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**Drosophila Survey of Hokkaido, XXXI.
Microdistribution of Drosophilid Flies
in the Vicinity of the Stream**

By

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(With 2 Text-figures and 1 Table)

Ecological methods have been used in analysing the natural population of drosophilid flies (Dobzhansky 1948, Herting 1955, Dyson-Hudson 1956, Paik 1958, Burla 1961, Kaneko and Tokumitsu 1963). Distribution of drosophilid flies in various environments in Hokkaido has been clarified through the series of surveys "Drosophila Survey of Hokkaido" by Momma and his collaborators (1954-1973).

The necessity has also arisen for investigation of drosophilid microdistribution which differs from micro-environments such as forest, stream side and open land. Toda (1973b) reported microdistribution of drosophilid flies at forest and grassland.

However, analysis of habitat of each drosophilid species and its connection with their life history is still insufficient.

We have found by experience that the constitution of drosophilid population differs according to the distance from a stream. This paper deals with microdistribution observed in the vicinity of the streams at three localities near Sapporo City.

Before going further, the present author wishes to express his sincere thanks to Prof. Eizi Momma for his pertinent guidance in the course of this study and for reading through the manuscript. Cordial thanks are also due to Messrs. Masahito T. Kimura and Masanori J. Toda for their kind advice.

Area studied

Three different streams were selected at locations in Jozankei, Moiwa and Nopporo which are in the suburbs of Sapporo City (cf. Toda 1973a).

Jozankei is located about 20 km southwest of the center of Sapporo City. At this location, the survey was carried out along the stream side of the upper

part of Toyohira River. This stream is about 10 m in width and has a 15 m dry river bed, and some shrubs were observed about 15 m from the stream. Further than 15 m from the stream, there were *Quercus crispula*, *Acer palmatum*, etc., and they formed the stream side forest. The undergrowth layers were very sparse, and here and there fallen leaves covered the ground.

The Moiwa studied area was located at the foot of Mt. Moiwa located in the southwest of Sapporo City. This forest has been under government protection as a natural forest. It consists of deciduous broad-leaved trees such as *Cercidiphyllum japonicum*, *Acer mono*, *Ulmus laciniata* and *Acer palmatum*. The stream here is very narrow and trickles throughout the year, and is canopied with many kinds of trees. Undergrowth layers at the stream side consist of many *Sasa senanensis*, *Pachysandra terminalis* and some kinds of moss.

Nopporo is located about 12 km northeast of the center of Sapporo City. The area studied was by a stream in the Nopporo Natural Forest. This streamlet is about 1 m in width, which is somewhat changeable from dry season to wet season. The Natural Forest consists of deciduous broad-leaved trees such as *Cercidiphyllum japonicum*, *Acer mono*, *Ulmus laciniata* and *Acer palmatum*, and some coniferous trees. Many *Sasa senanensis* are observed in the undergrowth layers and *Viburnum furcatum*, *Pachysandra terminalis* and *Hydrangea macrophylla*, etc., occur sparsely.

Collecting method

In 1974 collections were made at Jozankei and Moiwa from July to October and at Nopporo from May to October. All three localities are several hundred meters distant from human habitation. The collections were carried out with the use of small containers baited with fermenting banana. Dry milk cans about 2100 cc in capacity were used as containers. Six traps were set at intervals of 0 m, 5 m, 10 m, 15 m, 25 m and 50 m from the stream at each locality. These traps were suspended with strings from the branches about 80 cm above the ground. However, 2 traps nearest the stream at Jozankei were set directly on the ground for the lack of such trees. Flies collected with a polyethylene sack covering the mouth of the containers, and then transferred to glass vials containing 70% alcohol by means of a drawing pipe. They were collected once a month for two successive days at each locality. Collections were made at two hour intervals from 5:00 to 17:00, except October (from 7:00 to 17:00). These were made in the beginning of each month at Jozankei, in the middle of each month at Moiwa and in the end of each month at Nopporo.

Results

A total of 8,442 specimens was collected in the present survey. They represented 32 species belonging to 4 genera (Table 1). Among them, 5 common species were *D. coracina*, *D. ezoana*, *D. okadai*, *D. bifasciata* and *D. moriwakii* at

Table 1. Number of flies collected at three localities near Sapporo City.

Locality	Jozankei					Moiwa					Noppero						
	J	A	S	O	T	J	A	S	O	T	M	J	J	A	S	O	T
Species																	
<i>Amiota</i>																	
<i>variegata</i>	6	7	4	1	18	10	-	-	-	10	-	-	6	3	3	-	12
<i>Leucophenga</i>																	
<i>quinquemaculipennis</i>	-	-	-	-	-	2	-	-	-	2	-	-	-	-	20	-	20
<i>ornatipennis</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	2
<i>Chymomyza</i>																	
<i>caudatula</i>	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	1
<i>Drosophila</i>																	
<i>confusa</i>	2	-	1	-	3	220	24	17	13	274	114	6	26	24	102	1	273
<i>alboralis</i>	-	-	-	1	1	-	-	-	-	-	-	-	-	-	-	-	-
<i>quadrivittata</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	1
<i>nokogiri</i>	-	-	-	-	-	-	-	-	1	1	-	-	-	-	-	-	-
<i>coracina</i>	36	296	-	-	332	180	14	-	-	194	9	6	287	4	-	-	306
<i>bifasciata</i>	34	6	83	1	124	45	3	4	5	57	6	18	48	37	16	8	133
<i>imaii</i>	-	2	-	-	2	4	5	2	-	11	-	-	7	12	2	-	21
<i>suzukii</i>	-	-	21	3	24	-	1	-	2	3	-	-	2	2	28	13	45
<i>lutescens</i>	-	1	1	-	2	-	6	5	3	14	-	1	-	2	2	-	5
<i>melanogaster</i>	-	1	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-
<i>auraria</i>	3	5	4	4	16	-	-	-	-	-	1	-	11	2	6	1	21
<i>biauraria</i>	-	8	15	3	26	12	9	-	-	21	8	6	23	36	-	-	73
<i>testacea</i>	2	11	-	3	16	323	663	7	6	999	104	17	1,015	194	235	41	1,606
<i>nigromaculata</i>	-	-	2	4	6	11	34	2	4	51	1	2	41	4	81	18	147
<i>brachynephros</i>	1	-	4	11	16	2	4	5	1	12	9	1	13	4	116	34	177
<i>unispina</i>	-	-	-	15	15	10	5	10	42	67	-	2	15	3	19	21	60
<i>histrion</i>	-	-	3	1	4	6	38	5	6	55	1	10	2	4	21	-	38
<i>immigrans</i>	1	6	5	6	18	6	27	39	26	98	-	11	233	107	206	89	646
<i>ezoana</i>	9	76	56	80	221	-	-	-	-	-	-	-	-	-	-	-	-
<i>sordidula</i>	-	2	-	1	3	1	1	-	-	2	-	-	1	-	1	-	2
<i>pseudosordidula</i>	-	3	3	-	6	-	1	1	1	3	2	1	14	2	6	-	25
<i>lacertosa</i>	-	1	25	28	54	2	57	13	7	79	1	8	19	176	610	14	828
<i>moriwakii</i>	1	-	1	68	70	335	19	5	45	404	1	1	76	9	214	8	309
<i>okadai</i>	4	-	5	154	163	-	-	-	3	3	-	-	-	-	5	-	5
<i>neokadai</i>	-	-	8	48	56	-	-	-	-	-	-	-	-	-	22	-	22
<i>multispina</i>	-	-	-	-	-	4	-	-	-	4	-	-	-	-	1	-	1
<i>pengi</i>	3	1	6	-	10	-	4	-	-	4	1	10	9	21	44	-	85
<i>busckii</i>	-	-	-	-	-	2	-	-	-	2	-	-	-	-	-	1	1
Total	102	426	247	432	1,207	1,175	915	115	165	2,370	259	100	1,848	646	1,761	251	4,865

Jozankei; *D. testacea*, *D. moriwakii*, *D. confusa*, *D. coracina* and *D. immigrans* at Moiwa; and *D. testacea*, *D. lacertosa*, *D. immigrans*, *D. moriwakii* and *D. coracina* at Noppero. The constitution of drosophilid assemblage of each trap spot is shown in Fig. 1. Microdistribution in the vicinity of the stream was characterized by 4 species; *D. ezoana*, *D. lacertosa*, *D. okadai* and *D. neokadai*. They were collected in abundance close to the stream.

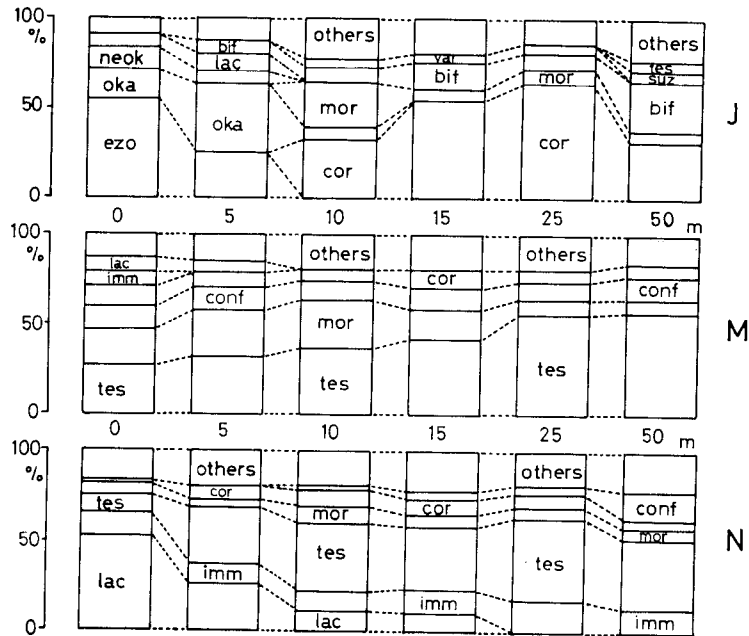


Fig. 1. Diagrams showing population constitution of drosophilid species at various distances from the stream. (J: Jozankei, M: Moiwa, N: Nopporo).

Jozankei

A total of 1,207 specimens was collected. They represented 25 species belonging to 2 genera. In July, *D. coracina* and *D. bifasciata* were the predominant species, constituting about 70% of the total specimens. A remarkable increase of flies of *D. coracina* and *D. ezoana* was observed in August, though *D. bifasciata* decreased. In September, *D. coracina* disappeared completely and *D. lacertosa* appeared in abundance. Further, a noticeable appearance of *D. suzukii* was newly found. *Drosophila bifasciata* was collected abundantly again in this month. A remarkable increase of specimens of *D. okadai* and *D. neokadai* was found close to the stream in October. A striking increase of *D. moriwakii* was also found in place of the decrease of *D. bifasciata* far from the stream.

Moiwa

A total of 2,370 specimens representing 27 species belonging to 3 genera was collected. In July, 4 species, *D. moriwakii*, *D. testacea*, *D. confusa* and *D. coracina*, were observed as predominant species, constituting about 90% of the specimens. In August, about 70% of the total collected specimens were *D. testacea*. *Drosophila moriwakii*, *D. coracina* and *D. confusa* abruptly decreased in number,

on the other hand, *D. lacertosa*, *D. histrio* and *D. nigromaculata* increased. In September, specimens of *D. testacea* almost disappeared and *D. immigrans* and *D. unispina* increased a little. In October, the number of *D. moriwakii* and *D. unispina* increased, constituting about 50% of the specimens. *Drosophila immigrans*, which was collected abundantly in September, was also collected fairly abundantly in October.

Nopporo

A total of 4,865 specimens comprising 31 species belonging to 4 genera was collected at this area. In May, *D. confusa* and *D. testacea* accounted for about 85% of the collected specimens. A remarkable decrease of drosophilid flies was observed in June. There were no abundant species. In July, an obvious increase of flies was seen in *D. testacea*, *D. coracina*, *D. moriwakii* and *D. immigrans*, and among these 4 species *D. testacea* accounted for about 55% of the total specimens. In August, there was a noticeable increase of *D. lacertosa* and a decrease of *D. coracina* and *D. moriwakii*. *Drosophila testacea* was still the most dominant species, though the collected number decreased remarkably compared with the last month. *Drosophila immigrans* was also collected fairly abundant. In September, *D. lacertosa* was collected, constituting about 30% of the total. *Drosophila confusa* showed a second peak in autumn. An increase in the number of the flies was observed in *D. brachynephros*, *D. suzukii*, *D. moriwakii*, *D. immigrans*, *D. testacea* and *D. nigromaculata*. In October, a small number of flies was collected and *D. immigrans*, *D. testacea*, and *D. brachynephros* were observed as common species.

Remarks

In the present survey, 12 species; *D. confusa*, *D. bifasciata*, *D. coracina*, *D. testacea*, *D. immigrans*, *D. brachynephros*, *D. unispina*, *D. ezoana*, *D. lacertosa*, *D. moriwakii*, *D. okadai* and *D. neokadai* were found as common species in the vicinity of the stream.

Microdistribution of these flies was characteristic according to the distance from the stream as shown in Fig. 1. Among 12 species, 4 ones (*D. ezoana*, *D. lacertosa*, *D. okadai* and *D. neokadai*) were found in abundance close to the stream as shown in Fig 2 a-d. Such a phenomenon shows that these 4 species especially prefer their habitats near a stream, and that they are dependent upon a wet environment.

Momma (1956) collected many specimens of *D. lacertosa* in the deciduous forest. Kaneko and Tokumitsu (1969) reported that each of these 4 species showed a characteristic altitudinal distribution. In the present survey, the difference in number among the 4 species observed at each locality seems to be affected by the various environments.

Drosophila moriwakii showed a peculiar habitat preference among the

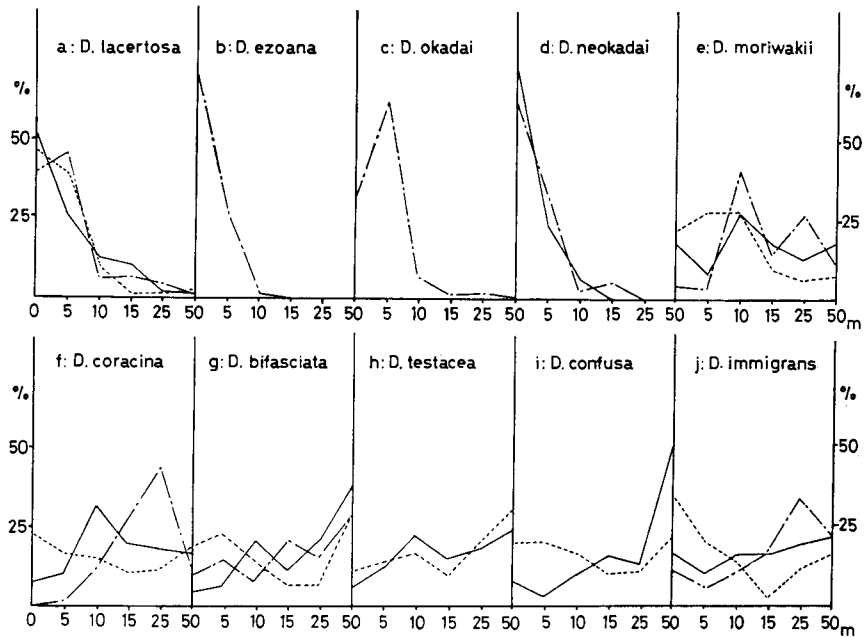


Fig. 2 Diagrams showing fluctuation of 10 common species according to the distance from the stream at three localities. (chain: Jozankei, broken: Moiwa, solid: Nopporo).

robusta species group (Fig. 2 e). Many flies of this species were found at every trap spot, showing their wider habitability. It is known that they are abundant in the deciduous forest as well as *D. lacertosa* (Momma 1957, Kaneko and Tokumitsu 1969). The results in the present survey did not conflict with such earlier reports.

Other members of the *robusta* species group, *D. sordidula* and *D. pseudosordidula*, were too rare to clarify their habitats. Ichijo's data (pers. comm.) suggest that these 2 species show almost the same pattern as *D. moriwakii*. Other common species did not seem to be so dependent on such a wet environment for their habitats (Fig. 2 f-j).

It is known that *D. testacea* was reared from decayed leaves and fungi (Kimura 1976). A few specimens of *D. testacea* were found at Jozankei where only some undergrowth layers and fungi were observed. *Drosophila coracina* and *D. bifasciata* were collected abundantly in the present survey, but the former was more restricted phenologically than the latter (Table 1). *Drosophila confusa* was also abundant in number in spring and in autumn, though it was reported as a spring type species (Toda 1973a).

Many specimens of *D. brachynephros* and *D. unispina* were collected in autumn, as they were reared from fungi (Kimura 1976). Many flies of *D.*

immigrans, which is known as a domestic species, were also found at Nopporo where they had been scarce before (Kaneko and Tokumitsu 1963). This suggests that this species has enlarged its habitat in recent years near Sapporo City.

Summary

The present survey was carried out in order to investigate microdistribution of drosophilid flies according to the distance from streams at three localities near Sapporo City in 1974. Characteristic microdistribution was shown by 4 species; *D. ezoana*, *D. lacertosa*, *D. okadai* and *D. neokadai*.

They have restricted habitats and increase in number nearer to the stream. *Drosophila moriwakii* showed a different habitat preference from the other *robusta* species without such habitat restriction. They were abundant not only in the vicinity of the stream but also in the forest. The common species, *D. confusa*, *D. coracina*, *D. bifasciata*, *D. testacea*, *D. brachynephros*, *D. unispina* and *D. immigrans* seem to exist independent of such a stream environment.

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