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.

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 last 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 Umeå University in Sweden. The material was determined at the dept. of Molecular Biology in Umeå 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
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.

Subgenus Drosophila Fallén, 1823

funebris species group

D. funebris (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.

histrio species group

D. histrio Meigen, 1830
These large flies are never common in Europe. The larvae live in mushrooms. Culturing may be possible using mushrooms in the medium.

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.


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 diptaran guild (Courtney et all., 1990).

*D. limbata* v. Roser, 1840

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


*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).


*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.


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.


*D. repleta* Wollaston, 1858

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

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

Subgenus Hirtodrosophila Duda, 1938

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

D. cameraria Haliday, 1833

Subgenus Lordiphosa Basden, 1961

D. fenestrarum Fallén, 1823
These flies are common but they are seldom attracted to fermenting baits.

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

D. rufifrons Loew, 1873

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.


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 undersize 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).  

**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.  

**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 all., 1998).  

**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.  

**Genus Gitona** Meigen, 1830

*G. distigma* Meigen, 1830  
These flies are widespread in Europe. They do not come to fermenting baits.  

**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)  

**L. quinquemaculata** Strobl, 1893  
This seems to be a northern species that is nowhere common.  

**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

**S. graminum** (Fallén, 1823)

**S. griseola** Zetterstedt, 1847

**S. impunctata** Frey, 1945

**S. flava** Fallén, 1823
This species has been reported as a pest on different Cruciferae etc.; evidently not so in Latvia.

**Subgenus Parascaptomyza** Duda, 1924
This is a commensal of culture that breeds in rotting vegetables etc.

**S. pallida** Zetterstedt, 1847

**Kopsavilkums**

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

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

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References


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