STUDIES ON SUCKING LICE (ANOPLURA) IN JAPAN

PART IV. TAXONOMICAL AND ECOLOGICAL STUDIES ON MURINE LICE

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Kiyotoshi KANEKO

(Department of Medical Zoology, School of Medicine, Tokyo Medical and Dental University, Bunkyo-ku, Tokyo)

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I. INTRODUCTION

In recent years, studies on the rural rackettsiosis have been actively pursued in this country. The collection of field rats, often required for this study, simultaneously brought a collection of large numbers of murine lice. The murine lice, differing from trombiculid mites, fleas and bdellonyssid mites, were scarcely thought to have the possibility of transmitting any kinds of human infectious diseases, as they neither infest on man nor engorge the human blood. The murine lice take the role of vectors of some infectious agents among rats in natural environment and may have a possibility of spreading human infectious diseases indirectly. Consequently, the relationship between insect vectors and rats in infectious diseases, especially the relationship of various kinds of murine lice to rats, are subjects of importance parallel with that between vectors and man for studying the epidemiology of certain kinds of human infectious diseases.

Though some knowledge of lice in Japan was gained by Uchida and a few others, the murine lice had so far been little investigated. In the last 10 years, Sasa (1950, 1954) first reported 6 species of murine lice belonging to 2 genera and described *Hoplopleura akanezumi* as a new species. Suyemoto & Scanlon (1953) studied the murine lice collected from the foot hills of Mt. Fuji, Ono & Hasegawa recorded 6 species of lice belonging to 2 genera from the field rats and mice of Hokkaido in 1955. And the present author recorded 11 species of murine lice from this country, of which 2 were described as new.

The present series of studies are an attempt to resolve the relationship of murine lice to a few kinds of rat borne diseases and the present paper deals with the taxonomical and ecological studies on murine lice found on various areas and adjacent islands covering whole districts of this country.

II. FIELD COLLECTION

Snap traps of small (10×6cm) and middle (17×10cm) sizes were usually used for trapping the small, wild, animal hosts. Wire-cage traps

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were occasionally employed to capture these animals alive. Sucking lice were separated from the bodies of trapped animals with a dissecting needle and then mounted in a Gum-chloral solution on a glass slide. When the bodies of lice were full of blood, the specimens were punctured on the ventral surface of abdominal segments with a fine needle. And then they were heated in a 10% KOH solution and the body contents were pressed out with forceps, then washed in water and placed in a 1% acetic acid solution for at least half an hour, and then washed again in water and mounted with the Gum-chloral solution. Microscopical identification of these mounted specimens has been precisely performed under middle magnification.

As for the scentific names of the host animals, the author followed the opinion of Dr. Yoshinori Imaizumi, a member of the National Science Museum (Tokyo).

III. CLASSIFICATION OF MURINE LICE

As for the classification of murine lice, the author followed the system proposed by Dr. G. F. Ferris.

Phylum Arthropoda
Class Insecta (Hexapoda)
Order Anoplura
Family Hoplopleuridae
Subfamily Hoplopleurinae — Genus *Hoplopleura*
Subfamily Polyplacinae — Genus *Polyplax*

Fig. 1. Morphological characteristics of murine lice

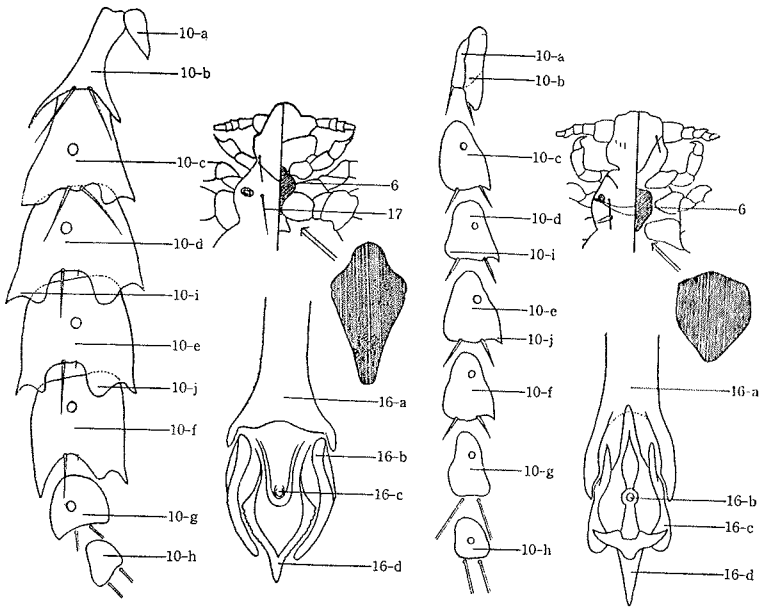
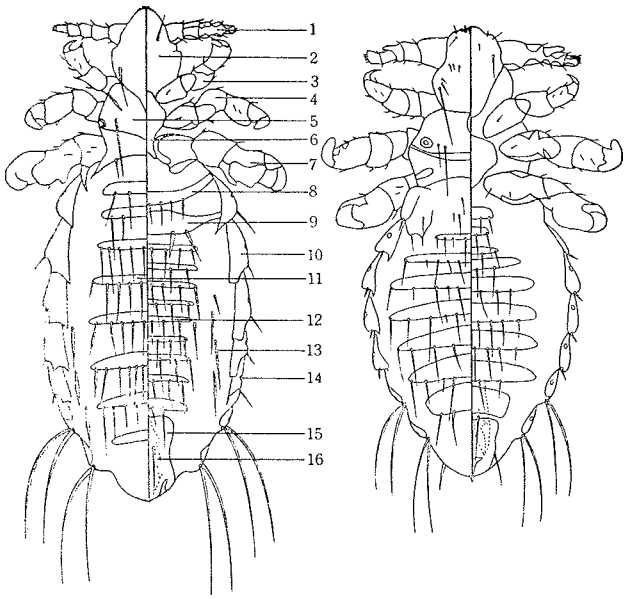


Fig. I. Morphological characteristics of murine lice



Hoplopleura oenomydis (Male) *Polyplax spinulosa* (Male)
Right half: Ventral view
Left half: Dorsal view

1. antenna; 2. head; 3. anterior leg; 4. middle leg; 5. thorax; 6. thoracic sternal plate; 7. posterior leg; 8. 2nd sternite 9. 3rd sternite; 10. paratergal plate; 11. abdominal tergite; 12. abdominal sternite; 13. submarginal seta; 14. spiracle; 15. genital plate; 16. genitalia; 17. thoracic seta; 10-a. to 10-h. paratergal plate 1-8; 10-i. ventral lobe; 10-j. dorsal lobe; 16-a. basal plate; 16-b. paramere; 16-c. penis; 16-d. pseudo-penis.

IV. Key to Species of Murine Lice in Japan

(1) Sternal plate of abdominal segment II extended laterally to articulate with the corresponding paratergal plate on each side. Two pairs of stout setae present on the first sternal plate of abdominal segment III. ..... Genus *Hoplopleura* (2)
Sternal plate of abdominal segment II narrow and not extended to articulate with the corresponding paratergal plate. Setae of sternal plate of abdomical segment III slender. ..... Genus *Polyplax* (7)

(2) A prominent pointed lobe present on dorsal side of paratergal plate VII. .....(3)
Paratergal plate VII lacking a conspicuous pointed lobe. .....(4)
Dorsal and ventral pointed lobes present on paratergal plate VII, the former wider than the latter. ..... *Hoplopleura intermedia*

(3) Apical lobes of paratergal plate III both narrow. A pair of very minute setae present on the near center of the dorsal surface of the thorax. .....
..... *Hoplopleura akanezumi*
Apical lobes of paratergal plate III both divided into 2 broad lobes by a deep incision. A pair of long setae present on the near center of the dorsal surface of the thorax. ..... *Hoplopleura himenezumi*

(4) Apical lobes of paratergal plate VI both acute. ..... *Hoplopleura acanthopus*
Dorsal apical lobe of paratergal plate VI broadly truncated, ventral apical lobe

acute. ……(5)

(5) Paratergal plate III with a tapering tooth at the dorsal angle and a broad ventral lobe. The lobes separated by a broad interspace. ……*Hoplopleura inagakii*

Paratergal plate III divided into 2 lobes by a deep incision, the dorsal apical lobe broadly truncated. ……(6)

(6) Dorsal apical lobe of paratergal plate III with the posterior margin indented. Paratergal plates IV to VI each with one seta about as long as the depth of incision, another seta minute. ……*Hoplopleura oenomydis*

Apical lobe of paratergal plate III with the posterior margin divided into two equal lobes by a deep and quite narrow incision. Paratergal plate IV to VI each with a pair of very minute setae. ……*Hoplopleura longula*

(7) One seta on paratergal plate IV longer than the plate itself, another seta on this plate, shorter than the plate. ……(8)

Without a long seta on paratergal plate IV. All setae on plates III, IV, V and VI shorter than the plates themselves. ……(9)

(8) Paratergal plate VI with ventral seta as long as or longer than the plate and the dorsal seta as long as or shorter than the plate itself. The thoracic sternal plate of the male with a slender anterior projection. ……*Polyplax shimizui*

Paratergal plate VI with both dorsal and ventral setae as long as or longer than the plate itself. The thoracic sternal plate of both sexes without anterior projection. ……*Polyplax reclinata*

Dorsal seta of paratergal plate IV about as long as or longer than the plate itself, another seta on this plate and both dorsal and ventral setae of plates III, V and VI shorter than the plates. ……*Polyplax serrata*

(9) Dorsal lobe of pseudopenis very short, about one-fourth the length on the ventral lobe, paramere well developed. ……*Polyplax spinulosa*

Dorsal lobe of pseudopenis one half the length of the ventral lobe, paramere small. ……*Polyplax abcisa*

V. TAXONOMICAL STUDY

Until May, 1959 those murine lice known in Japan were limited to 2 genera and 12 species. The hosts included 10 species of rodents and several species of insectivores. A list of murine lice and their host mammals collected from the various places on the main and adjacent islands of Japan is given in the following Table 1.

1. *Hoplopleura oenomydis* Ferris, 1921

Hosts; *Rattus rattus erythronotus* (Temminck, 1847) "Roof Rat"
Rattus norvegicus otomoi Yamada, 1930 "Norway Rat"

Distribution; This species is commonly found on rats throughout Japan.

Notes; The specimens collected from *Rattus rattus* in Niijima-island, Izu-sichito, have remarkably large spiracles on paratergal plates, whereas the specimens collected from other parts of Japan have small ones.

2. *Hoplopleura akanezumi* Sasa, 1950

Host; *Apodemus speciosus* (Linné, 1758) "Old World Woods Mouse"

Distribution; The type specimen was obtained from *Apodemus speciosus speciosus* at Mt. Fuji area, Shizuoka Prefecture. A great many specimens of this species were collected from various subspecies of *Apodemus speciosus* such as *A. s. speciosus* (Temminck, 1847) in Honshu, Shikoku and Kyushu; *A. s. ainu* (Thomas, 1906) in Hokkaido; *A. s. insperatus* Kuroda, 1938 on Izu-Oshima; *A. s. navigator* (Thomas, 1906) on Oki Island, Shimane Prefecture; *A. s. tusimaensis* Tokuda, 1941 on Tsushima Island, Nagasaki Prefecture; *A. s. sadoensis* Tokuda, 1941 on Sado Island, Niigata Prefecture; and *A. s. dorsalis* Kuroda, 1924 on Tane Island, Kagoshima Prefecture.

TABLE 1

List of Murine lice and their host mammals

(Rodentia, Muridae)		
Rattus rattus erythronotus:	*Polyplax spinulosa,*	*Hoplopleura oenomydis*
Rattus norvegicus otomoi:	*Polyplax spinulosa,*	*Hoplopleura oenomydis*
Apodemus speciosus speciosis:	*Polyplax serrata,*	*Hoplopleura akanezumi*
Apodemus speciosus ainu:	〃	〃
Apodemus speciosus insperatus:	〃	〃
Apodemus speciosus navigator:	〃	〃
Apodemus speciosus tusimaensis:	〃	〃
Apodemus speciosus sadoensis:	〃	〃
Apodemus speciosus dorsalis:	〃	〃
Apodemus argenteus argenteus:	*Polyplax serrata,*	*Hoplopleura himenezumi*
Apodemus argenteus hokkaidi:	〃	
Micromys minutus hondonis:		*Hoplopleura longula*
Micromys minutus japonicus:		〃
Mus caroli caroli:		*Hoplopleura intermedia*
Clethrionomys rufocanus bedfordiae:	*Polyplax abscisa*	*Hoplopleura inagakii*
Clethrionomys rnfocanus andersoni:		〃
Aschizomys niigatae:		〃
Eothenomys smithi:		〃
Microtus montebelli:	*Polyplax abscisa*	*Hoplopleura acanthopus*
(Insectivora, Soricidae)		
Suncus murinus:	*Polyplax reclinata*	
Crocidura dsi-nezumi dsi-nezumi:	*Polyplox shimizui*	
Crocidura dsi-nezumi chisai:	〃	

Notes; *Hoplopleura akanezumi* was included in *Hoplopleura affinis* (Burmeister, 1839) in my previous report (1955), but it differs from *H. affinis* in having a pair of much longer setae on the dorsal surface of the thorax.

3. *Hoplopleura himenezumi* Kaneko, 1956

Host; *Apodemus argenteus* (Temminck, 1847) "Geisha Mouse"

Distribution; The type specimen was callected from *Apodemus argenteus argenteus* (Temmindk, 1847), Nikko City, Tochigi Prefecture.

Notes; *Hoplopleura himenezumi* is one of the *Affinis-apomydis* group. It resemble these species in having the tapering ventral lobe of the sixth paratergal plate and tapering dorsal lobe of the seventh paratergal plate. But it differs from other species in having a third paratergal plate divided into 2 broad lobes by a deep incision.

4. *Hoplopleura acanthopus* (Burmeister, 1839)

Host; *Microtus montebelli* (Milne-Edwards, 1874) "Japanese Meadow Mouse"

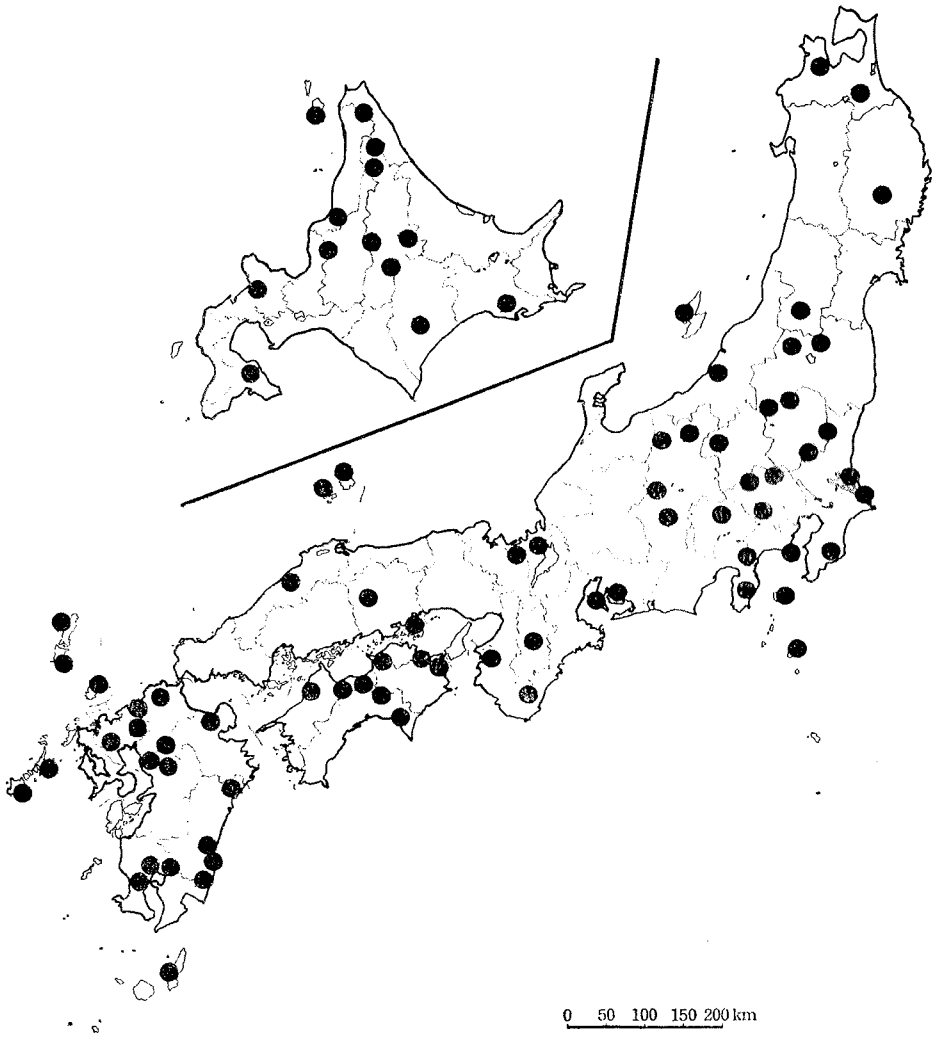
Distribution; *Hoplopleura acanthopus* so far has been found only on Honshu, and has not been found on Hokkaido, Shikoku or Kyushu.

Notes; In the present collection this species was the common parasite of *Microtus montebelli.* It is found in various areas throughout the world.

5. *Hoplopleura inagakii* Ono, 1955

Host; *Clethrionomys rufocanus* (Sundevali, 1846) "Large Red-backed Mouse"

Fig. 11. Known localities of *Hoplopleura akanezumi* in Japan

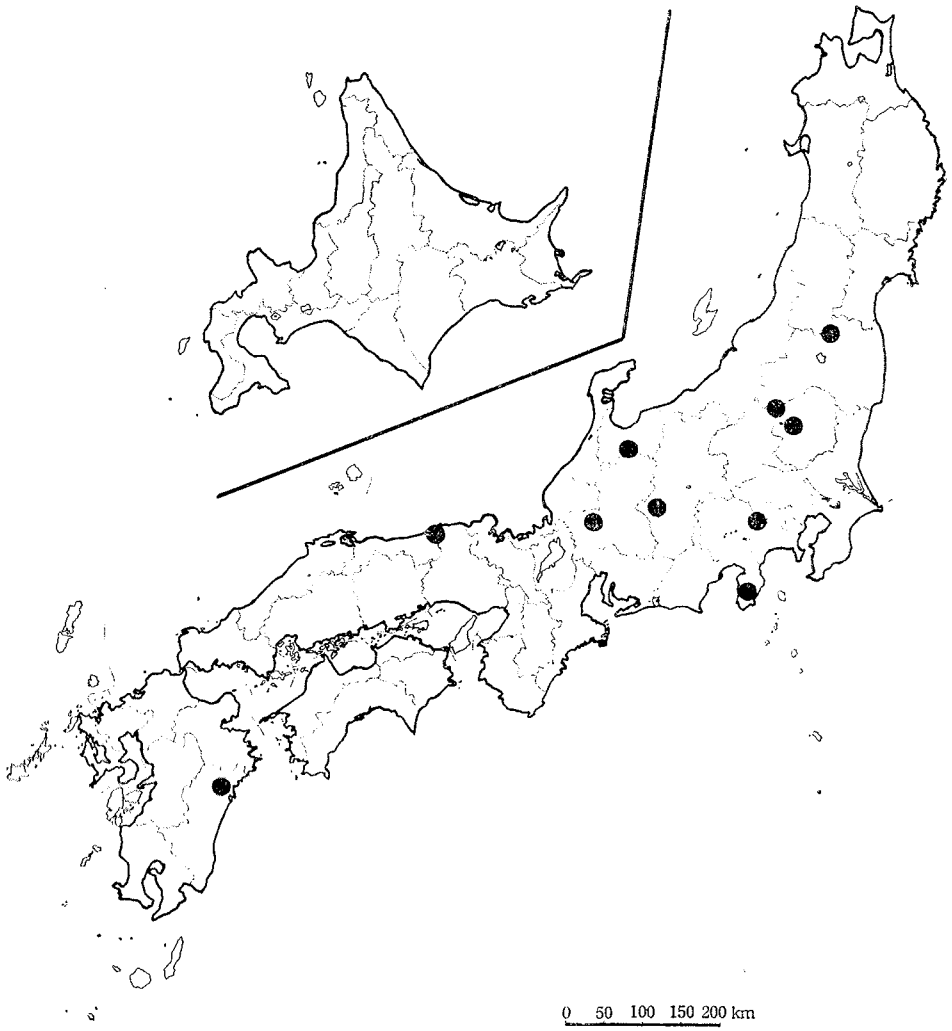


Clethrionomys rutilus (Pallas, 1778) "Small Red-backed Mouse"
Aschizomys niigatae (Anderson, 1909)
Eothenomys smithi (Thomas, 1905) "Japanes Dawn Meadow Mouse"

Distribution; The type specimens was found from *Clethrionomys rufocanus bedfordiae* (Thomas, 1905) at Hokkaido. The distribution of this species is restricted to Hokkaido, Tohoku, Kanto and Chubu districts.

Notes; This species is closely related to *Hoplopleura acanthopus*, but differs from it in having a broadly truncated dorsal lobe of the sixth paratergal plate. Submarginal setae of this species are about 12 in number and fewer than those of *Hoplopleura acanthopus*.

Fig. III. Known localities of *Hoplopleura himenezumi* in Japan



6. *Hoplopleura longula* (Neumann, 1909)

Host; *Micromys minutus* (Pallas, 1771) "Old World Harvest Mouse"

Distribution; This species was collected from various subspecies of *Micromys minutus* such as *M. m. hondonis* Kuroda, 1933 in Shizuoka Prefecture and *M. m. japonicus* Thomas, 1906 in Shikoku.

Notes; A few of those specimens from *M. m. hondonis* in Shizuoka Prefecture have 2 large setae on the third paratergal plate.

7. *Hoplopleura intermedia* Kellogg et Ferris, 1915

Host; *Mus caroli caroli* Bonhote, 1902 "Charles Mouse"

Distribution; The type specimen was obtained from *Rattus coucha*, in Mfongosi, Zululand, South Africa. In Japan this species was collected from

Fig. IV. Known localities of *Hoplopleura acanthopus* in Japan

a Charles Mouse on the main island of the Okinawas, but it has never been found on Hokkaido, Honshu, Shikoku or Kyushu.

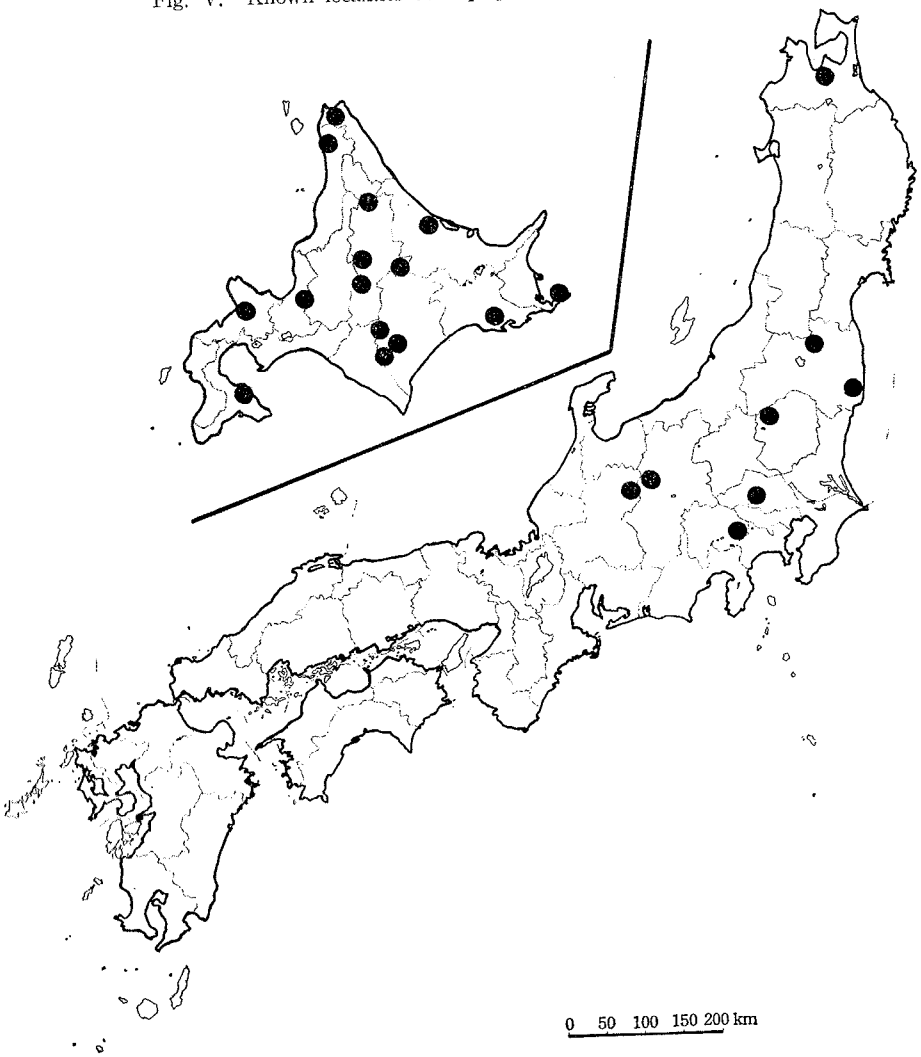
Notes; This species is closely related to *H. longula* and *H. hesperomydis*, but it is differentiated from these species by the shape of the dorsal and ventral lobes of the seventh paratergal plate and the dorsal lobe of the eighth.

8. *Polyplax spinulosa* (Burmeister, 1839)

Hosts; *Rattus rattus erythronotus*
Rattus norvegicus otomoi

Distribution; *Polyplax spinulosa* is the commonest species wherever *Rattus norvegicus* is found.

Fig. V. Known localities of *Hoplopleura inagakii* in Japan



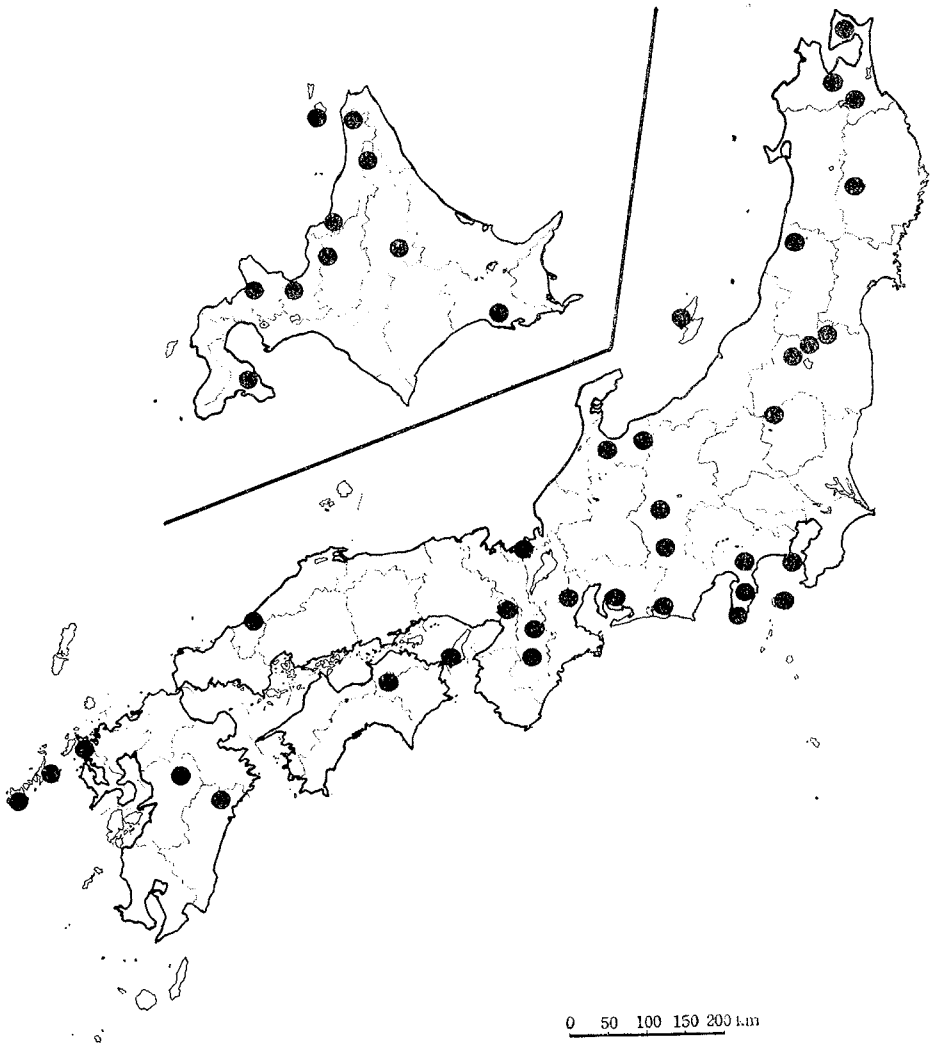
Notes; This species resembles *Polyplax alaskensis* Ewing, 1927 and *Polyplax borealis* Ferris, 1933, but it is separated from these 2 species by the fact that in these species the dorsal and ventral apical lobes of paratergal plates III-V are acute, while in *Polyplax spinulosa* the ventral apical lobes of these paratergal plates are rounded.

9. *Polyplax serrata* (Burmeister, 1839)

Hosts; *Apodemus speciosus*
Apodemus argenteus

Distribution; This species is the commonest species obtained from *Apodemus speciosus* and *Apodemus argenteus* in Japan, and is known to occur throughout Japan.

Fig. VI. Known localities of *Polyplax serrata* in Japan



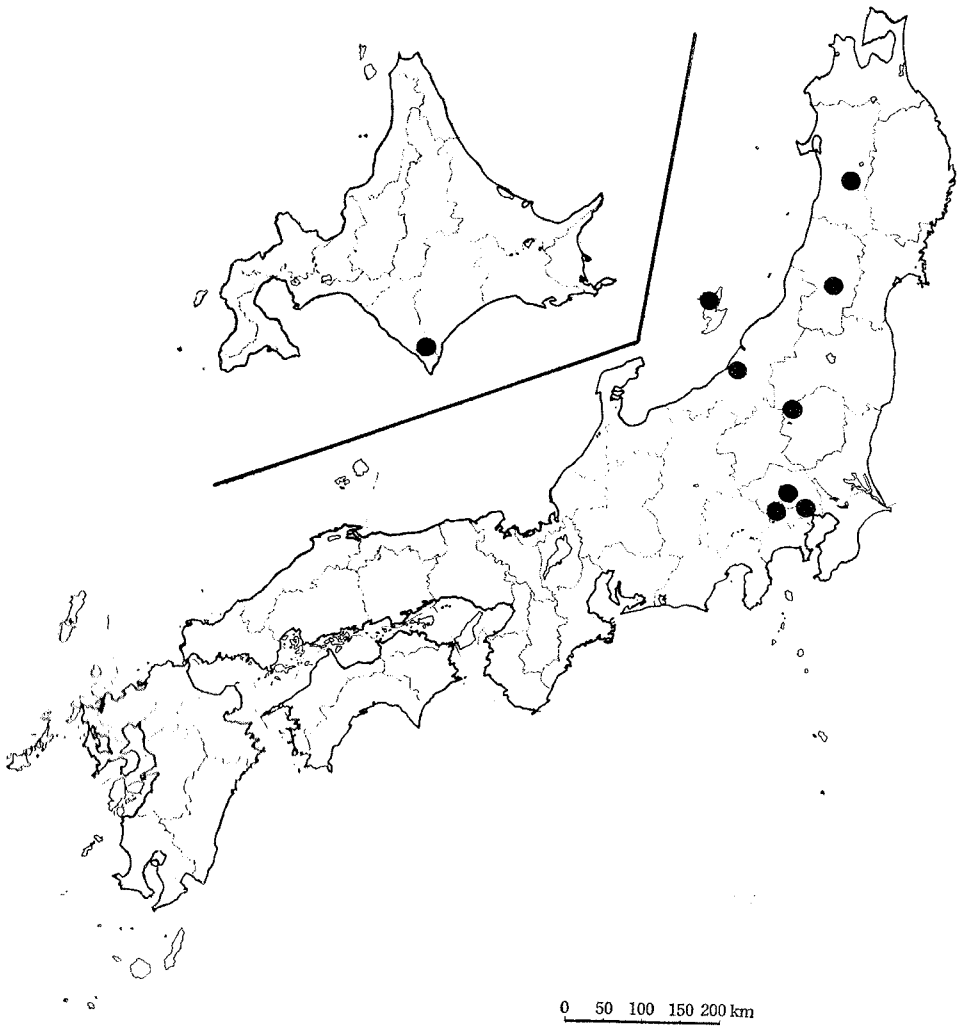
10. *Polyplax abscisa* Fahrenholz, 1938
Hosts; *Microtus montebelli*
Clethrionomys rufocanus
Eothenomys smithi

Distribution; This species has been recorded from *Clethrionomys rufocanus* on Hokkaido. It is also commonly found with the *Microtus montebelli* and occasionally with the *Eothenomys smithi* in northern Honshu.

Notes; This species is closely related to *Polyplax alaskensis* and *Polyplax borealis.*

11. *Polyplax reclinata* (Nitzsch, 1864)
Host; *Suncus murinus* (Linné, 1766) "House or Musk Shrew"

Fig. VII. Known localities of *Polyplax abscisa* in Japan



Distribution; This species was collected on the Okinawa, Yaeyama, and Miyako, of the Ryukyu group of Island.

Notes; *Polyplax reclinata* usually has large spiracles on the paratergal plates, but the specimens collected from *Suncus murinus* on Yaeyama Island were provided with smaller spiracles on the paratergal plates than those of the specimens collected from other parts.

12. *Polyplax shimizui* Kaneko, 1957

Hosts; *Crocidura dsi-nezumi chisai* Thomas, 1906 "Dsinezumi-shrew"
Crocidura dsi-nezumi dsi-nezumi

Distribution; The type specimen was collected from *Crocidura dsi-nezumi chisai* in Nagano Prefecture. Since then, this species was found also

in Aichi and Okayama Prefecture from the same host, and from *Crocidura dsi-nezumi dsi-nezumi* in Kagawa Prefecture, Shikoku.

Notes; This species is related to *Polyplax reclinata*, *Polyplax deltoides* Fahrenholz, 1939 and *Polyplax gerbilli* Ferris, 1923. It differs from these species in having a pair of short setae on the sixth paratergal plate, and a slender anterior projection on the thoracic sternal plate in male.

VI. ECOLOGY OF MURINE LICE

Japanese murine lice live on rodentia and insectivora, and have mouth parts adapted to sucking their host's blood. In all cases they are permanent ectoparasites and parasitise living on a restricted species of hosts. *Polyplax spinulosa*, for example, has never been found on *Apodemus speciosus* and *Microtus montebelli*. Every stage of its cycle (Egg, Larva, Adult) is usually spent on a single host. Host animals are often infested by 2 different species of lice, such as was observed in the cases of many brown rats parasitized with *Polyplax spinulosa* and *Hoplopleura oenomydis*. In such cases, 2 species of different genera had their habitats on different parts of a host, as some species of *Mallophaga* choose their own habitats on the different parts of a host bird. Species of genus *Polyplax* were found on the surface of the hide from back to haunch, and those of genus *Hoplopleura* on the neck and head. This restricted choice of habitat shown by some species of lice is a most interesting phenomenon.

The author selected three endemic areas of winter type scrub typhus (tsutsugamushi disease) located near Tokyo to investigate the relationship between the disease and murine lice. For this purpose he observed seasonal occurrences of murine lice in these areas. The areas were Oshima Island (Tokyo), the Izu Peninsula (Shizuoka) and Miura Peninsula (Kanagawa). During the period from November 1956 to November 1957, 461 host animals (*Apodemus speciosus*) and 1,203 murine lice composing 2 species were collected.

Oshima Island (Tokyo)

The results of the monthly surveys performed on Oshima Island from November 1956 to November 1957 are shown in Fig. VIII. One hundred and sixty host animals (*Apodemus speciosus insperatus*) were trapped and 566 murine lice comprising 2 species were obtained from them. *Hoplopleura akanezumi* was the commonest species and was found throughout the year and showed 2 peaks of occurrence in March and August. Only one *A. s. insperatus* trapped in August was infested with so many lice that the peak for this month should not be overemphasized. *Polyplax serrata* began to appear in March and disappeared in June, then it began to appear again in September and disappeared in December.

Izu Peninsula (Shizuoka)

Throughout the year, 197 host animals (*Apodemus speciosus speciosus*) were collected and 272 murine lice were found on them. In this area, *Polyplax serrata* rather than *Hoplopleura akanezumi* was dominant. *Polyplax serrata* began to appear in September and showed its peak of occurrence in November and disappeared in May; while no murine lice were collected in the surveys conducted during the months from May to August. *Hoplopleura akanezumi* showed 2 peaks in the spring and fall; the higher peak was in November and the lower peak in April.

Fig. VIII. Seasonal occurrence of murine lice from *Apodemus speciosus* on Oshima Island, Tokyo

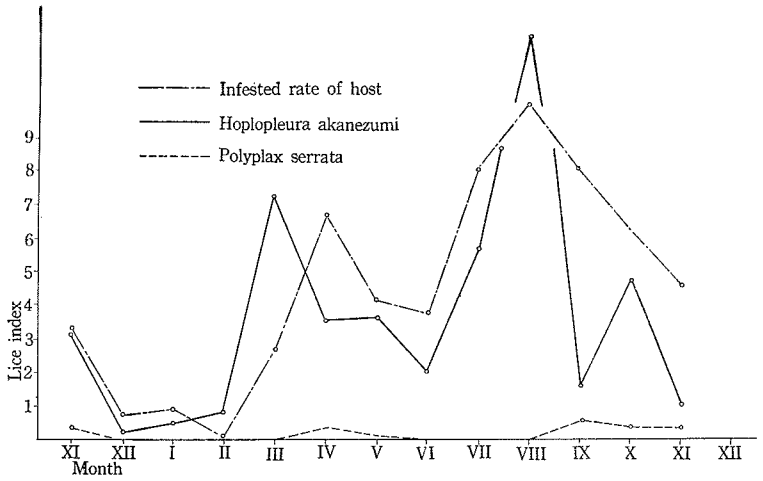
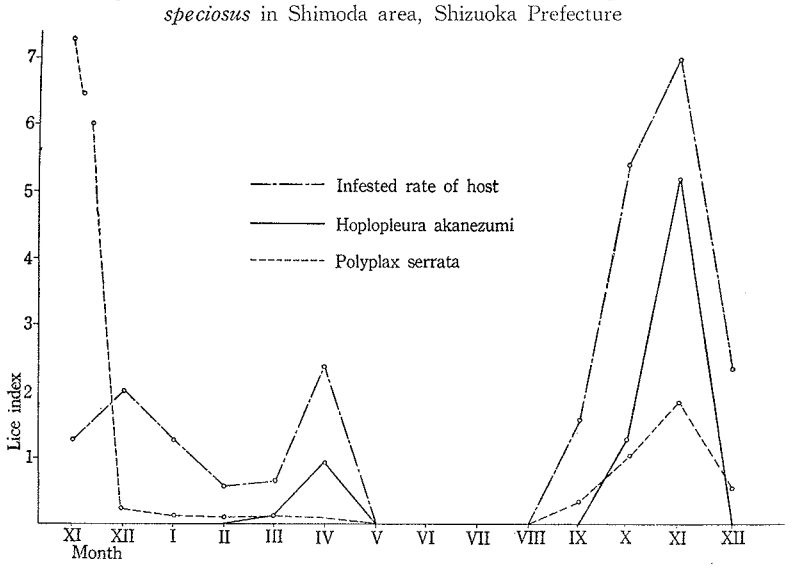


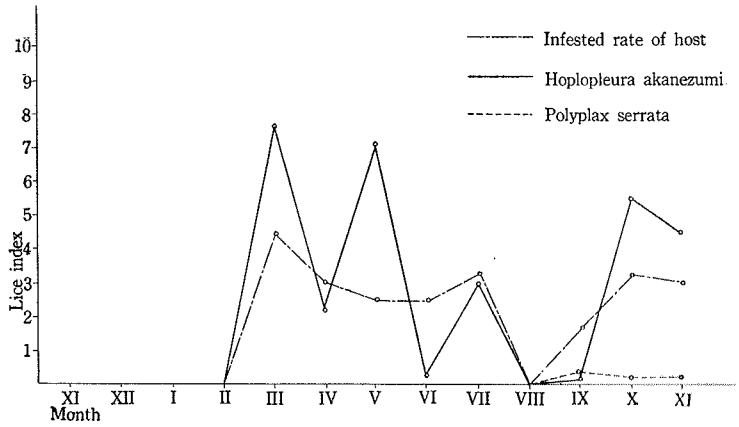
Fig. IX. Seasonal occurrence of murine lice from *Apodemus speciosus* in Shimoda area, Shizuoka Prefecture



Miura Peninsura Kanagawa)

During the period from November 1956 to November 1957, surveys were conducted 13 times in all. Through these surveys, 104 host animals (*Apodemus speciosus speciosus*) were trapped, and 365 murine lice comprising 2 species (*Hoplopleura akanezumi* and *Polyplax serrata*) were collected from them. *Polyplax serrata* was collected only during a 3 month period, i.e. from September through November. *Hoplopleura akanezumi* appeared from the period March to November, except for the month of August.

Fig. X. Seasonal occurrence of murine lice from *Apodemus speciosus* in Miura Peninsula, Kanagawa Prefecture



It has been often found that the number of lice collected from a host animal varied greatly even among animals caught in a restricted area. To verifty this experience, statistical examinations were made concerning the distribution of lice among hosts. The host animals were classified by the group according to the count of the infesting lice they carried. And the fitting of the distribution of lice counts to Poison's distribution was examined by the chi-square test in 3 localities. The classified numbers of hosts, their

TABLE 2

The type of the distribution of lice among host mice in three localities

Nos. of lice	K	Nos. of host infested					
		Oshima		Miura		Izu-Shimoda	
		Observed	Calculated	Obs.	Calc.	Obs.	Calc.
0	0	99	71.02	80	52.43	168	148.28
1—5	1	36	57.67	9	35.87	22	42.15
6—10	2	12	23.43	8	12.33	3	5.97
11—15	3	5	6.35	2	2.80	2	0.56
16—20	4	2	1.29	1	0.49	0	0.03
21—25	5	1	0.21	1	0.07	0	0.01
26—30	6	1	0.03	0	0.01	0	
31—35	7	1		0		0	
36—40	8	1		0		0	
41—45	9	0		1		0	
46—50	10	1		0		0	
51—	11	1		2		2	
		$\chi^2=52.389$ $Pr\chi_s^2 \ll 0.001$		$\chi^2=471.263$ $Pr\chi_s^2 \ll 0.001$		$\chi^2=12.284$ $Pr\chi_s^2 \ll 0.001$	

expected numbers of Poison's distributions and χ^2 values are illustrated in Table 2. From these calculations, the distributions of lice significantly depart from Poison's distributian, since Pr. $\chi^2_s = 0.001$ in three localities. The results suggested that rats were infested by lice in unequal chance.

The difference of infested rates between both sexes of hosts was also examined, employing the chi-square test. The difference was found to be of no great significance, since χ^2 values at three localities, Oshima, Shimoda and Miura, were 1.89, 1.98 and 0.07 respectively, being less than $\chi^2_{1,\ 0.05} = 3.841$.

TBALE 3

Comparison of the infesting rates between sex groups in three localities

Oshima Island

Sex of host	Nos. of infested host	Percentage of infestation	Nos. of host examined
Female	30	32.6	92
Male	31	43.1	72
Total	61	37.2	164

Shimoda

Sex of host	Nos. of infested host	Percentage of infestation	Nos. of host examined
Female	13	13.1	99
Male	17	21	81
Total	30	16.7	180

Miura peninsula

Sex of host	Nos. of infested host	Percentage of infestation	Nos. of host examined
Female	12	24.0	50
Male	12	21.8	55
Total	24	22.8	105

SUMMARY

The present paper deals with taxonomical observations, differential diagnoses, geographical distributions and host-parasite relationships together with a seasonal distribution and bionomics of Japanese murine lice.

Murine lice, so far known to occur in Japan and its adjacent islands, comprized 12 species belonging to 2 genera, namely *Hoplopleura oenomydis, H. akanezumi, H. himenezumi, H. akanthopus, H. inagakii, H. longula, H. intermedia, Polyplax spinulosa, P. serrata, P. abscisa, P. reclinata* and *P. shimizui*.

The hosts of these lice included 10 species of Rodentia and 2 species of Insectivora.

TABLE 4

Comparison of the infesting rates among body weight groups in three localities

Oshima Island

Body weight	Nos. of infested host	Percentage of infestation	Nos. of host examined
21—24 g	3	25.0	12
25—49 g	41	34.8	118
50—67 g	19	42.2	45
Total	63	30.3	175

Shimoda

Body weight	Nos. of infested host	Percentage of infestation	Nos. of host examined
21—24 g	1	6.3	16
25—49 g	13	11.6	112
50—67 g	18	35.2	51
Total	32	18.4	179

Miura peninsula

Body weight	Nos. of infested host	Percentage of infestation	Nos. of host examined
21—24 g	0	0	4
25—49 g	12	21.4	56
50—67 g	12	27.3	44
Total	24	23.1	104

The geographical distribution of murine lice seems to be closely related to their host's distribution. Namely, 2 genera and 6 species were found on Hokkaido, the same genera and 10 species on Honshu, the same genera and 5 species on Shikoku and the same genera and 6 species on Kyushu. Of these murine lice, *H. inagakii* was the commonest species on C. r. b. in Hokkaido, and it was found for the first time in northwestern Honshu by the author. In Honshu its hosts were *Clethrionomys rufocanus andersoni* (Thomas, 1905), *Aschizomys niigatae* (Anderson, 1909) and *Eothenomys smithi* (Thomas, 1909), which were new hosts for this species, *P. longula* collected from a Mu. m. m. in Shizuoka Prefecture was also a new record for Honshu and Mu. m. m. was a new host. *P. shimizui* obtained from a C. d. d. in Shikoku was a new record for Shikoku and C. d. d. was also a new host.

The seasonal occurrence of murine lice was observed in three endemic areas of winter type scrub typhus (tsutsugamushi disease). Both species of *H. akanezumi* and *P. serrata* showed 2 peaks in spring and autumn in 3 localities.

The ecological studies were made in 3 localities. And the infestation among age groups and between sexes was compared statistically. The results indicated that the infesting rate became greater as the mice grew

older, and there was no difference in the infesting rate of male or female mice. Number of lice on host animals differed among individuals in a restricted area and did not show a uniform distribution on statistical examination.

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