

**Notes on the black flies investigated in Okushiri Island,  
Hokkaido, Japan and their blood sources  
(Diptera : Simuliidae)<sup>1)</sup>**

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(May, 1987)

**Introduction**

Okushiri Island is the second largest isolated island of Hokkaido, and is one of a notable island for the faunal studies of many kinds of insects.

The tabanid fly fauna have been reported 1), 6), and these are the only records for the blood sucking insects of Okushiri Island. The other families of blood sucking insects are still unknown.

The authors investigated the black flies by the use of CO<sub>2</sub>-lured mosquito-net traps at 6 localities of the island 3 times during the period from June to August in 1986.

In this paper, the authors describe the numbers and ratios of black fly species collected in the investigations and the blood sucking behaviour of collected black flies with human, domestic animals and birds determined by means of the enzyme-linked immunosorbent assay (ELISA).

**Materials and Methods**

*1. Faunal study*

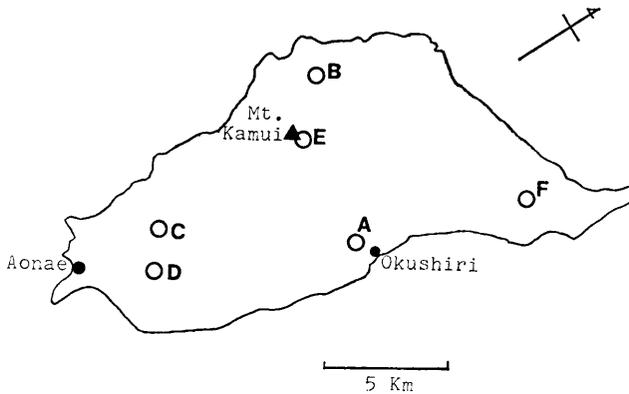
The investigations were made 3 times from June to August in 1986 as shown in Table 1. The collections were made at the 6 points in the island (Fig. 1) by the use of CO<sub>2</sub>-lured mosquito-net traps for 90 min each. The CO<sub>2</sub> was emitted 3,000 l/min into the mosquito-net as an attractant.

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- 1) 本研究は一部財団法人栗林育英学術財団研究助成金の援助のもとに行われた。
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**Table 1.** Collecting date and time in the investigation

Point	1st	2nd	3rd
A Tsurikake-R.	June 27. 14:00-	July 18. 17:40-	—
B Horonaigawa	June 27. 17:15-	July 18. 15:05-	—
C Tomisato	June 28. 8:40-	July 19. 17:20-	Aug. 2. 17:20-
D Aonae-R.	June 28. 10:40-	July 19. 11:45-	Aug. 2. 15:20-
E Kamui-yama	June 28. 14:00-	July 19. 14:30-	Aug. 2. 12:45-
F Miyatsu	June 28. 16:00-	July 18. 12:30-	—

each collection continued 90 min.



**Fig. 1.** Map of Okushiri Isl.  
A-F show collecting localities

The environmental characteristics of the points are shown as follows : A (Tsurikake-R.) : in the mixed forest of broadleaf trees and Japanese cedars at the lower reaches of Tsurikake River. B (Horonaigawa) : in the broadleaf tree forest of the valley of Horonai River. C (Yoneoka) : in the shelter wood stand of the Yoneoka pasture, where cattle and horses are grazing. D (Tomisato) : at the valley of Aonae river, broadleaf tree forests and Japanese cedar forest are developed on both sides of the river. E (Kamuiyama) : in the beech forest halfway up the Mt. Kamui-yama, the highest mountain of the island. F (Miyatsu) : in the Japanese cedar forest and the ground cover is mainly marsh vegetation.

## 2. Blood-meal identification

The blood-meal sources were identified by means of enzymelinked immunosorbent assay (ELISA). The methodology as adapted for this study was described earlier (5, 7), except for the following modifications : 1% gelatin dissolved in phosphate buffered saline (PBS), pH=7.2 was used for the coating buffer.

## Results and Discussion

### 1. Faunal study

The weather conditions at Okushiri in Okushiri Island are shown in Fig. 2. The days of investigation were almost fine or somewhat cloudy.

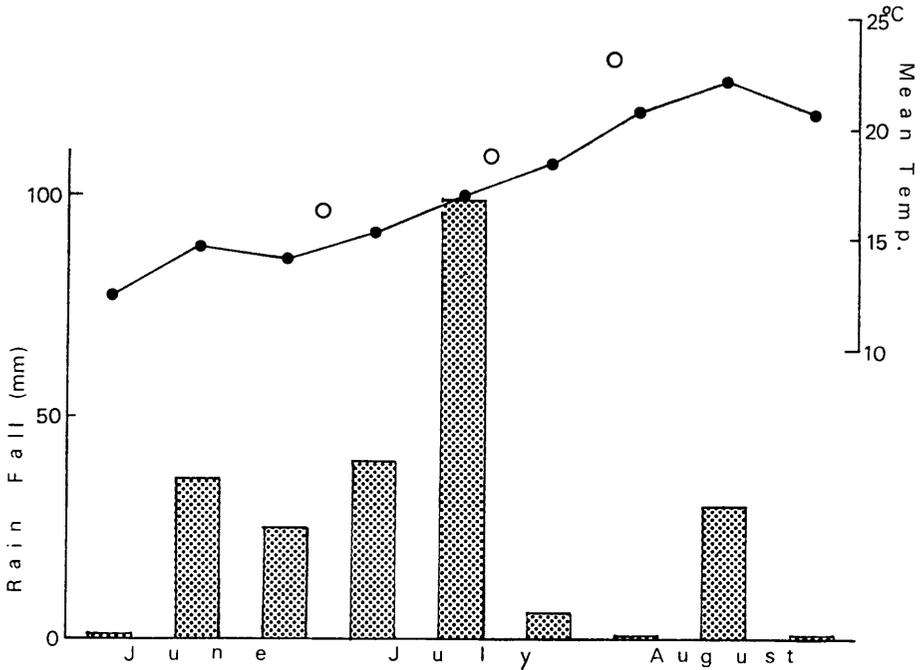


Fig. 2. Mean temperature and rain fall of 10 days at Okushiri in 1986.

○ show mean temperatures on the investigated days

In total of 222 black flies involving 6 species of 3 genera were collected in this investigation (Table 2). Among them, *Simulium* was most predominant, consisting of 3 species and 128 individuals. The second was *Prosimulium* (1 species, 85 indiv.), followed by *Gomphostilbia* (2 species, 9 indiv.).

*Simulium rufibasis* was the most predominant species which accounted for 50.5 percent (112 indiv.), *Prosimulium yezoense* being the next (38.3%, 85 indiv.). The other species are a few isolated individuals collected.

*S. rufibasis* are known to be distributed mainly in the central part of Hokkaido, but are not known from south western Hokkaido 2). However, this species have a wide distribution in Japan and Oriental regions, thus the predominance of this species in Okushiri Island is not strange.

The numbers and ratios of collected black fly species varied at each collecting points and this may be due to the difference of collecting times and to the environment of the collecting points.

**Table 2.** Species and numbers of black flies collected at 6 localities in Okushiri Isl. in summer period of 1986.

Date	Species	A	B	C	D	E	F	Total
June 23, 24	<i>P. yesoense</i>	7	0	1	25	13	7	53
	<i>G. shogakii</i>	0	0	0	2	0	0	2
	<i>G. sp.</i>	0	3	0	0	0	0	3
	<i>S. japonicum</i>	0	0	0	0	14	0	14
	<i>S. rufibasis</i>	2	1	4	3	32	1	43
	<i>S. suzukii</i>	1	0	0	0	0	0	1
	total	10	4	5	30	59	8	116
July 18, 19	<i>P. yesoense</i>	24	6	1	1	0	0	32
	<i>G. shogakii</i>	1	2	0	0	1	0	4
	<i>S. rufibasis</i>	1	1	0	0	12	0	14
	<i>S. suzukii</i>	1	0	0	0	0	0	1
	total	27	9	1	1	13	0	51
Aug. 2	<i>S. rufibasis</i>	—	—	55	0	0	—	55
	Total	37	13	61	31	72	8	222

This results are limited to a single year of investigation, therefore, the black fly fauna of this island must be investigated in detail in the future.

## 2. Blood source identification

The whole 6 species were observed to have blood-meals in their alimentary canals (Table 3). Of these species, *G. sp.* and *S. suzukii* could not be identified their blood sources.

**Table 3.** Number and percent of black flies reacted their blood-meals with anti-human and animal sera

species	Number of		No. & % black flies reacted against				Total
	collected	examined	anti-bovine	anti-horse	anti-human	anti-birds	
<i>P. yesoense</i>	85	69	4 (5.8)	13 (18.8)	15 (21.7)	0 (0.0)	32 (46.4)
<i>G. shogakii</i>	6	5	0 (0.0)	0 (0.0)	0 (0.0)	1 (16.6)	1 (16.6)
<i>G. sp.</i>	3	3	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
<i>S. japonicum</i>	14	13	1 (7.7)	0 (0.0)	2 (15.4)	0 (0.0)	3 (23.1)
<i>S. rufibasis</i>	112	101	8 (7.9)	2 (2.0)	28 (27.7)	0 (0.0)	38 (37.6)
<i>S. suzukii</i>	2	0	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Total	222	193	13 (6.7)	15 (7.8)	45 (23.3)	1 (0.5)	73 (37.8)

The two species, namely *P. yezoense* and *S. rufibasis*, were determined to attack both human and domestic animals: cattle and horse. *S. japonicum* was determined to attack human and cattle. And *G. shogakii* was determined to attack birds (Table 4).

The former three species are observed to have S-type tarsal claws and the black flies having S-type tarsal claws have been considered to be mammalophilic blood suckers 3), 4), therefore, the three species are regarded to be main black fly pests for both human and domestic animals in Okushiri Island. In spring, *P. yezoense* and *S. japonicum* may be dominant and during late spring to summer, *S. rufibasis* may be the dominant species to attack both human and domestic animals.

In spite of the fact that *G. shogakii* has T-type tarsal claws and is estimated to have ornithophilic blood sucking behaviour 3), 4), the blood source animals have been unknown for the long time 2). In the present study, despite of the data on only one individual, the fact that the blood-meal of the species is determined to be avian blood is a good support of the estimation. Furthermore, this species is the first species having T-type tarsal claws to be determined to suck birds by means of immunological techniques in Japan.

### Summary

In a total of 222 individuals of black flies belonging to 6 species and 3 genera were collected by means of CO<sub>2</sub>-lured mosquito-net traps at 6 localities of Okushiri Island 3 times during June to August in 1986. Of these species, *Simulium rufibasis* was the most dominant species followed by *Prosimulium yezoense*.

The blood-meals of collected black flies were determined immuno-serologically by the use of enzyme linked immunosorbent assay. The blood-meals of *S. rufibasis* and *P. yezoense* were determined to be human, cattle and horse bloods. That of *S. japonicum* was determined to be human and cattle blood. And that of *Gomphostilbia shogakii* was determined to be birds blood, and this is the first determination in which blood-meals of the black fly with T-type tarsal claws were identified as birds blood in Japan.

### References

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## 要 約

1986年6月から8月にかけて3回、北海道渡島半島沖の日本海に浮かぶ奥尻島内6箇所で炭酸ガスを誘引源とする蚊帳トラップ法で吸血性ブユ類成虫の採集調査を行った。

その結果、アカクラアシマダラブユを最優占種とする3属6種合計222個体を得た。

得られた個体の内 blood-meal を有する個体につきその blood-meal の同定を酵素抗体法を用いて、免疫学的に行った。

その結果、アカクラアシマダラブユ、キアシオオブユの2種で抗ヒト、抗ウシ、抗ウマ血清に、アシマダラブユで抗ヒトと抗ウシ血清に陽性反応が観察された。また、クジツノマユブユで、抗鳥類血清に陽性反応が観察されたが、これは、跗節の爪に強大な歯を持つブユとしては日本における初めての記録である。