

Fruit flies (Diptera: Drosophilidae) of the Russian Arctic

Мухи-дрозофилиды (Diptera: Drosophilidae) Российской Арктики

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Drosophilid flies of the Russian Arctic are reviewed. Thirteen species of Drosophilidae are recorded: one from the genus *Stegana*, seven from *Drosophila* and five from *Scaptomyza*. The northernmost localities in the Palaearctic are recorded for *D. melanogaster* Meigen, 1830 and *D. hydai* Sturtevant, 1921. *Scaptomyza yakutica* Sidorenko et Toda, 1996 described from Yakutia was found for the first time in Europe (the European part of Russia). Seven species of Drosophilidae are found in the tundra biome. The finding of Drosophilidae in the tundra zone contradicts the view on the absence of “wild” drosophilids in this zone.

Дан обзор мух семейства Drosophilidae Российской Арктики. Найдено 13 видов: один из рода *Stegana*, 7 из рода *Drosophila* и 5 из рода *Scaptomyza*. Для *D. melanogaster* Meigen, 1830 и *D. hydai* Sturtevant, 1921 отмечены наиболее северные местонахождения в Палеарктике. *Scaptomyza yakutica* Sidorenko et Toda, 1996, описанный из Якутии, впервые найден в Европе (в европейской части России). Нахождение 7 видов дрозофилид в тундре позволяет пересмотреть утверждение о том, что «дикие» дрозофилиды не встречаются в зоне тундры.

Key words: fruit flies, distribution, Arctic, northern Russia, tundra biome, Diptera, Drosophilidae, new records

Ключевые слова: мухи-дрозофилиды, распространение, Арктика, север России, тундра, Diptera, Drosophilidae, новые находки

INTRODUCTION

Interest to the Arctic has increased in the last decade in countries bordering to the Arctic Ocean because of the climate change and economic reasons. Much of the Arctic belongs to Russia, however, the Arctic insect fauna of Russia is insufficiently studied, especially with regard to the order Diptera, which is one of the most diverse and abundant groups of insects in the Arctic (Chernov, 2002; Chernov et al., 2014). The late K.B. Gorodkov did much collecting in the northern regions of Russia, but he published the results only on a few families (Gorodkov, 1971, 1980, 1997). Tipuloid and syrphid Diptera are rather

well-studied groups in the Russian Arctic (Chernov, 1963; Lantsov & Chernov, 1979). The Chloropidae were discussed by Nartshuk (2009) and Nartshuk & Khruleva (2011a, 2011b).

Drosophilidae are small, mostly yellow or dark brown flies with red eyes. The family has a worldwide distribution; some species are synanthropic and have worldwide distributions. In the Palaearctic Region, 304 species from 19 genera were known (Bächli & Rocha Pité, 1984).

Generic and species diversity is richer in the southern part of the Palaearctic and in tropical regions. Species diversity decreases dramatically in the northern Palaearctic

(Basden, 1956; Basden & Harnden, 1956). Larvae of Drosophilidae develop mostly in decaying fruits, some in mushrooms; larvae of most *Scaptomyza* Hardy, 1849 species are leaf miners (Bächli & Rocha Pité, 1984).

The aim of present paper is to provide data on the family Drosophilidae in Arctic Russia, especially in the tundra zone. The Arctic is treated according to Chernov et al. (2014). The middle part of the forest-tundra zone is considered to be the southern land border of the Arctic. However I included also some data from more southern localities in neighbouring areas, on the Kola Peninsula, in northern Siberia and the lower Anadyr River in Chukotka.

Northern Drosophilidae had never been specially investigated in Russia. Seventy species of Drosophilidae are distributed in North Europe (Fennoscandia and Denmark), but only 36 species were recorded north of the Polar Circle (Bächli et al., 2004). Nine species of Drosophilidae are known from two localities (Verkhoyansk and Zhigansk) in the northern Boreal zone in the Republic of Sakha (Yakutia), Russia, north of the Polar Circle (Watabe et al., 1994; see Table 1).

To date, only one species, *Drosophila melanogaster* Meigen, 1830, was recorded from the tundra zone, in Tiksi, northern East Siberia, but only indoors (Toda et al., 1996). Toda (1984) considered that “the northernmost drosophilid fauna as a biogeographical entity is virtually confined to the subarctic forest zone, never deeply entering the real tundra”.

MATERIAL AND METHODS

A part of the examined material was collected by O.L. Makarova in 2004 during a study of the insect fauna of Dolgiy Island in the Nenetskiy Nature Reserve, Nenetskiy Autonomous District of Arkhangelsk Province, northeastern European Russia. Dolgiy Island (69.12°N 59.13°E) is situated in the southeastern part of the Barents Sea (Pechora Sea) and belongs to the southern tundra subzone (Makarova & Makarov,

2006). These authors described the collection localities in detail. Five species, three from the genus *Scaptomyza* and two from the genus *Drosophila* Fallén, 1823, were found in the examined collection. All these species were determined by the late V.S. Sidorenko.

A second batch of specimens was collected by A.V. Barkalov in 2012 in the northwestern part of Taymyr Peninsula (73.24°N 80.35°E), 12.5 km south of Dikson, Krasnoyarsk Territory, West Siberia, and in 2013 at the lower Anadyr' River (84.83°N 178.96°E), 92 km from the town of Anadyr', Chukotka, northern Far East of Russia. The first locality is situated in arctic tundra (Chernov & Matveeva, 1972); the second belongs to the Anadyrsko-Koryakskaya Province of the Boreal Region and is situated near the eastern border of the subzone of the large montane pine forest, which is formed by *Pinus pumila* (Pallas) Regel (Yurtsev, 1978). Flies were collected with yellow pan traps. These localities are described in detail by Nartshuk et al. (2014). The names of collectors O.L. Makarova and A.V. Barkalov are omitted from the list of material.

Additional material from the collection of the Zoological Institute of the Russian Academy of Sciences (St Petersburg) was examined. It was collected mostly by V.Yu. Fridolin in 1923–1935 on the Kola Peninsula (Murmansk Province) and near Salekhard in northern West Siberia (Yamalo-Nenetskiy Autonomous District of Tyumen' Province).

Most of examined localities are situated to the north of the Polar Circle (66.32°N) but only four areas lie within the tundra zone, Dolgiy Island, vicinities of Dikson, Sob' River near Salekhard, and Pevek in Chukotka (see Fig. 1 and text below). Other localities belong to the northernmost subarctic forest and forest-tundra zones.

All specimens mentioned are kept at the Zoological Institute (St Petersburg), mostly pinned; the material collected by Barkalov is kept in ethanol.

The papers by Toda et al. (1996), Sidorenko (2001) and Bächli et al. (2004) were used for identification of species.

RESULTS

Family DROSOPHILIDAE

Subfamily STEGANINAE

Stegana (Stegana) furta (Linnaeus, 1767)

Material. Murmansk Prov., Murmansk, 22 Aug. 1923 (Fridolin), 1 exemplar.

Notes. Widespread Palaearctic species, occurring from Europe to the Far East of Russia. The northernmost known locality in Europe is Levanger (63.45°N 11.19°E) in Norway (Bächli et al., 2004).

Subfamily DROSOPHILINAE

Drosophila (Drosophila) funebris (Fabricius, 1787)

Material. Murmansk Prov., Lake Vud'yarv, Sept. 1931 and 1935 (Fridolin), 2 exemplars.

Notes. A worldwide-distributed synanthropic species; more abundant in cooler areas.

Drosophila (Drosophila) transversa (Fallén, 1823)

Material. Chukotka Autonomous Region, lower Anadyr' River, 64.83°N 175.96°E, 27–30 July 2013, 1 male, 3 females.

Notes. A widespread Holarctic species, more abundant in northern areas. In the Palaearctic Region, the northernmost locality is Alta (23.10°N 69.57°E) in Norway (Bächli et al., 2004). Larvae are mushroom feeders (Bächli et al., 2004).

Drosophila (Siphlodora) hydei Sturtevant, 1921

Material. Arkhangelsk Prov., Dolgiy I.: seawater-affected moist saline area 30 m long with *Puccinella phryganoides*, 7–18 July 2004, 1 female; steep sea coast about 200 m long, 13–17 July 2004, 1 male; bog with *Caltha arctica*, 21–28

July 2004, 1 female; meadow-like habitats, 7–17 July 2004, 1 male, 4 females; *Krasnoyarsk Terr.*, NW Taymyr Peninsula, 12.5 km S of Dikson, 73.24°N 80.35°E, bank of Lemborova River, 7–10 July 2012, 1 male, 2 females.

Notes. A cosmopolitan species with worldwide distribution, more common in warmer areas. The record from Taymyr is the northernmost in the Palaearctic. In Russia the species is known from the European part to Primorskiy Territory in the Far East (Sidorenko, 2001). In Europe the species reaches northern Norway (Bächli et al., 2004).

Drosophila (Siphlodora) repleta (Wollaston, 1858)

Material. Murmansk Prov., Tuloma Distr., 12 Aug. 1968 (Stadnitskiy), 1 male; *Tyumen' Prov.*: Malaya Khinema, Obdorsk [now Salekhard], 26 June 1925 (Fridolin), 1 exemplar; Sob' River near Obdorsk [now Salekhard], 1 Aug. 1925 (Fridolin), 1 exemplar.

Notes. A cosmopolitan species. The northernmost known locality in Europe is Raahe (64.30°N 24.30°E) in Finland (Bächli et al., 2004). Larvae develop in decaying plant material and mushrooms (Bächli et al., 2004).

Drosophila (Siphlodora) subarctica Hackman, 1969

Material. Murmansk Prov.: Laplandskiy Nature Reserve, on excrements, 24 Aug. 1976 (Sychevskaya), 1 female; Tuloma Distr., 12 Aug. 1968 (Stadnitskiy), 1 male; *Krasnoyarsk Terr.*, southern Taymyr Peninsula, Ary-Mas locality 17 km N of Khatanga, sparse growth of *Larix*, 27 Aug. 1971 (Gorodkov), 1 male; *Chukotka Autonomous Region*: lower Anadyr' River, 64.83°N 175.96°E, 27–30 July 2013, 1 male; Valkumiy, E of Pevek, southern slope, shrubs in tundra, 12 July 1964 (Gorodkov), 1 female.

Notes. The species occurs in North Europe, East Siberia and northern Japan; the northernmost localities in Europe are Rosttra (19.42°N 69.00°E) in Norway and Utsjoki (19.42°N 69.00°E) in Finland (Bächli et al., 2004).

Table 1. Species of Drosophilidae recorded from the Arctic parts of the Palaearctic.

| Species | Subarctic Norway | European Russia | | Asian Russia | | | |
|--|------------------|-----------------|---------------|----------------|-----------------|------------------|----------|
| | | Kola Peninsula | Dolgiy Island | Salekhard area | Taymyr Peninsul | Northern Yakutia | Chukotka |
| <i>Amiota alboguttata</i> (Wahlberg, 1839) | + | | | | | | |
| <i>Stegana furta</i> (Linnaeus, 1767) | | + | | | | | |
| <i>Cacoxenus argyreator</i> Frey, 1932 | + | | | | | | |
| <i>Chymomyza costata</i> (Zetterstedt, 1848) | + | | | | | + | |
| <i>Drosophila alpina</i> Burla, 1948 | | | | | | + | |
| <i>Drosophila bifasciata</i> Pomini, 1940 | + | | | | | | |
| <i>Drosophila ezoana</i> Takada et Okada, 1957 | | | | | | + | |
| <i>Drosophila funebris</i> (Fabricius, 1787) | + | + | | | | | |
| <i>Drosophila hydei</i> Sturtevant, 1921 | | | + | | + | | |
| <i>Drosophila littoralis</i> Meigen, 1830 | + | | | | | + | |
| <i>Drosophila lummei</i> Hackman, 1972 | | | | | | + | |
| <i>Drosophila melanogaster</i> Meigen, 1830 | ? | | + | | + | | |
| <i>Drosophila obscura</i> Fallén, 1823 | + | | | | | | |
| <i>Drosophila relimma</i> Wheeler, 1960 | | | | | | + | |
| <i>Drosophila repleta</i> (Wollaston, 1858) | + | + | | + | | | |
| <i>Drosophila subarctica</i> Hackman, 1969 | | + | | | + | + | + |
| <i>Drosophila subsilvestris</i> Hardy et Kaneshiro, 1986 | + | | | | | | |
| <i>Drosophila transversa</i> Fallén, 1823 | + | | | | | + | + |
| <i>Drosophila</i> gr. <i>virilis</i> | | | | | | | + |
| <i>Scaptomyza consimilis</i> Hackman, 1955 | | | + | | | | |
| <i>Scaptomyza flava</i> (Fallén, 1823) | | | | + | | | |
| <i>Scaptomyza graminum</i> (Fallén, 1823) | | | | + | | | |
| <i>Scaptomyza pallida</i> (Watabe et al., 1994) | | + | + | + | | + | |
| <i>Scaptomyza yakutica</i> Sidorenko et Toda, 1996 | | | + | | | | |
| Number of species | 10 | 5 | 5 | 4 | 3 | 9 | 3 |

Notes to Table. Subarctic Norway, after Basden & Harnden (1956) (*D. subsilvestris* listed as *D. silvestris* Basden, 1954; 3 specimens of *D. melanogaster* in bad condition were found in fruit traps and authors assumed that “they must have already been (dead?) in the fruit, when it was used as trap bait”); Kola Peninsula (Murmansk Province), specimens collected by Fridolin, Stadnitskiy and Sychevskaya; Dolgiy Island, specimens collected by Makarova; Salekhard area, specimens collected by Fridolin; Taymyr, specimens collected by Barkalov and Gorodkov; northern Yakutia, after Watabe et al. (1994); Chukotka, specimens collected by Barkalov and Gorodkov.

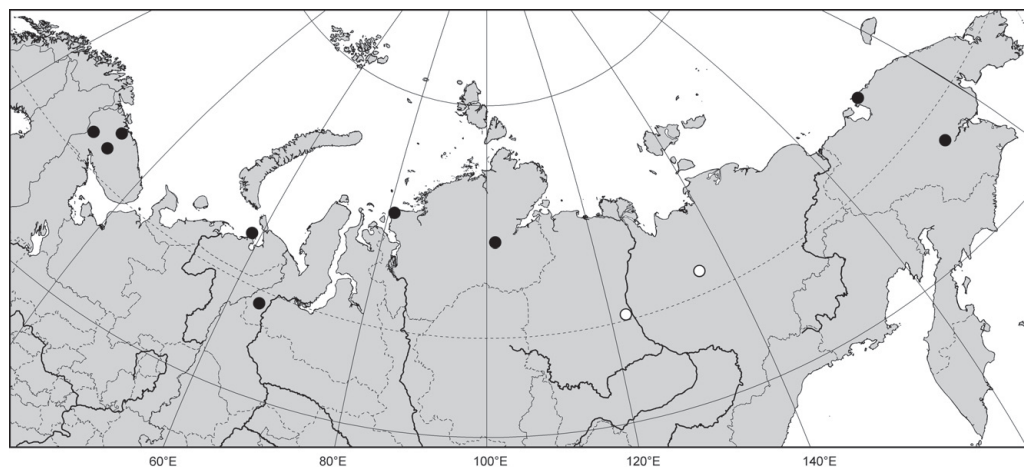


Fig. 1. Collecting localities of Drosophilidae in the Russian Arctic. Black circles, the material in the collection of the Zoological Institute (St Petersburg), examined; white circles, published records, no material examined (see text and Table 1 for details). The Polar Circle is designated by dashed line.

Drosophila (Siphlodora) gr. virilis

Material. *Chukotka Autonomous Region*, Val-kumiy, E of Pevek, southern slope, shrubs in tundra, 12 July 1964 (Gorodkov), 1 female.

Notes. I failed to determine the female using the paper by Watabe & Higuchi (1979).

Drosophila (Sophophora) melanogaster

Meigen, 1830

Material. *Arkhangelsk Prov.*, Dolgiy I., meadow-like habitats with *Hoenkenya oblongifolia*, 7–17 July 2004, 2 females; *Krasnoyarsk Terr.*, NW Taymyr Peninsula, 12.5 km S of Dikson, 73.24°N 80.35°E, bank of Lemborova River, 7–10 July 2012, 1 female.

Notes. A cosmopolitan synanthropic species with a worldwide distribution. The record from Taymyr is the northernmost in the Palaearctic. Toda et al. (1996) recorded this species indoors in Tiksi, at the Arctic Ocean coast in Yakutia. The larvae are decaying fruit feeders (Bächli et al., 2004).

Scaptomyza (Scaptomyza) consimilis

Hackman, 1955

Material. *Arkhangelsk Prov.*, Dolgiy I., burrow of Arctic fox, 28 July 2004, 1 male.

Notes. A widespread Palaearctic species known from Finland to Japan and in Russia from the European part to Kamchatka (Gornostaev, 1989). The northernmost known locality in Europe is Joutseno (28.30°N 61.05°E) in Finland (Bächli et al., 2004). The larvae are leaf miners of Ranunculaceae, Liliaceae and other plants (Sidorenko, 2001).

Scaptomyza (Scaptomyza) flava

(Fallén, 1823)

Material. *Tyumen' Prov.*, Sob' River near Obdorsk [now Salekhard], tundra, 18 June 1925 (Fridolin), 1 exemplar.

Notes. A widespread Holarctic species. The northernmost known locality in Europe is Staloojokk (16.40°N, 67.17°E) in Sweden (Bächli et al., 2004).

Scaptomyza (Scaptomyza) graminum

(Fallén, 1823)

Material. *Tyumen' Prov.*, Obdorsk [now Salekhard], 30 June 1925 (Fridolin), 1 exemplar.

Notes. A widespread Holarctic or cosmopolitan species, occurring in Iceland. The northernmost known locality in Europe

is Torsvag (19.32°N, 70.14°E) in Norway (Bächli et al., 2004). Larvae are leaf miners on various plants (Máca, 1972).

Scaptomyza (Scaptomyza) yakutica

Sidorenko et Toda, 1996

Material. Arkhangelsk Prov., Dolgiy I.: burrow of Arctic fox, 10–25 July 2004, 4 males, 2 females; meadow on SW slope, 8–19 July 2004, 1 male.

Notes. The species was previously known only from Yakutia (Sidorenko, 2001). Here it is recorded from the European part of Russia.

Scaptomyza (Parascaptomyza) pallida

(Zetterstedt, 1847)

Material. Murmansk Prov., Murmansk, 15 Aug. 1923 (Fridolin), 1 exemplar; Arkhangelsk Prov., Dolgiy I.: 10–25 July 2004, 5 males, 9 females; hole of Arctic fox, 25 July 2004, 8 males, 6 females; marine beach with *Hoenkenya oblongifolia*, 17–27 July 2004, 1 female; Tyumen' Prov., Voykar River near Obdorsk [now Salekhard], 10 Aug. 1925 (Fridolin), 1 exemplar.

Notes. A cosmopolitan species, inhabiting mostly grasslands. The species is known in Russia from the European part to Primorskiy Territory and the Kuril Islands (Gornostaev, 1989; Sidorenko, 2001). The northernmost known locality in Europe is Torsvag (19.32°N 70.14°E) in Norway (Bächli et al., 2004). The larvae develop in decaying plant material (Máca, 1972).

DISCUSSION

Only a few specimens have been collected from all of the examined localities, as Drosophilidae are not abundant in the Arctic. In the examined material, 13 species from three genera and two subfamilies of Drosophilidae were found: five species from Kola Peninsula, five species from Dolgiy Island, seven species from northern West Siberia (Taymyr and Salekhard areas), and three species from Chukotka (see Fig. 1 and Table 1). The number of species known from northern Russia may well be increased by more intensive surveys.

Nearly all species in the list have very wide distributions: five are cosmopolitan, three are widespread in the Holarctic Region, and two are widespread in the Palaearctic Region. Only two species, *Drosophila subarctica* and *Scaptomyza yakutica*, have northern distributions in the Palaearctic. The former is known from northern Europe, Yakutia and Japan (Hokkaido) (Toda et al., 1996); the latter was previously known only from Yakutia. Here it is recorded for the first time from Europe (European part of Russia). The presence of Holarctic species suggests faunal exchange across Beringia until relatively recent time, as Toda previously suggested (Toda, 1984).

For comparison, ten species occur in two localities in northern Norway (Turnflaten in Lyngsdal and Rosta in Rostadal) situated 165–200 miles north of the Polar Circle (Basden & Harnden, 1956; see Table 1). Twenty-three species from eight genera were recorded above the Polar Circle in the Palaearctic Region (Basden, 1956), most of which are cosmopolitan or circumpolar species. Eleven species were found in the Subarctic zone of Canada (Itvik, 68°22'N 133°45'W in the Mackenzie Delta, Northwest Territories): *Amiota quadrata* Tokada et Toda, 1981 (according Bächli et al. (2004), a subspecies of *A. subtusradiata* Duda, 1934 now), *Drosophila transversa*, *D. borealis* Patterson, 1952, *D. repleta*, *D. athabasca* Sturtevant et Dobzhansky, 1936, *D. testacea* von Roser, 1840, *D. montana* Stone, Griffen et Patterson, 1941, *Chymomyza caudatula* Oldenberg, 1914, *Ch. aldrichii* Sturtevant, 1916, *Ch. costata* (Zetterstedt, 1838), *Ch. tetonensis* Wheeler, 1949 (Takada & Toda, 1981; Toda, 1985). In Alaska, 17 species are known: seven in *Drosophila* and ten in *Scaptomyza* (Wheeler, 1965). However Wheeler & Throckmorton (1960) listed 21 species in Alaska; two of these, one belonging to the genus *Amiota* Loew, 1862, and one, to *Scaptomyza* Hardy, 1849, were undetermined. An undetermined species of *Scaptomyza* was collected at Cape Thompson in Canada, north of the Polar Circle and the spine

birch forest line. Toda (1984) listed 51 species in the Subarctic zone of both Palaearctic and Nearctic regions; of these, 19 species (40.4%) are Palaearctic, 12 ones (25.5%) are Nearctic, 11 species (32.4%) are Holarctic and 5 (10.6%) are cosmopolitan.

Seven of the discussed species were found in the tundra biome (Dolgiy Island, vicinity of Dikson, Sob' River, and Pevek): *Drosophila flava*, *D. hydei*, *D. melanogaster*, *D. subarctica*, *Scaptomyza consimilis*, *S. pallida*, and *S. yakutica*. The recording of seven species of Drosophilidae in the tundra zone provides the opportunity to reconsider the view by Toda (Toda, 1984; Toda et al., 1996) that "Tundra zone is virtually free from "wild" drosophilids. Only a cosmopolitan domestic species *D. melanogaster* was collected in a heated fruit shop in Tiksi." (Toda et al., 1996: 473).

The data on plant associations were available only for localities on Dolgiy Island. *Drosophila hydei* was collected on bogs with *Caltha* and on marshes. Species of *Scaptomyza* whose larvae are miners of plant leaves were collected in drier habitats, on meadow plants or on burrows of Arctic fox. Soil excavated from Arctic fox burrows is usually covered by grasses (Poaceae). The phytophagous frit fly *Oscinella frit* (Linnaeus, 1758) associated with Poaceae was also collected on Dolgiy Island and on Wrangel Island near Arctic fox burrows (Nartshuk, 2009; Nartshuk & Khruleva, 2011).

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