

## The Drosophilidae (Diptera) of Latvia

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**Abstract:** The Baltic countries represent a veritable *terra incognita* on the *Drosophila* map of Europe. To remedy the situation we made two collecting trips through the three Baltic countries in the summer of 2000. The first trip was made in early summer to get spring species such as those belonging to genus *Chymomyza* and the second in late August to get the mushroom feeding species. In general the drosophilid fauna of the Baltic resembles the well known fauna of the Nordic countries. The single most interesting result is that *Chymomyza amoena* was found in Estonia and Lithuania. This American species is a recent invader of Central Europe. Other interesting finding was the relative rarity of *D. subobscura* and the complete absence of *D. virilis* group species. The latter have become uncommon in Sweden and Finland in recent years as well.

**Key words:** Drosophilidae, *Chymomyza*, *Drosophila*, *Gitona*, *Leucophenga*, *Scaptomyza*, Latvia, new records.

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### Introduction

*Drosophila melanogaster* is now by far the best known insect. Its genome has been sequenced, its development is a model for other animals and its behaviour has been linked to individual genes. Very many of its genes have direct counterparts with our own genes; in several cases homologies are found in as evolutionarily distant organisms as green plants. Because of the small size and the fast rate of reproduction the function of genes can be established in *Drosophila*; these results can then be used to find a function of an unknown nucleotide sequence in humans. Like many other dipterans, *Drosophila* larvae have polytene chromosomes in the salivary glands that make the exact localization of genes to chromosomes possible.

*D. melanogaster* is taxonomically far away from the nominate species of the genus *D. funebris*; in fact so far that several drosophilid genera are placed within an obviously paraphyletic genus. Throckmorton (1975) and Desalle & Grimaldi (1991) show using both morphological and includes many taxa that are independent genera ( the largest of which is *Scaptomyza*).

*Drosophila* is the largest genus of the family Drosophilidae. The reason why the genus is large is that it includes *D. melanogaster*. Because of the immense amount of literature written on these small flies, removing *melanogaster* from the genus is out of question.

The power of *Drosophila* genetics can be harnessed to serve ecology and taxonomy. Drosophilid flies have quite diverse ecological niches and evidently much can be

learned through a study of their biology. We believe that the Latvian biologists will benefit in having a first survey of the drosophilid fauna in Latvia.

With the exception of a single record by Gimmerthal (1845) nothing has been published on the drosophilid fauna of the Baltic countries. There is a species list for Estonia (Kunberg, 1981). It is the work of a skilled entomologist, but has remained as an unpublished master's thesis written in Estonian. The Institute of Biology at Salaspils has a good collection of drosophilid specimens that are identified using the key of Stakelberg (1970). This key and the pictures are good but some common European species are missing. The authors Escher and Saura are involved in a project that concerns the drosophilid fauna of Northern Europe, in collaboration with Dr. Gerhard Bächli, University of Zürich, Switzerland. The project will cover the Northern European species of *Drosophila* and will give details of distributions, a key to the species and biological information. We wished therefore to gather as extensive entomological records as possible and to fill eventual gaps in the knowledge. The collection at Salaspils has been collected using traditional dipteran collection methods. This gives a species list different from the one that is obtained when using fermenting baits, observing mushrooms or felled trees. In other words, the different collecting methods complement each other. We describe here the drosophilid fauna of Latvia.

## Materials and methods

The material for this report was collected by the authors in June and August 2000. The records from the author Karpa's earlier collections are included.

Flies were collected from as many biotopes as possible, including dustbins, mushrooms, felled logs etc. and either with net sweeping or suction in fermenting baits using rotting bananas and other fruits. Depending on weather conditions and other factors, the traps were checked at least once an hour. After preliminary examining of the flies, in the field, they were put in ethanol and further determined in the lab. The material collected by the author Karpa is deposited at Institute of Biology, University of Latvia while the material collected by the Swedish group is at the Dept. of Molecular Biology of Umea University in Sweden. The material was determined at the dept. of Molecular Biology in Umea using a binocular microscope and the available determination keys to European species.

We made a special effort to get the *virilis* group species by collecting along the banks of small and large rivers.

## Results and discussion

The results are given in the accompanying species list and highlight certain species. In general, there was nothing completely unexpected if we compare the results with the well-known drosophilid fauna of the Nordic countries. The northern and alpine species were, of course, missing.

A remarkable result is the absence of the *virilis* group species. Four species, *D. littoralis*, *D. lummei*, *D. montana* and *D. ezoana* are found in Sweden and Finland. Of these *D. lummei* and *D. ezoana* have virtually disappeared from Finland and Sweden and, *D. littoralis* and *D. montana* have also become uncommon. These are our personal observations. In places in Sweden and Finland, where they were common in the 1970's and 80's they have disappeared. We shall study this phenomenon further this

summer. The only specimen of this group that we obtained was an undetermined female from the city moat of Pärnu, Estonia. We had expected to get hundreds of *virilis* group flies from the great rivers Daugava and Nemunas; but we did not get a single one. The riverside habitats gave mostly domestic species, in particular many *D. melanogaster*.

*D. subobscura* was also remarkably uncommon. In habitats where we expected it, we got mostly *D. obscura* in very large numbers. *D. subobscura* had disappeared from the sites in Sweden and Finland where we tried to collect it in 1994, but earlier it was very common and abundant and now it is to some extent returning. It would be interesting to know what has happened with these common flies (*D. virilis* group and *D. subobscura*). Laboratory strains are available from the period before the crash and there is also a vast amount of unpublished enzyme allele frequency data from Norway, Sweden and Finland from mid 1970's. This would allow us to compare allele frequencies before and after the crash, and it is also possible to carry out DNA comparisons.

## An annotated list of species

### Genus *Chymomyza* Czerny, 1903

*C. costata* Zetterstedt, 1838

Alūksne, 14.06.2000. Leg. A.Saura. Deciduous forest. Suction from birch log.

In addition, we obtained some *C. fuscimana* and *C. caudatula* from Estonia (Escher et al., 2002a). These two species can be found on the same felled logs as *C. costata*. They engage in a length courtship behaviour and are easily collected. *C. costata* is one of the most common drosophilid flies in northern Europe (Hackman et al., 1970).

The larvae diapause, many details of which remain unknown (Riihimaa, 1996).

In addition, we found some *Chymomyza amoena* in Estonia and Lithuania (Escher et al., 2002a,b). These findings are the northernmost records for this North American species immigrant to Central and Southern Europe (e.g. Band et al., 1999). Unlike the forest *Chymomyza* species mentioned above, *C. amoena* is collected over garbage and fermenting bait.

### Genus *Drosophila* Fallén, 1823

#### Subgenus *Dorsilopha* Sturtevant, 1942

*D. busckii* Coquillett, 1901

This is a domestic species that breeds in all kinds of refuse like rotting potatoes. These flies can be cultured using *Drosophila* medium with e.g. some malt added.

Salaspils, 29.10.1990. Leg. A.Karpa. Inside a house.

#### Subgenus *Drosophila* Fallén, 1823

##### *funnebris* species group

*D. funnebris* (Fabricius, 1787)

A widespread, domestic species. It breeds in particular in pickled cucumbers etc. and is therefore "vinegar fly". They are easily collected using fermenting bait and are easy to culture.

Zosna, 07.08.1956; Jaundubulti, 08.09.1956. Leg. Z.Spuris. Inside houses.

##### *histrionis* species group

*D. histrionis* Meigen, 1830

These large flies are never common in Europe. The larvae live in mushrooms. Culturing may be possible using mushrooms in the medium.

Mazsalaca, 17.08.1989, 26.09.1989. Leg. A.Karpa. Pine forest; Blīdene, 25.08.2000. Leg. A.Saura. Deciduous forest. Fermenting bait; Engure, 10.07.2001. Leg. K.Vilks. Pine forest.

### ***immigrans* species group**

#### *D. immigrans* Sturtevant, 1921

A widespread, domestic species that lives in compost heaps etc. They are easily collected over garbage; they come to fermenting bait and are easy to culture.

Jēkabpils, 22.08.2000. Leg. A.Saura. River shore. Fermenting bait; Blīdene, 25.08.2000. Leg. A.Saura. Deciduous forest. Fermenting bait.

### ***quinaria* species group**

These small yellow flies breed in mushrooms and are easy to collect on them. They come to fermenting baits and are easy to culture. They are a stable constituent of the mushroom-breeding dipteran guild (Courtney et al., 1990).

#### *D. limbata* v. Roser, 1840

This is a rather uncommon species that is almost always obtained close to black currant (*Ribes nigrum*).

Nida, 07.09.1998. Leg. E.Juceviča. Meadow; Birzuli, 22.08.2000. Leg. A.Saura. Pine forest. Suction over mushroom.

#### *D. phalerata* Meigen, 1830

These flies are common all over Latvia. In the north they go up to about 65°N but in the south all the way to North Africa. They have adult diapause described by Geyspits and Simonenko (1970) and Muona and Lumme (1981).

We found them in August 2000 from the following localities: Cesvaine, Blīdene, Lilaste Rudbārži and Vidoga. Leg. A.Saura;

Kurzeme, Leg. B.Gimmerthal (1845); Engure, 16.08.1995, 6.08.1998, 14.08.2000. Leg. A.Karpa. Mixed forest. Kolka, 16.09.1998. Leg. E.Juceviča. Meadow.

#### *D. transversa* Fallén, 1823

This is a very common species all over Latvia everywhere where there are mushrooms. The distribution extends from Norway across Asia to North America. It is a northern species that is uncommon in southern and central Europe but goes in the north all the way up to 71°N.

We found them from: Birzuli, Blīdene, Cesvaine, Jēkabpils, Lilaste, Rudbārži, Vidoga. Leg. A.Saura; Teiči, 21.08.1993. Leg. V.Spuņģis. Bog; Kuiviži, 08.08.1996, 26.08.1997. Leg. A.Karpa. Randu meadows; Engure, 14.07.1997, 14.08.2000. Leg. A.Karpa. Mixed forest.

In addition, we found *D. kunzei* Duda, 1924 in Estonia and Lithuania (Escher, 2002a,b). These two are the northernmost records for this central European species that may turn out to live in Latvia as well.

### ***repleta* species group**

These species are commensals of human culture. Both come to fermenting baits and both are easy to culture.

#### *D. hydei* Sturtevant, 1921

A widespread, domestic species that breeds in compost heaps etc.

Salaspils, 29.10.1990. Leg. A.Karpa. Indoors; Jēkabpils, 22.08.2000. Leg. A.Saura. River shore. Fermenting bait.

#### *D. repleta* Wollaston, 1858

A widespread, domestic species that breeds in urine wells of farmhouses etc. (Lakovaara, Itämies, 1994).

Salaspils, 29.09.1990, 21.08.1998, 20.08.1999. Leg. A.Karpa. Indoors.

***testacea* species group**

These small flies breed in mushrooms and are easily collected over them. They come to fermenting baits and can be cultured with *Drosophila* medium. Handling them is, however, difficult as they are very sensitive to ether. An interesting feature is that the overwintered flies are black and later in the season all appear to be pale yellow.

*D. testacea* v. Roser, 1840

Blīdene, 25.08.2000. Leg. A.Saura. Deciduous forest. Fermenting bait; Lilaste, 25.08.2000. Leg. A.Saura. Pine forest. Suction over mushroom.

**Subgenus *Hirtodrosophila* Duda, 1938**

These flies are rather uncommon. They come to fermenting baits. The larvae live in mushrooms.

*D. cameraria* Haliday, 1833

Kuiviži, 08.08.1996, 30.06.1997. Leg. A.Karpa. Randu meadows.

**Subgenus *Lordiphosa* Basden, 1961**

*D. fenestrarum* Fallén, 1823

These flies are common but they are seldom attracted to fermenting baits.

Kjavi, 20.06.1991. Leg. A.Karpa. Meadow; Kolka, 16.09.1998. Leg. E.Juceviča. Meadow.

**Subgenus *Scaptodrosophila* Duda, 1924**

These flies come to fermenting baits but are rather difficult to culture because of a larval diapause (as well as a possible adult one as well), the details of which are unknown.

*D. deflexa* Duda, 1924

Salaspils, 25.07.1996. Leg. A.Karpa. Inside a house. Kolka, 08.09.1998. Leg. E.Juceviča. Meadow; Jēkabpils, 22.08.2000. Leg. A.Saura. River shore. Fermenting bait.

*D. rufifrons* Loew, 1873

Engure, 22.06.1995. Leg. A.Karpa. Pine forest.

**Subgenus *Sophophora* Sturtevant, 1939*****melanogaster* species group / *melanogaster* subgroup**

*D. melanogaster* Meigen, 1830

A widespread, domestic species. Comes to fermenting baits, and is easy to culture. Breeds in all kinds of garbage; mostly rotting fruits etc. They fly around inside shops and stores throughout the year.

Salaspils, 10.08.1990, 17.09.1999, 10.08.2000. Leg. A.Karpa. Indoors; Blīdene, 25.08.2000. Leg. A.Saura. Deciduous forest. Fermenting bait; Jēkabpils, 22.08.2000. Leg. A.Saura. River shore. Very abundant over fermenting bait.

We expect that *D. simulans* Sturtevant, 1919 will be found in Latvia. It is very similar to *D. melanogaster* but the males can be distinguished. It is not as common as *D. melanogaster* in northern Europe. Collecting flies from stores etc. indoors localities will probably yield some *D. simulans*.

***obscura* species group**

This is a group of black flies; the underside of the abdomen of females is white and that of the males is red. All species found in Latvia thus far are indifferent to human culture. The breeding sites are more or less unknown. This is rather astonishing, since many species are very common and

much of evolutionary genetics is based on observations on these flies.

*D. bifasciata* Pomini, 1940

This species is common in northernmost Europe. It is very widely distributed; from Sicily to Lapland and to Japan in the east (Saura, 1974).

Teiči. 20.08.1993. Leg. V.Spuņģis. Bog.

*D. obscura* Fallén, 1823

These flies are widespread and common (Lakovaara, Saura, 1971); in fact they were by far the most common representatives in Estonia in localities where we expected to find *D. subobscura*. They were not equally frequent in Latvia.

Cesvaine, 22.08.2000. Leg. A.Saura. Mixed forest. Fermenting bait. Blīdene, 25.08.2000. Leg. A.Saura. Deciduous forest. Fermenting bait.

*D. subobscura* Collin, 1936

In comparison to the former, this is a southern species going to about 65°N in the North and to Sahara in the South (Saura, 1995). There is a study on the relationship of the genetic load and the Chernobyl incident (Saura et al., 1998).

Teiči, 20.08.1993. Leg. V.Spuņģis. Bog; Jēkabpils, 22.08.2000. Leg. A.Saura. River shore. Fermenting bait; Nīca, 24.08.2000. Leg. A.Saura. Village. Fermenting bait; Blīdene, 25.08.2000. Leg. A.Saura. Deciduous forest. Fermenting bait.

*D. tristis* Fallén, 1823

This is a southern species that goes to central Sweden (about 60°N) in the North; it has not been found in Finland. We did not find them in Estonia either. The males have blackish wingtips and are easily recognized among a mass of black flies.

Jēkabpils, 22.08.2000. Leg. A.Saura. River shore. Fermenting bait.

**Genus *Gitona* Meigen, 1830**

*G. distigma* Meigen, 1830

These flies are widespread in Europe. They do not come to fermenting baits.

Salaspils, 14.09.1999. Leg. A.Karpa. In house.

**Genus *Leucophenga* Mik, 1886**

This is a large genus of the family Drosophilidae. The adults come to fermenting baits. The larvae live in mushrooms.

*L. maculata* (Dufour, 1839)

Engure, 22.06.1995. Leg. A.Karpa. Meadow.

*L. quinque maculata* Strobl, 1893

This seems to be a northern species that is nowhere common.

Blīdene, 25.08.2000. Leg. A.Saura. Deciduous forest. Fermenting bait.

**Genus *Scaptomyza* Hardy, 1849**

Hackman (1959) has written a monograph on this large genus. Most species have a very wide distribution. Davis (2000) has shown that the genus originates from *Drosophila* in the Hawaiian islands. This is an instance in biogeography, where an insular (originating from the most isolated archipelago in the world) form has succeeded in colonizing the world. This is even more remarkable, as the larvae of most species are leaf miners of Caryophyllaceae etc. Only *S. pallida* is a commensal of human culture.

**Subgenus *Scaptomyza* Hardy, 1850**

The species are very widespread.

*S. consimilis* Hackman, 1955

Riebezers, 13.07.1991. Leg. A.Karpa. Deciduous forest; Kuiviži, 17.07.1997. Leg. A.Karpa. Randu meadows; Mērsrags, 16.09.1998. Leg. E.Juceviča. Meadow; Engure, 16.09.1998. Leg. E.Juceviča. Meadow.

*S. graminum* (Fallén, 1823)

Lukna, 09.08.1990. Leg. A.Karpa. Deciduous forest; Korģīte, 10.06.1991. Leg. A.Karpa. River shore; Burtnieki, 17.06.1991. Leg. A.Karpa. Meadow; Kuiviži, 13.07.1997, 03.08.1997. Leg. A.Karpa. Randu meadows; Engure, 26.06.1997, 21.06.1999. Leg. A.Karpa. Mixed forest.

*S. griseola* Zetterstedt, 1847

Engure, 06.08.1998. Leg. A.Karpa. Meadow.

*S. impunctata* Frey, 1945

Mazsalaca, 21.08.1989. Leg. A.Karpa. Pine forest; Engure, 14.07.2000. Leg. A.Karpa. Meadow.

*S. flava* Fallén, 1823

This species has been reported as a pest on different Cruciferae etc.; evidently not so in Latvia.

Pūre, 07.08.2000. Leg. V.Petrova. Meadow.

**Subgenus *Parascaptomyza* Duda, 1924**

This is a commensal of culture that breeds in rotting vegetables etc.

*S. pallida* Zetterstedt, 1847

Vecdaugava, 18.06.1971. Leg. A.Karpa. Meadow; Inčupe, 14.07.1974. Leg. A.Karpa. Meadow; Mazsalaca, 10.10.1989, 26.04.1991. Leg. A.Karpa. Pine forest; Teiči, 19.08.1991, 20.10.1993. Leg. V.Spunģis.

Bog; Kuiviži, 28.06.1994, 09.07.1999. Leg. A.Karpa. Randu meadows; Engure, 06.08.1998. Leg. A.Karpa. Pine forest, mixed forest, meadow; Jēkabpils, 22.08.2000. Leg. A.Saura. River shore. Fermenting bait; Lilaste, 25.08.2000. Leg. A.Saura. Pine forest. Suction.

**Kopsavilkums**

Baltijas valstis pašreiz ir baltais plankums drozofilu izpētes ziņā Eiropā. Lai uzlabotu stāvokli, 2000. gada vasarā tika veiktas divas ekspedīcijas trijās Baltijas valstīs. Pirmā ekspedīcija tika veikta agri pavasarī, lai ievāktu ģints *Chymomyza* mušas, otrā – augusta beigās, lai iegūtu uz sēnēm dzīvojošās mušas.

Viens no interesantākiem atradumiem Igaunijā un Lietuvā ir *Chymomyza amoena*. Šī Amerikas suga nesen ienākusi no Dienvideiropas. Jāpiemin arī relatīvi retās sugas *D. subobscura* atradumi un *D. virilis* sugu grupas trūkums.

Pavisam ekspedīciju laikā tika ievāktas 15 Drosophylidae dzimtas mušu sugas. Sugu sarakstā pievienots LU Bioloģijas institūta kolekcijās esošais materiāls, kopā 29 sugas.

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