species and 1 subspecies belonging to 6 genera, blood-sucking mosquitoes are represented by 40 species of 5 genera, blood-sucking midges - 16 species of 10 genera, blood-sucking biting midges - 17 species of the 1st genus. The greatest species diversity is characteristic of the subzone of small-leaved aspen-birch forests, where 95 species and 1 subspecies are found. To date, the fauna of dipterans subzones of the middle taiga remains poorly studied. The group of dominants in the southern taiga is represented by horseflies H. ciureai, H. bimaculata, H. muehlfeldi and H. pluvialis, mosquitoes A. cantans, midges B. maculatus and S. pusilla, woodlice C. punctatus. In the subzone of small-leaved aspen-birch forests, horseflies T. bromius, A. fulvus, A. rusticus, H. ciureai, H. bimaculata, H. pluvialis and H. subcylindrica, mosquitoes A. cinereus and A. cantans, midges B. maculatus and S. pusilla, woodlice C. punctatus. The dominant species in the forest-steppe zone are horseflies T. bromius, T. bovinus, H. ciureai, H. bimaculata, H. pluvialis and H. subcylindrica, mosquitoes A. punctor and A. cantans, midges B. maculatus, S. pusilla and B. erythrocephala, woodlice C. punctatus.

1. Introduction
The territory of the Tyumen region is located in the West Siberian lowland and has a fairly branched river system, there is also a large area of lakes and marshes of various types. In the spring, as a result of melting snow and floods, a significant number of temporary water bodies are formed on the rivers [1]. All these conditions are favourable for the development of blood-sucking Diptera insects - horseflies, mosquitoes, midges and woodlice.

The study of blood-sucking insects in the region was carried out mainly in the 60-70s of the last century when the development of new oil-gas regions began. At the same time, studies were conducted to study the fauna and ecology of the blood-sucking dipters of the Tyumen region [2-5]. Later, at the end of the 20th and beginning of the 21st centuries, work was carried out to study and introduce new means and methods of protecting cattle from attack by parasitic insects, which to some extent touched upon the issues of the Diptera fauna.
Currently, there are processes of climate change on the planet that is taking place on the territory of Russia more intensively than in many other countries of the world [6]. In this regard, the conditions for the existence of insects are changing, the habitats to the north are expanding. These factors, combined with an increase in the probability of import of pathogens of dangerous exotic diseases to the territory of the country (an increase in the volume of population migration, the purchase of imported livestock), indicate the need for systematic monitoring of the species composition and ecology of blood-sucking Diptera insects that can participate in the spread of human and animal diseases.

2. Material and research methods

In natural terms, the south of the Tyumen region is divided into two landscape and geographical zones: forest with subzones of the middle taiga, southern taiga and small-leaved aspen-birch forests and forest-steppe [1]. For the fauna of blood-sucking Diptera insects, only literature data are provided; for the remaining 3 climatic subzones, there are also materials of our long-term studies (2004-2019).

The collection of horsefly imagos was carried out both permanently on the same pasture systematically once every 5-7 days during the summer period, and once on different pastures using Yule traps [7-8] and a standard entomological net.

For collecting mosquitoes, midges and woodlice, we used "on-site" test-tube trapping and an entomological net with removable pouches [9].

Identification of the species of horseflies was carried out according to the defining tables of N.G. Olsufiev [10]. When determining the species composition of mosquitoes, we used defining tables of L.P. Kukharchuk [11], midges - defining tables of V.D. Patrusheva [12] and A.V. Yankovsky [13], woodlice - A.G. Mirzaeva [14]. The dominance index (ID, %) was used for quantitative characterization of species [15]. To establish the degree of relative abundance of horsefly species the scale of K. V. Skuf'in was used [16], mosquitoes - the scale of F.A. Skripchenko [17], midges and woodlice - the scale of Engelmann H.-D. [18].

3. Research results

As a result of a synthesis of literature data and long-term data of our studies of the species composition of blood-sucking dipters, it was found that 108 species and 1 subspecies of these insects live in the south of the Tyumen region (table 1).

Horsefly fauna (family Tabanidae) has 35 species and 1 subspecies belonging to 6 genera: *Chrisops* Mg., *Tabanus* L., *Atylotus* O.-S., *Hybomitra* End., *Heptatoma* Mg. and *Haematopota* Mg. By the degree of abundance in all natural zones where our studies were carried out, the background species are *Hybomitra ciureai*, *H. bimaculata*, *Haematopota pluvialis*, in addition, in the southern taiga - *H. muehlfeldi*, birch forests - *Tabanus bromius*, *Atylotus fulvus*, *A. rusticus*, *Haematopota subcylindrica* and in the forest-steppe - *T. bromius*, *T. bovinus*, *subcylindrica*.

Blood-sucking mosquitoes (family Culicidae) is represented by 40 species of 5 genera: *Anopheles* Mg., *Culiseta* Felt., *Coquillettidia* Dyar, *Aedes* Mg., *Culex* L. In all climatic zones, e dominates Aspen-birch forests, the dominant group also includes *Aedes cinereus*, and in the forest-steppe zone - *Aedes punctor*.

Fauna of blood-sucking midges (family Simuliidae) is represented by 16 species of 10 genera: *Byssodon* End., *Cneta* End., *Nevermannia* End., *Eusimulium* Roub., *Schoenbaueria* End., *Boophthora* End., *Odagmia* End., *Argentisimulium* Rub. et Yank., *Simulium* Latr. According to the degree of species abundance, *Byssodon maculatus* prevails in the southern taiga subzone, *Schoenbaueria pusilla*, in the forest-steppe zone prevails in the subzone of aspen-birch forests, 3 dominant species are represented: *Boophthora erythrocephala*, *Byssodon maculatus*, *Schoenbaueria pusilla*.

Blood-sucking woodlice (family Ceratopogonidae) are represented by 17 species of the same genus *Culicoides*. Dominates in all climatic zones of the region *Culicoides punctatus*. 
### Table 1. Species composition and distribution of blood-sucking Diptera insects of the Tyumen region.

| #     | Species                                | Family Tabanidae | Middle taiga | Southern taiga | Small-leaved aspen-birch forests | Forest-steppe zone |
|-------|----------------------------------------|-------------------|--------------|----------------|----------------------------------|-------------------|
| 1     | *Chrysops sepulcralis* (Fabricius, 1794) |                   | -            | x              | x                                | -                 |
| 2     | *Chrysops nigripes* Zetterstedt, 1840   |                   | -            | x              | x                                | -                 |
| 3     | *Culiseta morsitans* Meigen, 1820      |                   | -            | x              | x                                | -                 |
| 4     | *Culiseta caecutiens* Linnaeus, 1758   |                   | -            | x              | x                                | x                 |
| 5     | *Culiseta pictus* Meigen, 1820         |                   | -            | +              | +                                | +                 |
| 6     | *Culiseta ochroptera* Meigen, 1820     |                   | -            | x              | x                                | x                 |
| 7     | *Hybomitra fulvus* Meigen, 1820       |                   | -            | x              | +                                | -                 |
| 8     | *Hybomitra palliater* (Olufjev, 1936)  |                   | -            | -              | +                                | x                 |
| 9     | *Hybomitra rustica* (Linnaeus, 1767)   |                   | -            | x              | +                                | x                 |
| 10    | *Tabanus autumnalis* (Fabricius, 1776) |                   | -            | x              | x                                | x                 |
| 11    | *Hybomitra arnoldi* (Linnaeus, 1858)   |                   | -            | x              | x                                | x                 |
| 12    | *Hybomitra发生变化* (Fabricius, 1776) |                   | -            | x              | x                                | x                 |
| 13    | *Hybomitra发生变化* (Fabricius, 1776) |                   | -            | x              | x                                | x                 |
| 14    | *Hybomitra发生变化* (Fabricius, 1776) |                   | -            | x              | x                                | x                 |
| 15    | *Hybomitra发生变化* (Fabricius, 1776) |                   | -            | x              | x                                | x                 |
| 16    | *Hybomitra发生变化* (Fabricius, 1776) |                   | -            | x              | x                                | x                 |
| 17    | *Hybomitra发生变化* (Fabricius, 1776) |                   | -            | x              | x                                | x                 |
| 18    | *Hybomitra发生变化* (Fabricius, 1776) |                   | -            | x              | x                                | x                 |
| 19    | *Hybomitra发生变化* (Fabricius, 1776) |                   | -            | x              | x                                | x                 |
| 20    | *Hybomitra发生变化* (Fabricius, 1776) |                   | -            | x              | x                                | x                 |
| 21    | *Hybomitra发生变化* (Fabricius, 1776) |                   | -            | x              | x                                | x                 |
| 22    | *Hybomitra发生变化* (Fabricius, 1776) |                   | -            | x              | x                                | x                 |
| 23    | *Hybomitra发生变化* (Fabricius, 1776) |                   | -            | x              | x                                | x                 |
| 24    | *Hybomitra发生变化* (Fabricius, 1776) |                   | -            | x              | x                                | x                 |
| 25    | *Hybomitra发生变化* (Fabricius, 1776) |                   | -            | x              | x                                | x                 |
| 26    | *Hybomitra发生变化* (Fabricius, 1776) |                   | -            | x              | x                                | x                 |
| 27    | *Hybomitra发生变化* (Fabricius, 1776) |                   | -            | x              | x                                | x                 |
| 28    | *Hybomitra发生变化* (Fabricius, 1776) |                   | -            | x              | x                                | x                 |
| 29    | *Hybomitra发生变化* (Fabricius, 1776) |                   | -            | x              | x                                | x                 |
| 30    | *Hybomitra发生变化* (Fabricius, 1776) |                   | -            | x              | x                                | x                 |
| 31    | *Hybomitra发生变化* (Fabricius, 1776) |                   | -            | x              | x                                | x                 |
| 32    | *Hybomitra发生变化* (Fabricius, 1776) |                   | -            | x              | x                                | x                 |
| 33    | *Hybomitra发生变化* (Fabricius, 1776) |                   | -            | x              | x                                | x                 |
| 34    | *Hybomitra发生变化* (Fabricius, 1776) |                   | -            | x              | x                                | x                 |
| 35    | *Hybomitra发生变化* (Fabricius, 1776) |                   | -            | x              | x                                | x                 |
|       | Total species                           |                   | 33           | 35             | 27                              |                   |
|       | subspecies                              |                   | 1            | 1              | 1                               |                   |

| #     | Species                                | Family Culicidae | Forest-steppe zone |
|-------|----------------------------------------|-------------------|-------------------|
| 36    | *Culiseta bergrothi* (Edwards, 1921)   |                   | +                 |
| 37    | *Culiseta longiareolata* (Macquart, 1838) |       | +                 |
| 38    | *Culiseta morsitans* (Theobald, 1901)  |                   | +                 |
| 39    | *Culiseta ochroptera* (Peus, 1935)     |                   | -                 |
| 40    | *Culiseta alaskaensis* (Ludlow, 1906)  |                   | +                 |
| 41    | *Culiseta morsitans* (Theobald, 1901)  |                   | +                 |

**Note:** The table includes species distribution across different zones within the Tyumen region, with symbols indicating presence (+) or absence (-).
|        |                                                      |   |   |   |   |
|--------|-------------------------------------------------------|---|---|---|---|
| 42     | *Coquillettidia richardti* (Ficalbi, 1889)            | x | x | + | x | x ++ |
| 43     | *Aedes cinereus* Meigen, 1818                        | x | x | +++ | x | ++++ | x ++ |
| 44     | *Aedes rossicus* Dolbeskin, Gorickaja ja Mitrofanova, 1930 | - | ++ | +++ | ++ |
| 45     | *Aedes vexans* (Meigen, 1830)                        | x | x | +++ | x | ++ | x ++ |
| 46     | *Aedes caspius* (Pallas, 1771)                        | x | ++ | x | + | ++ |
| 47     | *Aedes dorsalis* (Meigen, 1830)                       | - | x | + | x | + |
| 48     | *Aedes cantans* (Meigen, 1818)                        | x | x | ++++ | x | ++++ |
| 49     | *Aedes riparius* (Dyar et Knab, 1907)                 | x | x | ++ | x | ++ | x +++ |
| 50     | *Aedes mercurator* (Dyar, 1920)                       | - | + | + | + |
| 51     | *Aedes belimingi* (Martini, 1926)                     | - | + | x | + |
| 52     | *Aedes excrucians* (Walker, 1856)                     | x | x | +++ | x | +++ | x +++ |
| 53     | *Aedes eudees* Howard, Dyar et Knab, 1913             | - | x | ++ | x | ++ | ++++ |
| 54     | *Aedes flavescens* (Müller, 1764)                     | x | x | + | x | ++ | + |
| 55     | *Aedes cyprius* Ludlow, 1920                          | x | ++ | x | ++ | x |
| 56     | *Aedes communis* (De Geer, 1776)                      | x | x | +++ | x | + | x |
| 57     | *Aedes pionips* (Dyar, 1919)                          | x | + | x | + |
| 58     | *Aedes punctor* Kirby, 1837                           | x | x | ++ | x | + | x | ++++ |
| 59     | *Aedes hexodontus* (Dyar, 1916)                       | x | x | x |
| 60     | *Aedes sticticus* Meigen, 1838                        | - | + | x | + | + |
| 61     | *Aedes nigrius* (Eckstein, 1918)                      | - | x | - | - |
| 62     | *Aedes nigripes* Zetterstedt, 1838                     | - | + | - | - |
| 63     | *Aedes diantaeus* Howard, Dyar et Knab, 1913          | x | x | +++ | x | ++ | ++++ |
| 64     | *Aedes intrudens* (Dyar, 1919)                        | x | x | + | x | ++ | ++ |
| 65     | *Aedes pullatus* Coquillett, 1904                     | x | x | + | x | + |
| 66     | *Aedes impiger* Walker, 1848                          | - | x | - | - |
| 67     | *Aedes cataphylla* (Dyar, 1916)                       | x | x | + | x | + |
| 68     | *Aedes leucomelas* Meigen, 1804                       | - | - | - | - | + |
| 69     | *Aedes albsescens* Edwards, 1921                      | - | - | - | - | + |
| 70     | *Aedes subdivers Martini, 1926                         | - | - | - | - | + |
| 71     | *Aedes implicatus* Vockeroth, 1954                    | - | + | - | - |
| 72     | *Culex modestus* Ficalbi, 1890                        | - | + | x | + | x | + |
| 73     | *Culex territans* Walker, 1856                        | - | x | - | - |
| 74     | *Culex vagans* Wiedemann, 1828                        | - | x | - | - |
| 75     | *Culex ppienis Linnaeus, 1758                          | - | x | + | x | + | + |

Total species: 18 37 30 32

family Simuliidae

|        |                                                      |   |   |   |   |
|--------|-------------------------------------------------------|---|---|---|---|
| 76     | *Byssodon maculatus* (Meigen 1804)                     | x | x | ++++ | x | ++++ |
| 77     | *Cnetha verna* (Macgauth, 1826)                        | x | x | + | x | x |
| 78     | *Nevermannia angustitarsis* (Lundstrom, 1911)          | x | - | - | - |
| 79     | *Eusimulium aureum* (Fries, 1824)                      | x | x | x | x | x |
| 80     | *Schoenbaueria pusilla* (Fries, 1824)                  | x | x | ++++ | x | ++++ |
| 81     | *Schoenbaueria subpusilla* (Rubzov, 1940)              | - | - | + | - |
| 82     | *Schoenbaueria nigra* Meigen, 1804                     | - | x | +++ | x | ++ | x |
| 83     | *Boophthora erythrocephala* (De Geer, 1776)            | - | + | x | + | x | + |
| 84     | *Parabyssodon transiens* (Rubzov, 1940)               | - | x | x | - |
| 85     | *Odagmia ornata* Meigen, 1818                         | x | x | + | x | ++ | x |
| 86     | *Argentisimulium noelleri* (Friedrichs, 1920)         | - | + | x | + | - |
| 87     | *Simulium longipalpe* Beltukova, 1955                  | x | ++ | x | + | - |
| 88     | *Simulium reptans* Beltukova, 1955                     | - | x | x | + | x |
| 89     | *Simulium morstians* Edwards, 1915                     | - | x | x | x |
| 90     | *Simulium rostratum* Lundström, 1911                   | x | x | + | x | x |
91 Simulium venustum Say, 1823 x x + -

| Total species: | 9 | 13 | 15 | 10 |
|---------------|---|----|----|----|
| family Ceratopogonidae |
| 92 Culicoides obsotetus (Meigen, 1818) | x | + | +++ | + |
| 93 Culicoides chiopterus (Meigen, 1830) | x | + | ++ | - |
| 94 Culicoides gornostaeae Mirzoeva, 1984 | x | - | ++ | - |
| 95 Culicoides pulicaris (Linnaeus, 1758) | x | ++ | ++ | |
| 96 Culicoides punctatus (Meigen, 1804) | x | ++++ | x | ++++ | ++++ |
| 97 Culicoides impunctatus Goetghebuer, 1920 | x | - | - | - |
| 98 Culicoides griscens Edwards, 1935 | x | ++ | x | +++ | + |
| 99 Culicoides reconditus | x | - | x | + | - |
| Campbell et Pelham-Clinton, 1960 |
| 100 Culicoides fascipennis (Staeger, 1839) | x | +++ | +++ | + |
| 101 Culicoides subfascipennis Kieffer, 1919 | - | + | ++ | + |
| 102 Culicoides pallidicornis Kieffer, 1919 | - | - | + | - |
| 103 Culicoides circumscriptus Kieffer, 1918 | - | + | + | + |
| 104 Culicoides salinarius Kieffer, 1914 | - | + | + | + |
| 105 Culicoides manchuriensis Tokunaga, 1941 | - | - | + | - |
| 106 Culicoides tuberculosis (Meigen, 1830) | - | - | x | + |
| 107 Culicoides stigma (Meigen, 1818) | - | - | + | - |
| 108 Culicoides helveticus | x | - | - | - |
| Callot, Kremer et Deduit, 1962 |
| Total species | 10 | 9 | 15 | 8 |
| Total species | 37 | 92 | 95 | 77 |

Note: ++++ = dominant, +++ = subdominant, ++ = small, + = rare species, x = literature data.

4. Conclusion
In the south of the Tyumen region, 108 species and 1 subspecies of blood-sucking Diptera were found, of which horseflies - 35 species and 1 subspecies, mosquitoes - 40, midges - 16 and woodlice - 17 species. The greatest species diversity is typical for the subzone of small-leaved aspen – birch forests, where 95 species and 1 subspecies occur, the smallest in the middle taiga. It should be noted that data on the species composition of blood-sucking mosquitoes, midges and midges in the middle taiga of the south of the Tyumen region is available only in literary sources of 60-70 years of the last century, and the fauna of horseflies of this subzone is still not studied.

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