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Drosophila Survey of Hokkaido, X.

Drosophilidae from several localities of Hokkaido¹⁾

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(With 3 Text-figures and 5 Tables)

Cytotaxonomical and cytogenetical studies of *Drosophila* of Hokkaido were launched at Hokkaido University by Professor Sajiro Makino and his colleagues. During the past several years, investigations into the distributional and ecological features of *Drosophila* in Hokkaido have made considerable progress, thanks to extensive work accomplished and reported in nearly forty papers by Makino and his associates. Such work has resulted in a considerable accumulation of data contributing to *Drosophila* genetics on the cytotaxonomic basis. Momma (1957) summarized the data collected during the period from 1951 to 1956 by his own and co-workers' survey in Hokkaido, with particular reference to the habitats and distribution of drosophilid flies.

During the period from 1954 to 1958, the present author has actively collected and examined drosophilid flies in the following several localities of Hokkaido: Rishiri Island, Hakodate, Shakotan Peninsula and Shiretoko Peninsula. In addition a collection was made at Asamushi, Aomori Prefecture, Honshu. In the present paper, the author wishes to record the data so far gained from these collections.

The author is specially grateful to Professor Sajiro Makino, Hokkaido University, who directed this work with many valuable suggestions and revised the manuscript, also to Dr. Eizi Momma, and to Dr. Toyohi Okada, Tokyo Metropolitan University, for their invaluable advices and helpfulness. Cordial thanks should be extended for the kind assistance given by Mr. S. Muramatsu, Miss C. Iwai, and members of the Biological Association at the Otaru Fisheries High School, for the collection of specimens which were made available for this study.

1. Localities and method of collection

Hokkaido is the northernmost island of Japan located at the same latitude as the northern frontier of the Manchurian Subregion adjacent on the south of the Siberian Subregion in the Palaearctic Region. The collections of *Drosophila* were made in the following localities, Mt. Rishiri (1719 m. high) and Rishiri Is. (45° 11' N., 141° 14'E.) from 31st July to 10th August, 1956; Hakodate (41°46'N., 140° 44'E.) and Asamushi, Aomori Pref. (40°53'N., 140°52'E.) from 17th-20th August, 1954; Shakotan and the Shakotan Peninsula (43°21'N., 140°28'E.) from 22nd-28th July, 1958; and on Mt. Raus (1661 m high) and the Shiretoko Peninsula (44°05'N.,

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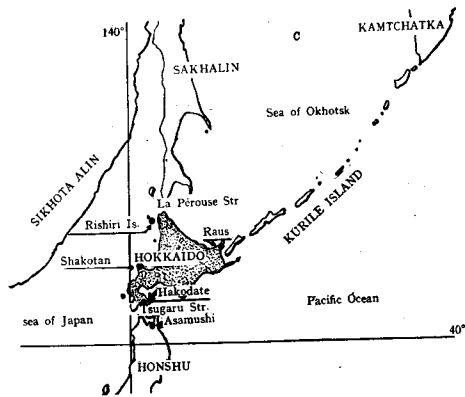


Fig. 1. Map showing Hokkaido and adjacent islands. Relative positions of the collecting stations are shown with black spots.

145°09'E.) from 7th-15th August, 1958. In Figure 1 are shown the localities as mentioned above.

The major part of the collections was made with the use of small containers which were baited with fermenting banana or other fermenting fruit such as tomato, peach, cantalop and watermelon, and bound with strings to the branches of bushes and trees. They were called "lures" by Spencer (1950). As the containers, use was made of either dry-milk cans about 660 cc in capacity, or paper beer cups about 180 cc in capacity, usually the latter. Flies obtained were generally drawn from the containers by means of a tubular tin-can collector (Takada 1954). By the use of traps as above described over 90 per cent of the flies here reported upon were captured. In addition a few species of flies were collected by means of net sweeping in various sorts of vegetation at Hakodate and Asamushi, since they show exhibit no interest in baits.

2. Drosophilidae from Mt. Rishiri in Rishiri Island, northern Hokkaido

From the 31st July to the 10th August, 1956, a preliminary survey of *Drosophila* was undertaken on Mt. Rishiri, an extinct volcano of konide type, situated in the central part of Rishiri Island lying near the northernmost point of Hokkaido, as shown in Figure 1. The traps baited with banana and tomato were set up at eight places at elevation intervals of about 200 m, three traps being placed on each point. The relationship between the altitude and the distribution of *Drosophila* species is diagrammatically shown in Figure 2. Table 1 gives numerical

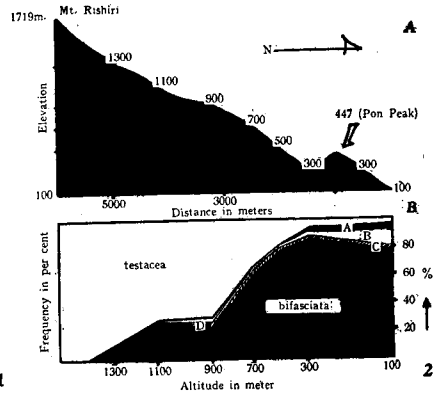


Fig. 2. Diagrams showing the relationship between the altitude and distribution of *Drosophila* species in Mt. Rishiri (1719 m high). (A): Sectioned view of Mt. Rishiri. (B): Elevational distribution of *Drosophila* species shown in frequency in Mt. Rishiri. A, *D. nigromaculata*. C, *D. histrio*. D, *D. makinoi*. B, other species.

data of *Drosophila* species obtained, showing the elevational distribution of species in Mt. Rishiri. In the following are given some notes on remarkable species obtained in this collection.

Table 1. Numerical data of *Drosophila* species obtained in Mt. Rishiri collection (Aug. 1956), showing an elevational distribution of flies.

Altitude (m)	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	Total
	0-100	-300	-500	-700	-900	-1100	-1300	-1719	
Vegetation	Forest zone (fir trees)			Shrub zone (birch trees)			Alpine plant zone		
Species									
<i>Parascaptomyza disticha</i>	2								2
<i>Drosophila histrioides</i>	1	1							2
<i>D. coracina</i>	1								1
<i>D. busckii</i>	2								2
<i>D. testacea</i>	3	5	16	24	47	30	23	16	164
<i>D. bifasciata</i>	56	63	72	43	15	11	2		262
<i>D. nigromaculata</i>	3	2	1		3				9
<i>D. unispina</i>	1	1							2
<i>D. makinoi</i>			1		4				5
<i>D. histrio</i>	2	1	2	2					7
<i>D. immigrans</i>			1						1
<i>D. funebris</i>	4								4
<i>D. lacertosa</i>				1					1
Total	75	73	93	70	69	41	25	16	462

Drosophila bifasciata Pomini: This species has been found to be one of the dominant species through out all seasons in northern Hokkaido (Takada 1957). It has been recorded from high lands in northern parts of Japan, Korea, Italy and Holland. A total of 262 specimens comprising 56 per cent of all flies collected in this survey were obtained in twenty traps placed at 20 to 1300 m altitude in fir, birch and alder woodlands. Twenty-six specimens obtained in four traps at 300 to 500 m altitude were pale brownish in bodily coloration, due probably to immediately preceding emergency. According to Basden (1956), the present species occurs in small numbers in Europe.

Drosophila testacea van Roser: This is a very common species with a wide distribution through Hokkaido (Okada 1956, Takada 1957). A large number of specimens were found in every place at every altitude and in various plant zones, such as those of forest, shrub and alpine plants.

Drosophila makinoi Okada: This is a species very rare in occurrence. Five specimens were obtained in three traps placed at 500 to 900 m elevation. The present species, as well as *D. (D.) cameraria* Haliday, belongs to the *melanderi* group, members of which are characterized by particular periphallid organs. Okada (1956) originally described the present species from Mt. Taisetsu, Hokkaido and Yatsugatake, Nagano Prefecture, Honshu. Takada (1954, 1957) recorded a related species, *D. cameraria*-like species, from Mt. Taisetsu and Akan, Hokkaido.

Table 2. Numerical data of *Drosophila* species from the collection in Hakodate with sweeping net (Aug., 1954).

Species	Female	Male	Total
<i>Parascaptomyza disticha</i>	184	226	410
<i>Scaptomyza graminum</i>	0	1	1
<i>S. polygonia</i>	21	43	64
<i>Drosophila nipponica</i>	8	9	17
<i>D. lutea</i>	0	2	2
<i>D. auraria</i> (type A)	40	88	128
<i>D. suzukii</i>	0	2	2
<i>D. brachynephoros</i>	1	0	1
<i>D. immigrans</i>	1	1	2
<i>D. histrio</i>	1	0	1
	Total		628

Table 3. Numerical data of *Drosophila* species from the collection in Asamushi with sweeping net (Aug., 1954).

Species	Female	Male	Total
<i>Parascaptomyza disticha</i>	72	61	133
<i>Scaptomyza graminum</i>	0	1	1
<i>S. polygonia</i>	2	3	5
<i>S. apicalis</i>	1	0	1
<i>Drosophila nipponica</i>	0	2	2
<i>D. lutea</i>	1	0	1
<i>D. auraria</i> (type A)	1	2	3
<i>D. auraria</i> (type B)	0	1	1
<i>D. nigromaculata</i>	1	0	1
	Total		148

3. Drosophilidae from Hakodate and Asamushi

Collections were made at various places neighbouring the city of Hakodate and near the Asamushi Marine Biological Station, Asamushi Aomori Prefecture from the 17th to 20th August, 1954. A large number of flies was obtained on various kinds of herbs by net sweeping. A total of 776 flies (628 flies in Hakodate and 148 flies in Asamushi), were obtained in the two localities. The following 13 species were represented: *Parascaptomyza disticha*, *Scaptomyza graminum*, *S. polygonia*, *S. apicalis*, *Drosophila nipponica*, *D. lutes*, *D. auraria* (type A), *D. auraria* (type B), *D. suzukii*, *D. histrio*, *D. immigrans*, *D. nigromaculata*, and *D. brachynephoros*. They live on various kinds of grasses. The species and numerical data from these collections are as shown in Tables 2 and 3. *Parascaptomyza disticha* is one of the cosmopolitan outdoor species. This is most predominant in the collections from both Hakodate and Asamushi, as seen in Table 3.

Among the above species recorded in these collections, noticeable is *Scaptomyza polygonia* Okada, since female specimens of it have not been described

from Hokkaido. Suzuki (1955) was first to collect this species in Sapporo. Okada (1956) described it on the basis of the male characters.

Twenty-one females and forty-three males of this species were collected in Hakodate, and two females and three males in Asamushi. It is, therefore, obvious that the present species has a rather wide distribution from the southern part of Hokkaido to the northern part of Honshu, between which the Tsugaru Strait lies. This species is particularly attracted to certain species of grasses such as *Trifolium* and *Polygonum*. The description of the female characters will be presented in another paper (Takada, in press).

Table 4. Numerical data of *Drosophila* species from the collection in Shakotan (July, 1958).

Species	Female	Male	Total
<i>Parascaptomyza disticha</i>	16	21	37
<i>Scaptomyza graminum</i>	12	1	13
<i>S. apicalis</i>	1	2	3
<i>S. polygonia</i>	0	1	1
<i>Drosophila coracina</i>	2	1	3
<i>D. histrioides</i>	6	6	12
<i>D. auraria</i> (type A)	36	50	86
<i>D. busckii</i>	3	8	11
<i>D. nipponica</i>	1	1	2
<i>D. suzukii</i>	0	2	2
<i>D. nigromaculata</i>	24	26	50
<i>D. brachynephoros</i>	4	3	7
<i>D. testacea</i>	2	3	5
<i>D. funebris</i>	18	21	39
<i>D. immigrans</i>	3	7	10
<i>D. virilis</i>	1	4	5
<i>D. lacertosa</i>	17	28	45
<i>D. sordidula</i>	1	1	2
	Total		334

4. Drosophilidae from the Shakotan Peninsula, western Hokkaido

The present author with assistance of three students made collections, mainly by the use of traps and sometimes by nets, in the vicinity of Shakotan, a town on the western coast of Shakotan Peninsula, from the 22nd to 28th July, 1958. In this preliminary collection, a total of 334 specimens was obtained, they comprised the following species: *Parascaptomyza disticha*, *Scaptomyza graminum*, *S. apicalis*, *S. polygonia* (only one male), *Drosophila coracina*, *D. histrioides*, *D. auraria* (type A), *D. busckii*, *D. nipponica*, *D. suzukii*, *D. nigromaculata*, *D. brachynephoros*, *D. testacea*, *D. funebris*, *D. immigrans*, *D. virilis*, *D. lacertosa*, and *D. sordidula*. The numerical data are given in Table 4. The predominant species are *D. auraria* (type A), *D. nigromaculata*, *D. lacertosa*, *D. funebris* and *Parascaptomyza disticha*.

5. Drosophilidae from Mt. Raus, Shiretoko Peninsula in the eastern extremity of Hokkaido

A survey of *Drosophila* was undertaken in the Shiretoko Peninsula from the 7th to 15th August, 1958, by the author with the aid of three students of the Biological Association at the Otaru Fisheries High School, Messrs. Sugiyama, Atsuya and Mitsuhashi, and some others. The major part of the collection was made on Mt. Raus by the use of traps with fermenting banana which were set up at ten places ranging in elevation from 150 to 1000 m at intervals of about 100 m elevation, two traps being placed at each spot. The species of flies and their number obtained are listed in Table 5. A total of 419 flies belonging to 13 species were collected, from amongst which *D. bifasciata* was found to be the most dominant species so far as the present survey shows.

Table 5. Numerical data of *Drosophila* species from the collection Mt. Raus, Shiretoko Peninsula (Aug., 1958).

Species	Female	Male	Total
<i>Leucophenga</i> sp.	0	1	1
<i>Drosophila coracina</i>	0	3	3
<i>D. bifasciata</i> *	50	150	200
<i>D. helvetica</i>	2	3	5
<i>D. testacea</i>	30	32	62
<i>D. nigromaculata</i>	31	8	39
<i>D. brachynephoros</i>	3	1	4
<i>D. funebris</i>	4	3	7
<i>D. moriwakii</i>	22	24	46
<i>D. lacertosa</i>	6	15	21
<i>D. okadai</i> **	3	5	8
<i>D. ezoana</i>	14	7	21
<i>D. histrio</i>	1	1	2
	Total		419

* Two color types, pale and yellowish, are included.

** This is a new species, the description of which will be given in another paper (Takada, 1959 in press).

Among the flies here obtained there are eight specimens of the genus *Drosophila* which have not been described as yet; they closely resemble, but clearly differ from *D. lacertosa* Okada. After close examination it became evident that the species in question is a member of the *robusta* group, and new to science. The name proposed for it is *D. okadai*, the description of which will be given elsewhere in the near future (Takada in press).

6. Notes on the diurnal activity of *Drosophila* on Mt. Raus

Observations of flies were made with five traps baited with yeasted banana for three days at a place near Raus Hot Spring (150 m elevation), with special

regard to the diurnal activity. A total of 226 flies was obtained which classified into the following six species: *Drosophila testacea*, *D. bifasciata*, *D. nigromaculata*, *D. moriwakii*, *D. lacertosa* and *D. ezoana*. All flies showed a clear bimodality in diurnal activity, having the first high peak before sunrise, and the second low peak after sunset, as shown in Figure 3.

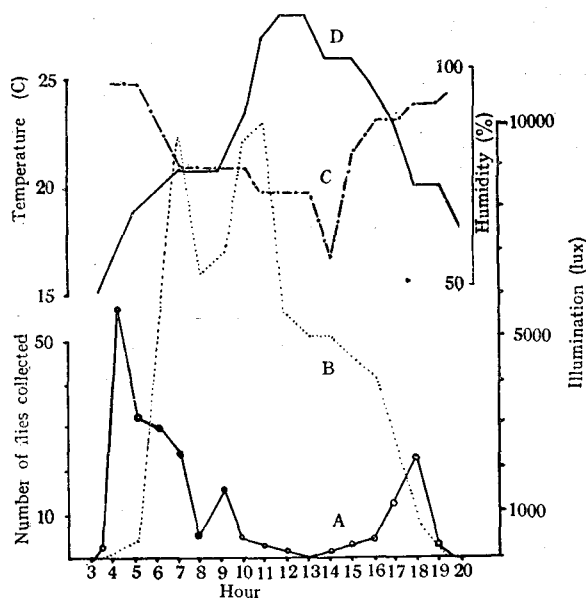


Fig. 3. Illustrating the diurnal activity of *Drosophila* observed in Raus, Hokkaido (Aug. 1958). A. Number of flies collected. B. Illumination. C. Humidity. D. Temperature.

Morikawi, Okada, Ohba and Kurokawa (1952) observed diurnal behavior of *Drosophila* at Akkeshi, Hokkaido and showed that a peak appears usually in early morning without there being another peak before sunset. Ishihara (1955) dealt with the diurnal activity of *Drosophila* in Sapporo and Mt. Taisetsu, Hokkaido and indicated that there occurred a bimodal activity with two peaks formed in the morning and evening, thus a considerable influence of light upon their activity was suggested. According to Nozawa (1956) who studied the diurnal behavior of *Drosophila* in a latifoliate forest near Anjo, Aichi Prefecture, there are a high peak in the morning and a low peak in the evening. Based on the results of the observations in Raus, a suggestion is made that there may exist two factors which influence the diurnal activity of *Drosophila*: they are illumination under 50 Lux, and humidity more than 95 per cent. Evidence presented by *D. ezoana* may offer data supporting the above considerations. Takada and Okada (1958) reported that *D. ezoana* is well adapted to the cold and northern environments in Hokkaido. The occurrence of this species is restricted to the moist region of Hokkaido, being always found in the riverside

areas. Many specimens were collected in the summer of 1958 from a riverside locality (150 m elevation) on Mt. Raus, where butter-burs (*Petasites japonicus*) and smartweeds (*Polygonum Reynoutria*) were growing. *D. ezoana* was attracted to traps under 50 Lux of illumination and about 100 per cent of humidity, before sunrise and after sunset.

7. Summary

Collections of drosophilid flies were undertaken in Rishiri, Hakodate, Shakotan, and Shiretoko in Hokkaido, and at Asamushi in Honshu during a period ranging from 1954 to 1958; data obtained from the collections are presented in this paper.

A total of 1991 specimens was obtained, mainly by the use of traps baited with fermenting fruit. They were classified into 29 species of Drosophilidae as follows: *Leucophenga* sp., *Parascaptomyza disticha*, *Scaptomyza graminum*, *S. apicalis*, *S. polygonia*, *Drosophila coracina*, *D. histrioides*, *D. nipponica*, *D. suzukii*, *D. auraria* (type A and type B), *D. lutea*, *D. bifasciata*, *D. helvetica*, *D. busckii*, *D. testacea*, *D. nigromaculata*, *D. brachynephoros*, *D. unispina*, *D. virilis*, *D. ezoana*, *D. immigrans*, *D. histrio*, *D. funebris*, *D. moriwakii*, *D. makinoi*, *D. sordidula*, *D. lacertosa* and *D. okadai*.

Among them the following five species were found to be rare in occurrence: *Scaptomyza polygonia*, *Drosophila helvetica* (*affinis* species-subgroup), *D. ezoana* (*virilis* species-group), *D. makinoi* (*melanderi* species-group) and *D. okadai* (*robusta* species-group).

Notes on the diurnal activity of flies observed in Raus were given.

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