

Studies on the Chironomid Midges of Lakes in Southern Hokkaido

北海道南部の湖におけるユスリカ相の研究

M. SASA¹, Y. SUGAYA² and M. YASUNO³

佐々 学¹・菅谷芳雄²・安野正之³

1. Visiting Fellow of the National Institute
for Environmental Studies

国立公害研究所客員研究員

2. Engineering Division

技術部

3. Environmental Biology Division

生物環境部

環境庁 国立公害研究所

THE NATIONAL INSTITUTE FOR ENVIRONMENTAL STUDIES

Preface

Surveys on bottom fauna in Japanese lakes have been carried out from 1976 with relation to eutrophication of fresh water. During taxonomical and morphological studies on chironomid midges, a lot of new species and newly recorded species in Japan were described. Furthermore, by ecological analysis on benthos in various category of eutrophic lakes, it has been demonstrated that chironomid species were useful as biological indicators of aquatic environments.

The present report shows the results of taxonomical study on chironomids in lakes of southern part of Hokkaido. A total of 62 species were described, among which 13 were new species and 14 were new record. The chironomid fauna of the Hokkaido lakes was different from that in Honshu (the main island) which will be important information for the future works in the Japanese lakes, and the morphological and taxonomical description here will be useful for investigators on fresh water environment.

Kiyoshi SUGAHARA
Director of Environmental
Biology Division
March, 1988

CONTENTS

Distribution of chironomid larvae in Lake Shikotsu, Lake Toya and Lake Utonai in southern Hokkaido	1
Yoshio SUGAYA and Masayuki YASUNO	
Studies on the chironomid midges collected from lakes and streams in southern Hokkaido Island, Japan	9
Manabu SASA	
Chironomid midges collected on the shore of lakes in the coastal region of Abasiri, northern Hokkaido	77
Manabu SASA	

Distribution of chironomid larvae in Lake Shikotsu,
Lake Toya and Lake Utonai in Southern Hokkaido

Yoshio SUGAYA¹ and Masayuki YASUNO²

SUMMARY

Surveys on zoobenthos in two oligotrophic lakes and one shallow eutrophic lake in southern Hokkaido were carried out in June 1986. Neither chironomids nor oligochaete inhabited at the sites deeper than 50 m in Lake Toya. Distribution of chironomid species in the oligotrophic lakes was characteristic. *Orthocladius glabripennis*, *Paratendipes tamayubai*, *Paratanytarsus inopertus*, *Cricotopus sylvestris* and *Polypedilum nubeculosum*, which were all known as the species inhabiting in rivers, were recovered only from near the shore of the lakes. *Monodiamesa* sp. was collected at the depth of 5 - 20m in Lake Shikotsu and Lake Toya. *Chironomus plumosus* and *Clinotanypus sugiyamai* known as profundal species in an eutrophic lake were found at the depth of 0.6 m in Lake Utonai.

INTRODUCTION

There have been very limited studies on the benthos in lakes in Hokkaido (Miyadi, 1932; Kitagawa, 1974, 1975a, 1975b, 1976; Ito, 1978; Ito and Uno, 1980 ; Yasuno *et al*, 1987).

In the present study, larval collections of chironomids were conducted in the profundal zone in Lake Toya and at sub-littoral in Lake Shikotsu and Lake Utonai in June 1986. These three lakes are situated at the southern Hokkaido as shown in Fig 1. (L.Shikotsu; 42° 45'N 141° 17'E, L.Toya; 42° 36'N 140° 51'E and L.Utonai; 42° 42'N 141° 43'E). Lake Shikotsu is known as an oligotrophic lake which is 78.76 km² in area, 363 m in maximum depth and 250 m in altitude. This lake was made by depression with volcanic activities. Lake Toya, an oligotrophic lake, is 70.44 km² in extent, 179.2 m in the maximum depth and 84 m in altitude. Lake Toya is a caldera lake. Lake Utonai is a small and shallow (2.43 km² in area and 1.5 m) mesotrophic lake, which freezes from December to February. The altitude of the lake is 5 m above sea level.

METHODS

In Lake Shikotsu, two sampling points were selected as shown in Fig.1.

-
1. Engineering Division, the National Institute for Environmental Studies, 16-2 Onogawa, Tsukuba, Ibaraki 305, Japan.
 2. Environmental Biology Division, the National Institute for Environmental Studies, 16-2 Onogawa, Tsukuba, Ibaraki 305, Japan.

The samplings in Lake Toya were made at four points in northern part of the lake. Heavy amount of volcanic eruptions from Mt.Usu entered the lake in 1970. In Lake Utonai, the samplings were conducted at two points 0.2 m and 0.6 m in depth. Six samples of sediment were collected with an Ekman-Birge grab at each point of each lake, two of which served for identification and another four were provided for the measurement of biomass. Chironomid larvae in the sampled sediments was washed with a mesh netting of 0.25 mm in aperture. The methods to recover the adults from the sediment samples were described in the previous paper(Sasa *et al*, 1980). The identification of larvae was made with the keys in Wiederholm ed.(1980).

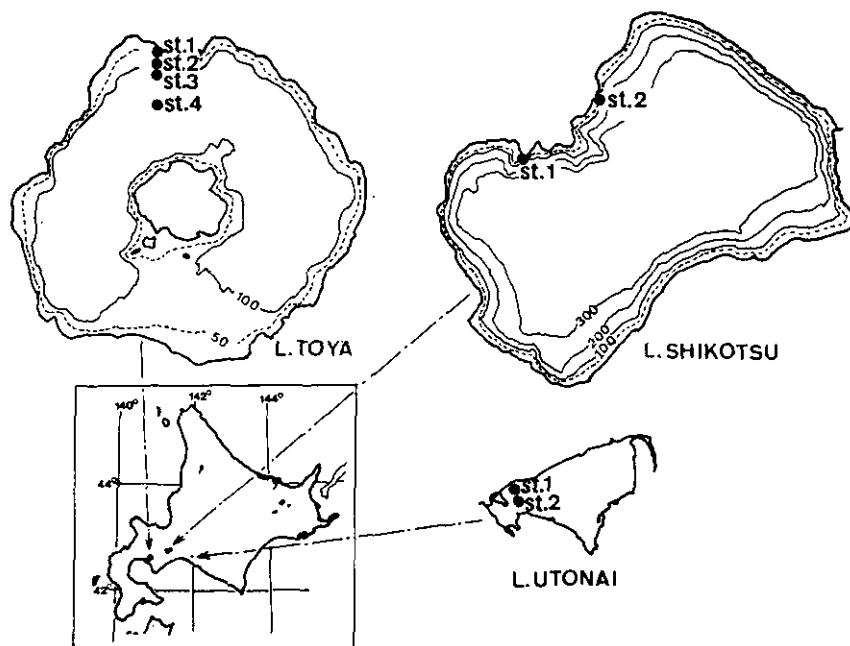


Fig. 1 Map showing the sampling sites in Lake Shikotsu, Lake Toya, and Lake Utonai in Hokkaido

The transparency was measured with a Secchi disc. The water temperature, dissolved oxygen and pH were measured at the surface. The amount of chlorophyll-*a* was determined by UNESCO/SCOR method (UNESCO,1966). Concentrations of nutrients were measured for the surface water of Lake Shikotsu and Lake Toya.

RESULTS

Limnological features

Table 1 shows the limnological data in the three lakes. The water temperature, pH and dissolved oxygen of the surface water in Lake Shikotsu on 12th June 1986 were, 8.7 °C, 7.4 and 11.2 mg l⁻¹, respectively. Those for Lake Toya on 13th June 1987 were 15.0 °C, 6.8 and 11.2 mg l⁻¹, respectively. The transparency was more than 22 m for the former and 13.6 m for the latter. The concentration of nitrate in Lake Shikotsu and in Lake Toya were 0.04 mg l⁻¹.

Table 1. Limnological data in Lake Shikotsu, Lake Toya, and Lake Utonai in June 1986.

	L. Shikotsu	L. Toya	L. Utonai
DO (mg l^{-1})	11.2	11.2	-
Temperature ($^{\circ}\text{C}$)	8.7	15.0	-
pH	7.4	6.8	7.2
Transparency (m)	> 22	13.6	> 0.6
T-N (mg l^{-1})	0.05	0.26	-
$\text{NO}_3\text{-N}$ (mg l^{-1})	0.04	0.18	-
$\text{NO}_2\text{-N}$ (mg l^{-1})	N.D.	N.D.	-
$\text{NH}_4\text{-N}$ (mg l^{-1})	N.D.	N.D.	-
T-P (mg l^{-1})	0.003*	0.003*	-
Chl-a ($\mu\text{g l}^{-1}$)	0.14	0.11	-

* less than detectable limit.

and 0.18 mg l^{-1} , respectively. Concentrations of nitrite, ammonia and phosphate of these lakes were less than detectable limits. Chlorophyll-a concentration of these lakes were 0.14 and $0.11 \mu\text{g l}^{-1}$, respectively.

Fig.2 shows the depth profiles of the water temperature, pH, dissolved oxygen of Lakes Shikotsu and Toya, which were illustrated based on the data measured in August by K.Imada et al of Hokkaido Fish Hatchery (unpublished), in Lake Toya, and on 28th in Lake Shikotsu. The thermal stratification had

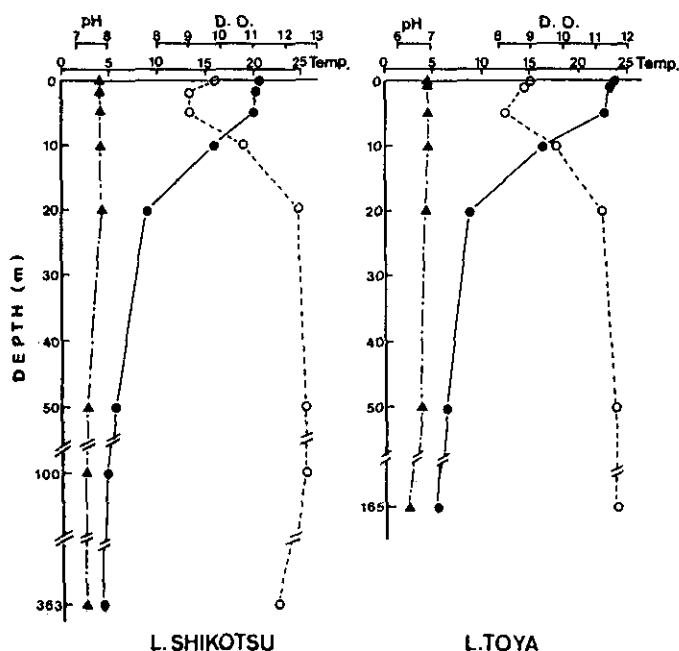


Fig. 2 Depth profiles of water temperature, pH, and concentration of dissolved oxygen in Lake Shikotsu and Lake Toya in August 1986. solid circle; water temperature, triangle; pH, open circle; dissolved oxygen (mg l^{-1})

developed at about 10 m in both lakes in August. The dissolved oxygen and pH did not show any marked stratification. There was more than 11 mg l⁻¹ oxygen at the bottom in both lakes in August.

Standing crops of zoobenthos

Table 2 shows the standing crops of chironomids, aquatic oligochaetes, mollusca and other macro-zoobenthos at each sampling points in the three lakes. Standing crops of zoobenthos decreased with the increase in the depth. The standing crops of chironomids in lake Shikotsu, were 2.71, 1.12 and 1.67 g wet weight m⁻² at 8-10 m, 20 m, and 40-60 m in depth, respectively. And those for oligochaetes were 0.05 and 0.02 g wet weight m⁻² at 8-10 m and 20 m in depth, respectively, but no oligochaetes could be collected at 40-60 m in depth.

Table 2 Standing crops of zoobenthos in Lake Shikotsu, Lake Toya, and Lake Utonai (g wet weight m⁻²) in June 1986.

	Lake Shikotsu			Lake Toya			Lake Utonai	
	St.1	St.2		St.1	St.2	St.3	St.1	St.2
	8-10m	20m	40-60m	5m	50m	100m	0.2m	0.6m
Chironomidae	2.71	1.12	1.67	1.60	0.03	0	2.05	0.64
Oligochaeta	0.05	0.02	0	0.65	0	0	6.93	0.38
Mollusca	13.35*	0	0	0	0	0	0	0
Others	0.90**	0	0	0.03	1.60	1.00	0.05**	1.37**

* including shell

** other aquatic insects

In lake Toya, chironomid larvae were collected at 5 m and 50 m in depth 1.60 and 0.03 g wet weight m⁻², respectively, but oligochaetes could be collected only at 5 m in depth (0.65 g wet weight m⁻²). At the depth of 100 m or 150 m, no chironomids nor oligochaetes were found. Nemertini were collected only from this lake.

In Lake Utonai, many chironomids and oligochaetes were collected from the shallower sampling point. Standing crops of oligochaetes were 6.93 g wet weight m⁻².

Mollusca was collected only from Lake Shikotsu. Although a species of snail was sighted in Lake Utonai, no individuals were detected in samples.

Chironomid fauna in the profundal zone

Table 3 shows the densities of chironomid species collected from the three lakes.

Lake Shikotsu

Five species of chironomids were found at 8-10 m and four species were from 20-60 m. The most abundant species was *Procladius(Holotanypus)* sp., which was followed by *Phaenopsectra* sp. and *Monodiamesa* sp. Four species were common

Table 3 Densities of chironomid larvae (Number of individuals m⁻²) in Lake Shikotsu, Lake Toya and Lake Utonai in June 1986.

SPECIES	SAMPLING SITE		Lake Shikotsu			Lake Toya			Lake Utonai	
	DEPTH		St.1	St.2	St.1	St.2	St.3	St.1	St.2	
			20-60m	8-10m	5m	50m	100m	0.2m	0.6m	
<i>Procladius(Holotanypus) sp.</i>			71	622	40	11	-	-	-	
<i>Clinotanypus sugiyamai</i>			-	-	-	-	-	-	111	
<i>Monodiamesa sp.</i>			115	100	22	-	-	-	-	
<i>Chironomus sp.</i>			9	33	-	-	-	-	-	
<i>Chironomus plumosus</i>			-	-	-	-	-	-	11	
<i>Glyptotendipes sp.</i>			-	-	-	-	-	44	-	
<i>Harnischia sp.</i>			-	-	-	11	-	-	-	
<i>Phaenopsectra sp.</i>			151	422	-	-	-	-	-	
<i>Polypedilum spp.</i>			-	-	-	-	-	2,020	522	
<i>Stictochironomus sp.</i>			-	-	966	-	-	-	-	
<i>Corynocera sp.</i>			-	-	-	-	-	167	67	
<i>Tanytarsus sp.</i>			-	33	888	-	-	-	-	

to the two sampling points, though *Tanytarsus sp.* was found only at 8-10 m in depth.

Lake Toya

Stictochironomus sp. and *Tanytarsus sp.* predominated in the bottom at 5 m, where other two species, *Procladius(Holotanypus) sp.* and *Monodiamesa sp.* were also 12 found. The density of *Stictochironomus sp.* was 966 m⁻² and that of *Tanytarsus sp.* was 888 m⁻². A few *Procladius(Holotanypus) sp.* and *Harnischia sp.* were collected at 50 m in depth.

Lake Utonai

A total of five species of chironomid larvae was collected from this lake. At the shallower site (0.2 m in depth), *P.nubeculosum* and *P.scalaenum*, were dominant, The density of the two species together was 2,020 individuals m⁻². Other two species, *Glyptotendipes sp.* and *Corynocera sp.* were also found at this site. At slightly deeper site, 0.6 m in depth, *Polypedilum spp.*, *Corynocera sp.*, *Clinotanypus sugiyamai* and *Chironomus sp.* were collected. The density of *Polypedilum spp.* was lower than that at 0.2 m.

Chironomid emerged from the sediment samples in the lakes

Adults specimen of *Cricotopus sylvestris* and *Polypedilum nubeculosum* were recovered from the sediment samples on the shore of Lake Shikotsu. From the samples on the shore in Lake Toya, *Orthocladius glabripennis*, *Paratendipes tamayubai* and *Paratanytarsus inopertus* emerged. Six species of adult chironomids were recovered from the sediment sampled in Lake Utonai. They were *Procladius sagittalis*, *Clinotanypus sugiyamai*, *Chironomus plumosus*, *Polypedilum nubeculosum*, *P.scalaenum* and *Tanytarsus holochlorus*.

DISCUSSION

Brundin(1956) pointed out *Monodiamesa ekmani* and *M.bathyphila* were indicators of oligotrophic lakes. The finding of *Monodiamesa* in oligotrophic Lakes Shikotsu and Toya agrees with his conclusion. We found this genus inhabited in Lake Chuzenji, an alpine oligotrophic lake in Japan(Yasuno *et al*, 1983).

Five species of chironomid, *Cricotopus sylvestris*, *Orthocladius glabripennis*, *Paratendipes tamayubai*, *Polypedilum nubeculosum* and *Paratanytarsus inopertus* emerged from the sediment samples on the shore of Lake Shikotsu and Lake Toya. None of them were collected from the bottom samples, and therefore their habitats may be limited at a littoral zone. All of them had been collected from rivers so far (Sasa, 1981, 1983).

The standing crops of oligochaetes of the two oligotrophic lakes were extremely low, and they did not inhabit at all at the bottom deeper than 50 m. This is a contrast to the results in the oligotrophic lakes in the Nikko National Park (Yasuno *et al*, 1983).

ACKNOWLEDGMENT

We are indebted to Dr. K. Imada and Dr. T. Ito, Hokkaido Fish Hatchery, for their assistance during the survey and providing the data on the environmental factors for the lakes. We are grateful to Prof. H. Kurohagi of Toya Limnological Station, Hokkaido University, for providing a boat for the survey in Lake Toya.

References

- Brundin,L.(1956): Die bodenfaunistischen Seetypen und ihre Anwendbarkeit auf die Sudnalkugel. Zugleichen eine Theorie der productionsbiologischen Bedeutung der glazialen Erosion. Rep. Inst. Freshwat. Res. Drottningholm, 37, 186-235.
- Ito,T(1978):Benthic macro-invertebrates and bottom sediments in Onuma-group (Onuma, Konuma and Junsainuma) Hokkaido, Japan. Scientific Report of Hokkaido Fish Hatchery. 33, 1-19.
- Ito,T. and T.Uno (1980): Long-term change of benthic invertebrates and high contents of organic matters of bottom sediments in Lake Akan Hokkaido; Japan. Scientific Report of Hokkaido Fish Hatchery. 35, 11-19.
- Kitagawa,N.(1974): Studies on the bottom fauna of five lakes in Southern Hokkaido. J. Limnol., 36, 125-134. (In Japanese)
- Kitagawa,N.(1975a): Studies on the bottom fauna of Lakes Mashu-ko, Akan-Panke-ko and Toyoni-ko, Hokkaido, Japan. Jpn. J. Ecol., 25, 155-159.(In Japanese)
- Kitagawa,N.(1975b):Studies on the bottom fauna of four lakes in Eastern Hokkaido. Jpn. J. Limnol.,37, 37-41. (In Japanese)
- Miyadi,D.(1932): Studies on the bottom fauna of Japanese Lakes. VII. Lakes of Hokkaido. Jpn. J. Zool., 4, 223-240.

- Pinder L.C.V.(1978): A key to adult males of British CHIRONOMIDAE (Diptera) the non-biting midges. Freshwater Biological Association Scientific Publication No.37, 1, 169 pp.
- Sasa,M.(1981): Studies on chironomid midges of the Tama River. Part3. Species of the subfamily Orthocladiinae recorded at the summer survey and their distribution in relation to the pollution with sewage waters. Res. Rep. Nat. Inst. Environm. Stud. 29, 1-77.
- Sasa,M.(1983): Studies on chironomid midges of the Tama River. Part 4. An observation on the distribution of Chironominae along the main stream in June, with description of 15 new species. Res. Rep. Nat.Inst. Environm. Stud., 43, 1-67.
- Sasa,M.(1984): Taxonomical and Morphological Studies on the Chironomid Species Collected from Lakes in the Nikko National Park. Res. Rep. Nat. Inst. Environm.Stud., 70, 19-215.
- Sasa,M. and K.Kamimura(1987): Chironomid midges collected on the shore of lakes in the Akan National Park, Hokkaido (Diptera, Chironomidae). Res. Rep. Nat. Inst. Environm. Stud., 104, 9-61.
- Sasa,M.(1988); Studies on the chironomid midges collected from lakes and streams in southern Hokkaido Island, Japan. Res. Rep. Nat. Inst. Environm. Stud., 121,
- UNESCO(1966): Determination of photosynthetic pigments in seawater. Report of SCOR/UNESCO Working Groupe 17, which met from 4 to 6 June 1964, UNESCO, Paris : Monographs on Oceanographic Methodology, 1, 69p.
- Wiederholm,T.(Ed.)(1980): Chironomidae of the Holoarctic region. Keys and diagnoses Part.1. Larvae. Entmologica Scandinavica Supplement No.19,457pp.
- Yasuno,M., T.Iwakuma, Y.Sugaya and M.Sasa(1984); Ecological studies on chironomids in lakes of the Nikko National Park. Res.Rep. Natl. Inst. Environ. Stud., 70. 1-15.
- Yasuno,M., and Y.Sugaya(1987): Distribution of Chironomid Larvae in Lake Akan, Lake Panke and Lake Kussharo. Res. Rep. Nat. Inst. Environm. Stud., 104, 1-7.

支笏湖、洞爺湖およびウトナイ湖におけるユスリカ幼虫の分布

菅谷芳雄¹・安野正之²

北海道南部の3湖、貧栄養湖の支笏湖、洞爺湖及び中栄養湖に分類されているウトナイ湖の底性動物調査を1986年6月に行った。支笏湖では岸及び水深10, 20, 40~60 mの地点で貧栄養湖の指標種と指摘されている *Monodiamesa* sp.を含む7種のユスリカが出現した。水深40~60 mの地点ではイトミミズは生息していなかった。洞爺湖では岸及び水深5, 50, 100及び160 mで調査し水深50 mまでの地点で合計8種類のユスリカが出現した。洞爺湖でも *Monodiamesa* sp.が確認された。水深100, 160 mでは底生動物は皆無であった。支笏湖、洞爺湖ともにイトミミズの現存量は水深が増すに従って減少し水深50 mでいなくなった。ウトナイ湖では水深0.2及び0.6 mで調査し8種類のユスリカが採取された。ユスリカ幼虫の湖内での分布には明らかなパターンがあり、岸近くには河川との共通種 (*Orthocladius glabripennis*, *Paratendipes tamayubai*, *Paratanytarsus inopertus*, *Cricotpus sylvestris* 及び *Polypedilum nubeculosum*) が生息し水深5 mではすでに既に他の種と入れ代わっていた。ウトナイ湖で水深0.6 m地点で出現した *Chironomus plumosus* と *Clinotanypus sugiyamai* は他の湖の沖帯に出現する種であるが調査当時最大水深であった0.6 mの地点でのみ採取された。水深の点では他の湖の沿岸域に当たる水深でも沖帯と沿岸帯を棲み分けているものと考えられる。

1. 国立公害研究所 技術部 〒305 茨城県つくば市小野川16番2

2. 国立公害研究所 生物環境部 〒305 茨城県つくば市小野川16番2

Studies on the chironomid midges collected from lakes and streams
in the southern region of Hokkaido, Japan

Manabu Sasa¹

SUMMARY

Collections of adult as well as larval chironomids were conducted for two days, June 12 and 13 1986, from three lakes in southern Hokkaido, Toya, Shikotsu and Utonai. Adult chironomids were collected also at the side of a small mountain stream, Osaru River, on July 12. The larvae collected with bottom mud of the lakes were brought to the NIES laboratory, and were identified by the adult males emerged from these samples. As the results, a total of 52 species of the family Chironomidae were confirmed as breeding in these areas, and the numbers of male and female specimens collected and identified from these lakes and a stream are as in Table 1. Of the 53 species collected in the present survey, 13 are regarded as new to Japan, and 10 species among them are described as new species. The number of species collected from these lakes were 29 in Lake Toya, 8 in Lake Shikotsu and 13 in Lake Utonai. The number of species found in common between Toya and Shikotsu was only 4, between Toya and Utonai was only 2, and between Shikotsu and Utonai was only 1. Of 11 species collected at the side of Osaru River, only one was in common with Lake Utonai, and another with Lake Toya. These differences in the distribution of chironomid species among the lakes and the stream seem to reflect the chemical, physical and biological characteristics of the water quality. Twenty three (23) species identified in the present survey in Hokkaido are judged as the chironomids previously described from Europe and/or North America.

1 Visiting Fellow of the National Institute for Environmental Studies.
Present address : Toyama Medical and Pharmaceutical University, Sugitani,
Toyama-shi, 930-01, Japan

Table 1. List of species collected from three lakes and a stream in southern Hokkaido, June 1986 (page and figure numbers, and the numbers of male (M) and female (F) collected and identified)

	Page	Fig.	Shikotsu		Toya		Utonai		Osaru	
			M	F	M	F	M	F	M	F
1 <i>Chironomus plumosus</i>	13			4			1	3		
2 <i>Chironomus yoshimatsui</i>	13				1	3				
3 <i>Camptochironomus biwaprimus</i>	13	1A			1					
4 <i>Paracladopelma camptolabis</i>	14				3					
5 <i>Paratendipes tamayubai</i>	14				2					
6 <i>Pentapedilum tigrinum</i>	15	1B					1			
7 <i>Pentapedilum utonaiprimum</i>	16	2A					1			
8 <i>Phaenopsectra kizakiensis</i>	16				31	25				
9 <i>Polypedilum arundineti</i>	17	2B			4					
10 <i>Polypedilum nubeculosum</i>	18		5	1						
11 <i>Polypedilum scalaenum</i>	18	3A			1		23	14		
12 <i>Polypedilum tsukubaense</i>	19	3B				1				
13 <i>Stictochironomus akizukii</i>	20		4	1	17	7				
14 <i>Stictochironomus multannulatus</i>	20				1					
15 <i>Micropsectra shinaensis</i>	20	4A								1
16 <i>Micropsectra utonaitertia</i>	21	4B					1			
17 <i>Micropsectra yunoprime</i>	22	5A			1					
18 <i>Paratanytarsus toyaprimus</i>	24	5B			7	1				
19 <i>Tanytarsus akantertius</i>	26	5C			49	25				
20 <i>Tanytarsus mendax</i>	28	6B					64	19		
21 <i>Tanytarsus utonaiquartus</i>	29	6A					8	1		
22 <i>Tanytarsus yunosecundus</i>	30				1					
23 <i>Brillia longifurca</i>	31				4	2				
24 <i>Cricotopus osarudigitatus</i>	31	7A					1			
25 <i>Cricotopus osaruquadratus</i>	32	7B					1	6		3
26 <i>Cricotopus sylvestris</i>	34		12	3						

	Page	Fig.	Shikotsu		Toya		Utonai		Osaru	
			M	F	M	F	M	F	M	F
27 <i>Cricotopus triannulatus</i>	34			2						
28 <i>Nanocladius tamabicolor</i>	34						1	1		
29 <i>Paratrichocladius tamaater</i>	35	8A								2
30 <i>Eukiefferiella coerulscens</i>	36	10B			1					
31 <i>Heterotrissocladius subpilosus</i>	36				3					
32 <i>Orthocladius frigidus</i>	37	8B			2					
33 <i>Orthocladius kanii</i>	37	9A			8					
34 <i>Orthocladius glabripennis</i> Complex	38	9B	9	8	25	12				
35 <i>Heleniella osarumaculata</i>	38	10A								2
36 <i>Limnophyes akannonus</i>	41						1	3		
37 <i>Limnophyes hudsoni</i>	41				6					2
38 <i>Limnophyes prolongatus</i>	42	10C			3					
39 <i>Metriocnemus tamaokui</i>	44		1							
40 <i>Parakiefferiella osaruflava</i>	44	11A								4
41 <i>Parakiefferiella osarufusca</i>	46	11B								2
42 <i>Paraphaenocladius penerasus</i>	47	12A			1					
43 <i>Pseudosmittia toyanigra</i>	48	12B			1					
44 <i>Smittia aterrima</i>	49				2					
45 <i>Smittia nudipennis</i>	49									1
46 <i>Toyamayusurika shiotanii</i>	49	13A								1
47 <i>Corynoneura lobata</i>	50	14B								1
48 <i>Psilodamesa montium</i>	51	15C			2					
49 <i>Clinotanypus sugiyamai</i>	52	14B					7	4		
50 <i>Conchapelopia melanops</i>	52	15D			1					
51 <i>Pentaneura japonica</i>	53	15D				1				
52 <i>Procladius choreus</i>	53	15B					2			
53 <i>Procladius sagittalis</i>	54	15A					2			

INTRODUCTION

Hokkaido is an island located in the northern-most part of Japan, and its fauna and flora are known to be largely in common with the Palaearctic Region, somewhat differing from those of the mainland of Japan, which are generally the mixture of the Palaearctic and the Oriental fauna. The present report comprises the results of the third survey of the chironomid fauna of Hokkaido, following the first survey reported by Sasa (1985a) in winter of the sewage distches in Sapporo City and of Lake Utonai, and the second report by Sasa & Kamimura (1987) of the mountain lakes in the Akan National Park. The areas studied in the present survey are located in the southern part of Hokkaido. Collections of the adults as well as larval chironomids were carried out from Lakes Shikotsu, Toya and Utonai, and a small mountain stream, Osaru River. The methods for collection, preservation and examination of the chironomid specimens were same as described in the previous papers by Sasa & Kamimura (1987, p.12). As the results, a total of as many as 53 species were collected and identified, among which 10 are described as new species, and additional 8 species are judged as new to Japan. It was especially noteworthy that the numbers of species collected from the lakes Toya, Shikotsu and Utonai were 29, 8, and 13, respectively, and each of these three lakes as well as the mountain stream showed quite different characters in view of the chironomid fauna.

Acknowledgments

The author is greatly indebted to Dr. James E. Sublette, Professor of Biology, University of Southern Colorado, for his kind advices in identification of the specimens and assistances in collection of references. Thanks are also due to Dr. Masayuki Yasuno and Mr. Yoshio Sugaya for their assistances in the collection and rearing of the specimens, to Mrs. Fumiko Kamimura for preparing the slide specimens.

COLLECTION RECORDS AND TAXONOMIC NOTES

Subfamily CHIRONOMINAE

1. *Chironomus plumosus* (Linnaeus, 1758)

Four females emerged during 4 to 12 July, 1986 from bottom samples collected in lake Shikotsu on 12 June (No.A 121:06-09). A male, 3 females and 2 pupal exuviae were recovered by laboratory rearing of bottom samples collected in Lake Utonai on 13 June 1986 (No.A 125:01-05).

2. *Chironomus yoshimatsui* Martin et Sublette, 1972

A male and 3 females were collected on the shore of Lake Toya on 12 June 1986 (No.A 122:01-04).

3. *Camptochironomus biwaprimus* Sasa et Kawai, 1987

(Plate 1A)

A male was collected on the shore of Lake Toya on 13 June 1986 (No.A 122:11). BL 7.98mm. WL 3.60mm. Body largely black or dark brown; ground color of scutum yellow, scutal stripes dark brown, scutellum yellow, postnotum black, halteres yellow, wing unmarked; in the front leg, femur largely yellow but gradually darkened apically, tibia largely brownish yellow and gradually darkened towards base and apex, tarsal segments entirely black; in the middle and hind legs, femora largely yellow and slightly darkened near apex, tibiae also largely yellow and slightly darkened at basal and apical portions, tarsi I largely dark brown, II to V entirely black; abdominal tergites I to III uniformly brown, IV and V dark brown in the middle portion and brown laterally, VI and VII largely dark brown, distal 1/3 of tergite VII yellow, VIII and hypopygium dark brown.

Frontal tubercles (Fig.1A1) medium in size, 22 μ high, 18 μ in diameter, and 95 μ apart from each other. Eyes each with a long dorsomedial projection, ER 0.29. Antenna lost in this specimen, so 28, 30, cl 36. Anteprenotum well developed, united in the middle and with two pairs of tubercles on both sides of junction, lateral setae absent (Fig.1A2). Scutum and scutellum in Fig. 1A3. dm 6, dl 15:17, pa 8:10. Scutellar setae 8 in the anterior and 6 in the posterior row. Wing in Fig. 1A4. fCu only slightly beyond r-m, VR 1.05. R₂₊₃ ending close to end of R₁, RR 0.26. End of R₄₊₅ much beyond end of Cu₁, R/Cu 1.11. Anal vein running almost parallel to Cu and Cu₂, extending much beyond fCu. Squama with 10 fringe hairs. Terminal structure of tibiae as in genus *Chironomus*, terminal scale of front tibia with rounded margin (Fig.1A5), terminal combs of middle and hind tibiae low, wide and both with a short spur (Fig.1A6). Tarsus IV cylindrical and longer than tarsus V in all legs, pulvilli well developed. fLR 1.46, hLR 0.58, fBR 2.0, hBR 3.3 (middle tarsi missing).

Hypopygium in Fig. 1A7. Ninth tergite with a pair of low and broad lobes on both sides of anal point, which bear numerous short setae. Anal point short, stout and with rounded apex. Dorsal appendage (Fig.1A8) in a form of a narrow and long plate, covered entirely with microtrichiae, and bearing several long and stout setae. Ventral appendage (Fig.1A9) much longer and stouter than dorsal appendage, extending to near tip of gonostylus, also thickly covered with short microtrichiae, and bearing numerous long and stout setae on the entire length. Gonocoxite stout and bearing numerous setae distributed on almost the entire surface. Gonostylus widest at base and tapering towards sharply pointed apex, inner margin being convex for basal half and concave for distal half, also bearing numerous setae distributed almost evenly on the entire surface (Fig.1A7).

Remarks. This species is morphologically a typical member of the *Chironomus* complex of the tribe Chironomini and belongs to the genus *Camptochironomus* Kieffer, 1918, since ninth tergite has a pair of large lobes flanking anal point, and ventral appendage is extremely long and bearing numerous setae on almost the entire length of the shaft. This specimen is almost identical in morphological structures and measurement data with the specimens described by Sasa & Kawai (1987) by the name of *C. biwaprimum* with specimens collected or reared from Lake Biwa, and seems to differ from the two species of this genus reported from Europe by Pinder (1978, p.111, Fig.142A, B) in that anal point is much wider, and dorsal appendage is much larger and bearing long setae in the present Japanese species.

4. *Paracladopelma camptolabis* (Kieffer, 1913)

Three males were collected on the shore of Lake Toya on 12 June 1986 (NO. A 122:13-15). BL 1.78-2.14 (mean 1.96) mm, WL 1.96 mm, AR 2.00, AHR 0.53, ER 0.27, 0.29, so 13:14, 12:14, pn 2:2, 3:3, dm 10, 12, dl 6:7, 7:7, pa 3:3, 3:3, sc 8, 9, sq 6, RR 0.25, 0.31, 0.32, VR 1.17, 1.18, 1.22, R/Cu 1.11, 1.12, 1.13, fLR 1.80, 1.81, mLR 0.60, 0.61, 0.62, hLR 0.69, 0.69, 0.72, fTR 0.26, 0.29, fBR 3.0, mBR 4.0, 5.2, hBR 6.7. Hypopygium and other morphological characters as described and illustrated by Sasa (1984, p.46; 1985b, p.37, 1985c, p.112).

Remarks. This species was reported as being widely distributed in Europe, and was recorded also from Lake Chuzenji (Tochigi), Miike (Miyazaki), and Motosu (Yamanashi) by Sasa (1984, 1985b,c)

5. *Paratendipes tamayubai* Sasa, 1983

Two male emerged on 27 June from a bottom sample collected at Station 5A of Lake Toya (No. A 122:17,18). BL 4.10, 4.34 mm, WL 2.01, 2.08 mm, AR 1.65, 1.69, AHR 0.53, 0.56, ER 0.18, 0.26, so 10:10, 12:12, cl 15, 24, pn 2:1, 2:2, dm 6, 8, dl 8:8, 8:10, pa 3:4, 4:4, sc 9, 11, sq fringed, RR 0.29, 0.30, VR 1.18, 1.18, R/Cu 1.13, 1.14, fLR 1.39, mLR 0.58, hLR 0.65, fTR 0.24, fBR 2.0, mBR 3.4, hBR 3.5. Antepnotum well developed, pulvilli absent.

Remarks. This species was described based on large numbers of males, females and pupae collected at upstream parts of the Tama River (Sasa, 1983, p.9) and also recorded by Sasa & Kawai (1987) from Lake Biwa.

6. *Pentapedilum tigrinum* Hashimoto, 1983

(Plate 1B)

A male was collected by sweeping bushes on the shore of Lake Utonai on 13 June 1986 (No. A125:07). BL 3.74mm, WL 1.85 mm. Body coloration peculiar to this species (Figs. 1B2, 6), i.e. ground color of scutum yellow, median stripes dark brown along midline and paler on both sides, lateral stripes with an anterior and a posterior dark spots and paler in the rest areas, scutellum yellow, postnotum largely dark brown; ground color of abdomen also yellow, tergite I with a pair of large triangular dark marks, II, IV, VI and VII with a broad transverse dark band leaving oral and caudal margins pale, III and V with a central dark mark and a pair of rather faint lateral dark areas, VIII and IX largely dark brown; wings without dark marks, halteres yellow, legs entirely yellow. Head in Fig. 1B1. Eyes bare, each with a long dorsomedial projection, ER 0.28. Frontal tubercles absent. so 12:13, cl 22. Antenna with 13 flagellar segments, AR 1.59, AHR 0.50. Anteprenotum highly reduced medially and deeply separated in the middle, without lateral seta. Scutum and scutellum in Fig. 1B2. dm 8, dl 13:15, pa 5:5, sc 6. Wing in Fig. 1B3. Squama with 4:7 fringe setae. Wing membrane with macrotrichiae in the terminal region between veins R₄₊₅/M and M/Cu₁, and on veins R, R₁, R₄₊₅, M and Cu₁. R₄₊₅ ending near tip of wing, R/Cu 1.15; fCu much beyond r-m, VR 1.21. R₂₊₃ ending closer to end of R₁ than to end of R₄₊₅, RR 0.21. Terminal scale of front tibia (Fig.1B4) broad and apically pointed. Terminal combs of middle and hind tibiae (Fig.1B5) broad and only narrowly separated, the broader comb without spur and the other with a long spur. fLR 1.63, mLR 0.55, hLR 0.70, fTR 0.27, fBR 3.0, mBR 3.2, hBR 3.8. Pulvilli well-developed.

Hypopygium in Fig. 1B7. Ninth tergite with long setae in the central portion. Anal point long, slender and parallel-sided, with rather pointed apex. Dorsal appendage (Fig.1B8) composed of a triangular basal portion bearing 3 or 4 long inner setae and numerous microtrichiae, and a slender, smoothly curved apical blade bearing a long lateral seta arising near base. Ventral appendage (Fig. 1B9) slender, with 9 recurved dorsal setae and a long, caudally directed apical seta. Gonostylus also long and slender, longer than gonocoxite and with straight inner margin, widest at about middle, bearing 6 long setae along inner margin.

Remarks. This species was describes by Hashimoto (1983, P.21), with Katayama (Shizuoka) as the type locality, and was stated as being common in southern area of Japan. The above characters of the present specimen is almost coincident with the male of the original description.

7. *Pentapedilum utonaiprimum* Sasa, sp. nov.

A male was collected on the shore of Lake Utonai on 13 June 1986 (No.A 125:08). BL 3.84 mm, WL 1.86 mm. Body coloration quite similar to that of the preceding species, i.e. ground color of scutum yellow, median stripes dark brown along midline and paler laterally, lateral stripes each with an anterior and a posterior dark brown areas, scutellum yellow, postnotum dark brown, legs yellow, abdominal tergites II, IV VI and VIII largely dark brown, III, V and VII largely yellow and each with a central dark area.

Frontal tubercles absent. ER 0.34, so 12:13, cl 22. Antenna with 13 flagellar segments, AR 1.53, AHR 0.53. Scutum and scutellum in Fig. 2A3. dm 15, dl 16:18, pa 5:5, sc 6. Antepronotum (Fig.2A1) deeply separated in the middle, without lateral seta. Wing in Fig. 2A2. sq 5:5, RR 0.14, VR 1.18, R/Cu 1.13. Wing membrane with macrotrichiae in the distal portion between R₄₊₅/M, M/Cu1 and Cu1/Cu2, and on veins R, R₁, R₄₊₅, and M. Terminal scale of front tibia (Fig.2A4) with pointed apex. One terminal comb of middle and hind tibiae with a long spur, the other comb without spur (Fig.2A5). Front tarsi lost. mLR 0.62, hLR 0.67, mBR 3.4, hBR 4.7. Pulvilli well developed.

Abdominal tergite VIII with triangular oral margin. Hypopygium in Fig. 2A6. Anal point long, slender, almost parallel-sided and apically rounded. Dorsal appendage (Fig.2A7) composed of triangular base bearing 3 long inner setae and microtrichiae, and a bare distal blade bearing no lateral seta. Ventral appendage (Fig.2A8) bears 8 recurved dorsal setae and a long, caudally directed apical seta. Gonostylus slender, inner margin almost straight and widest at about middle, bearing 6 long setae along inner margin.

Remarks. This specimen also belongs to genus *Pentapedilum* in the strict sense, and is morphologically quite similar to *P. tigrinum* Hashimoto, which was collected also at the same place on the same day, but differs essentially in the absence of lateral seta on dorsal appendage, and in coloration of scutum and abdomen. *Pentapedilum nubens* (Edwards, 1929) recorded from Europe is similar to this species in that dorsal appanage has no lateral seta, but according to Edwards (1929, p.376) and Pinder (1978, p.134, fig.165C), body coloration is generally darkened and rather uniform, wing with macrotrichiae all over (only at tip in the present species), gonostylus is wider, and dorsal appendage is more strongly curved along entire length and apically wider.

8. *Phaenopsectra kizakiensis* (Tokunaga, 1940)

A total of 31 males and 25 females were collected at various localities on the shore of Lake Toya on 12 and 13 June 1986, some resting on walls and bushes during daytime, others attracted to light during the nighttime (No.A 122:44-99).

Remarks. This species was described by Tokunaga (1940, p.290) by male and female collected at Lake Kizaki (Nagano), with the name of *Pentapedilum* (*Pentapedilum*) *kizakiensis*. Sasa (1984, p.54) described male, female, pupa and larva collected at Lake Yunoko (Tochigi) and transferred this species to genus *Phaenopsectra* Kieffer, 1921. Among the known species of this genus, the

present species is characteristic in that dorsal appendage has no lateral seta. Standard measurement data of the present specimens are within the variation ranges of those obtained with the specimens collected from Yunoko and reported by Sasa (1984, p.102). The measurement data of the male wing in the present specimens are WL 3.65-4.04 (3.84 in average of 10) mm, RR very small, 0.10-0.23 (0.18), VR also relatively small, 1.01-1.07 (1.04), R/Cu 1.17-1.20 (1.15).

9. *Polypedilum arundineti* Goetghebuer, 1921

(Plate 2B)

Four males were collected on the shore of Lake Toya on 13 June 1987 (No.A 123:01-04). BL 3.24-3.84 (3.49 in average of 4) mm, WL 1.68-1.80 (1.73) mm. Ground color of scutum brown, scutal stripes yellow (stripes are paler than ground color; Fig.2B1), scutellum yellow, postnotum dark brown; leg segments almost entirely pale yellow, halteres yellow, wing unmarked; abdominal tergites (Fig.2B5) largely dark brown, but each with a caudal pale area, and the dark areas on tergites II to IV are triangularly produced backwards, such as seen in *Chironomus nipponensis*.

Frontal tubercles absent. Eyes bare, each with a long dorsomedial projection, ER 0.23-0.30 (0.27). Antenna with 13 flagellar segments, AR 1.64-1.80 (1.72), AHR 0.48-0.51 (0.49). so 10-12 (10.4) on each side, cl 13-19 (16.3). Anteprepronotum highly reduced in the middle portion, lateral setae absent. Scutum and scutellum in Fig. 2B1. dm 15-21 (17.8), dl 10-13 (11.4), pa 3-5 (most frequently 4, mean 4.0), sc 6-9 (7.3). Wing membrane bare, bluish, and granular under high magnifications. R₂₊₃ ending closer to end of R₁ than to end of R₄₊₅, RR 0.16-0.23. fCu much beyond r-m, VR 1.18-1.24 (1.20). R₄₊₅ extending to almost tip of wing, ending much distal to end of Cu₁, R/Cu 1.15-1.16. Squama with 6-10 (8.6) fringe hairs. Tip of front tibia with a long and pointed terminal scale (Fig.2B2). One terminal comb of middle and hind tibiae with a very long spur, the other comb without spur (Figs.2B3, 4). All legs with large pulvilli. fLR 1.55, mLR 0.61-0.63, hLR 0.82-0.83, fBR 4.3, mBR 4.8, hBR 5.6.

Hypopygium in Fig. 2B6. Anterior margin of 8th tergite triangularly produced towards middle (a characteristic of genus *Polypedilum*). Anal point long, slender and almost parallel-sided. Dorsal appendage (Fig.2B7) composed of a large triangular and setigerous base bearing about 5 inner setae, and a narrow, slightly curved apical blade with rounded apex and bearing a long lateral seta arising near the base. Ventral appendage (Fig.2B8) slender and tapering towards apex, bearing 6 or 7 recurved setae and a long, caudally directed apical seta. Gonostylus relatively narrow and slender, widest at about middle and inner margin smoothly concave, with two rows of long setae along inner margin.

Remarks. These specimens are provisionally identified as *P.arundineti*, since most of the morphological characters are closely related to this species described by various authors as common in Europe (Edwards, 1929, p.403; Goetghebuer, 1937, p.59; Pinder, 1978, p.138, fig.169D). However, the present specimens differ from these descriptions in body coloration (almost uniformly

blackish), in the shape of ventral appendage (stouter), and of gonostylus (also stouter in the European specimens). Sasa (1985a) recorded this species from Lake Utonai, Hokkaido.

10. *Polypedilum nubeculosum* (Meigen, 1804)

Altogether 5 males and a female emerged in the laboratory from bottom samples collected at Lake Shikotsu on 12 June, 1986 (No.A 121:11-16). A male emerged also from a bottom sample collected at Lake Utonai on 13 June 1986 (No.A 125:10).

Remarks. This is a species widely distributed in Europe, and was also recorded frequently from Japan (Tokunaga, 1940, p.297; Sasa, 1984, p.58; 1985a, p.4; 1985b, p.42; 1985c, p.118; Sasa & Kamimura, 1987, p.18; Sasa & Kawai, 1987a, p.24).

11. *Polypedilum scalaenum* (Schrank, 1803)

(Plate 3A)

Two males were collected on the shore of Lake Utonai, 13 June 1986; a total of 21 males and 14 females merged from bottom samples collected on the same day from the same lake (No. A 125:11-49). A male was collected also on the shore of Lake Toya on 13 June 1986 (No.A 123:05)

Male. Standard measurement data of 10 males: BL 3.40-4.14 (mean 3.71) mm, Antepnotum in Fig. 3A7. WL 1.73-1.98 (1.86) mm, AR 1.41-1.66 (1.53), AHR 0.52-0.60 (0.55), ER 0.18-0.25 (0.22), so 10-14 (11.3), pa 5-7 (5.5), sc 12-18 (15.3, composed of an anterior row of 4-8 short setae and a posterior row of 8-10 long setae), sq 5-10 (8.2), RR 0.21-0.32 (0.28), VR 1.22-1.29 (1.25), R/Cu 1.09-1.13 (1.11), fLR 1.45-1.57 (1.51), mLR 0.54-0.57 (0.56), hLR 0.27-0.76 (0.74), fTR 0.27-0.29 (0.28), fBR 3.4-5.0 (4.0), mBR 4.6-6.3 (5.5), hBR 5.3-8.2 (7.2). Body coloration and other morphological characters as illustrated and described by Sasa (1985a, p.7) with specimens collected at Lake Utonai. Hypopygium in Fig. 3A8.

Female. Body coloration almost as in male, largely brown; ground color of scutum yellow, scutal stripes brown, scutellum yellowish brown, postnotum dark brown, abdominal tergites uniformly brown; halteres yellow, wing unmarked (unusual as a member of the *Tripodura* group), leg segments brownish yellow. Standard measurement of 10 specimens: BL 2.80-3.26 (mean 3.04) mm, WL 1.84-2.15 (2.01) mm, AR 0.40-0.47 (0.45), AHR 0.52-0.60 (0.57), ER 0.18-0.27 (0.21), so 9-12 (10.9), cl 16-21 (18.5), pn 0, dm 13-21 (14.8), dl 18-30 (22.3), pa 4-9 (most frequently 5, mean 5.8), sc composed of 6-10 short setae in anterior row and 8-12 longer setae in posterior row, 14-20 (mean 17.8) in total; sq 6-12 (9.0), RR 0.18-0.25 (0.23), VR 1.17-1.33 (1.25), R/Cu 1.10-1.17 (1.14), fLR 1.58-1.67 (1.61), mLR 0.50-0.59 (0.55), hLR 0.70-0.76 (0.73), fTR 0.25-0.30 (0.28), fBR 2.5-5.0 (3.4), mBR 3.2-5.0 (4.1), hBR 3.6-6.4 (4.8).

Head in Fig. 3A1. Antenna composed of 5 flagellar segments, segments I to III with a long neck. Small frontal tubercles present (Fig. 3A2). Scutum and scutellum in Fig. 3A6. Spermathecae in Fig. 3A4, cercus in Fig. 3A5.

Remarks. *P. scalaenum* is a species widely distributed in Europe, and its adult morphology was described by Edwards (1929, p.402), Goetghebuer (1937, p.64), Townes (1945, p.38) and Pinder (1978, p.136). It has also been recorded by males and pupae collected from Lake Utonai by Sasa (1985a, p.7). In the present survey, large numbers of males and females were reared from bottom samples collected from the same lake, and adults were collected also on the shore of Lakes Utonai and Toya. In the male, this species is morphologically characteristic in that anal point is conspicuously expanded apically, ninth tergite has a pair of long and narrow processes flanking anal point, dorsal appendage is pad-like, entirely covered with microtrichiae and with several long setae on posterior margin, and thus a typical member of the subgenus *Tripodura* Townes, 1945, but is also unusual as a member of this group in having no dark marks on wing. In the female, most values of the standard measurements are similar to those of the male but dorsolateral setae are significantly higher in numbers (18-30, mean 22.3 in female; 12-21, mean 15.3 in male). Small frontal tubercles are present in female, but they are completely absent in male, so long as observed with the present specimens.

12. *Polypedilum tsukubaense* (Sasa, 1979)

(Plate 3B)

A male was collected on light at the side of Lake Toya on 12 June 1986 (No.A 123:06). BL 3.80 mm, WL 2.13 mm. Body almost entirely pale yellow, including scutal stripes and postnotum. Frontal tubercles absent. ER 0.31, so 13:13, cl 17. Anteprenotum (Fig.3B1) deeply and widely separated in the middle and without lateral setae. Scutum and scutellum in Fig. 3B3. dm 20, dl 18:18, pa 4:4, sc 19 in two rows. Wing in Fig. 3B2. R₂₊₃ almost completely fused with R₁, RR 0. fCu much beyond r-m, VR 1.28. R₄₊₅ reaching to almost the extreme tip of wing and ending much distal to end of Cu₁, R/Cu 1.14. Terminal scale of front tibia with rounded margin (Fig. 3B4). One terminal comb of middle and hind tibiae with a very long spur, the other comb without spur (Fig.3B5).

Hypopygium in Fig. 3B6. Ninth tergite with 22 long setae in the central portion, and 7 short setae on posterior margin near the base of anal point. Anal point long and slender, almost parallel-sided and with truncate apex. Dorsal appendage (Fig.3B7) roughly horn-shaped, basal portion only slightly expanded and without microtrichiae, two long inner setae are arising at about middle (in most other species of this group, inner setae arise on the basal more or less expanded portion), and the long lateral seta arises at about distal 1/3. Ventral appendage (Fig.3B8) long, slender and finger-like, tapering towards apex, bearing one long terminal seta, and 12 or 13 stout, recurved and barbed setae on lateral and dorsal side of distal half, leaving the apical 1/5 covered thickly with only the microtrichiae (also a characteristic of this species).

Remarks. This species is morphologically quite unique among the *nubeculosum* group of the genus *Polypedilum*, and was recorded from mountain streams at Tsukuba (Ibaraki) and upstream parts of the River Tama (Tokyo) by Sasa (1979, p.17; 1981, p.101; 1983, p.12).

13. *Stictochironomus akizukii* (Tokunaga, 1940)

A total of 4 males and a female were collected on the shore of Lake Shikotsu on 12 June (No.A 121:21-25), also 17 males and 7 females were collected on the shore of Lake Toya on 13 June 1986 (No. A 122:21-43). The standard measurement data of 10 males were within the variation ranges of those observed with the specimens collected at Lake Yunoko (Tochigi) by Sasa (1984, p.102). The measurement data of wings of 10 males among the present specimens are WL 3.08-3.66 (mean 3.46) mm, RR 0.40-0.52 (0.46), VR 0.97-1.04 (1.01), R/Cu 1.15-1.20 (1.17).

Remarks. This species was described by Tokunaga (1940, p.299) by male and female collected at Toyohara (Karahuto, type locality), Fukuoka, Wakayama and Tokyo, by the name of *Chironomus (Stictochironomus) akizukii*. Hashimoto (1982) recorded male at Ozegahara (Tochigi). Sasa (1984, p.48) collected large numbers of this species at 4 lakes in the Nikko National Park (Tochigi), and gave descriptions and illustrations of male, female, pupa and larva. Additional records were made by Sasa (1985b, p.38) from Lake Miike (Miyazaki), by Sasa (1985c, p.115) from Lake Sainoko and Yamanaka (Yamanashi), and by Sasa & Kawai (1987a, p.25) from Lake Biwa (Shiga).

14. *Stictochironomus multannulatus* (Tokunaga, 1938)

A female emerged on 4 July from a bottom sample collected in Lake Toya on 12 June 1986 (No.A 122:20). This species is characterized especially in the presence of multiple dark marks on the wing.

15. *Micropsectra shinaensis* (Tokunaga, 1940)

(Plate 4A)

A male was collected on the shore of Osaru River on 12 June 1986 (No.A 128:31). BL 3.18 mm, WL 2.23 mm. Ground color of scutum brown, stripes dark brown, scutellum yellow, postnotum dark brown, abdominal tergites brown; wing unmarked, leg segments yellow. Eyes bare, each with a dorsomedial projection, ER 0.40. so 12:13, cl 14. Frontal tubercles not detectable and both antennae are missing from the present specimen. Anteprepronotum (Fig.4A1) separated in the middle and without lateral setae. dm 13, dl 9:9, sc 10. Wing in Fig. 4A2. Macrotrichiae are distributed on almost entire wing surface, including on principal veins. Anal lobe almost flat, squama bare. RR 0.40, VR 1.09, R/Cu 1.14. Anal vein extending beyond fCu. Front tibia with a short and narrow terminal spur (Fig.4A3). Terminal scale of middle and hind tibiae low, wide and contiguous, without spur (Fig.4A4). fLR 1.64, mLR 0.63, hLR 0.72. Tarsi with long beards, fBR 4.8, mBR 5.3, hBR 6.5. All legs with an empodium, a pair of simple claws, and a pair of small pulvilli.

Hypopygium in Fig. 4A5. Posterior margin of ninth tergite forms an obtuse angle in the middle. Bands of ninth tergite widely separated. Anal point stout, abruptly narrowed near apex, and with pointed apex. Dorsal appendage with concave inner margin, tapering towards pointed apex, bearing

two apical setae, 7 short dorsal setae, and a long basal seta arising on a conspicuous tubercle (Figs.4A6,7) Digitus absent. Ventral appendage finger-like, with some 20 recurved setae on dorsal side of apical half and 4 caudally directed setae on ventral side near distal margin (Fig.4A8). Median appendage long and slender, bearing spoon-shaped setae on apical half and simple setae on basal half (Fig.4A8). Gonostylus almost straight and nearly parallel-sided, with rounded apex (Fig.4A5).

Remarks. This species was described by Tokunaga (1940, p.306) by the name of *Tanytarsus (Micropsectra) shinaensis* based on male collected at Kamikoti (Nagano), a valley located at a high altitude in Japan Alps. The present specimen is coincident with its description especially in that body is largely brown, wing entirely covered with macrotrichiae, fLR about 1.6, anal point small and excavated dorsally on basal half, dorsal appendage is subtriangular, broad and pubescent basally and beaklike apically, digitus is absent, and median appendage with spoon-like setae. However, the original description is very short and the figure is given only for the dorsal appendage, and thus this diagnosis is a provisional one.

16. *Micropsectra utonaitertia* Sasa, sp. nov.

(Plate 4B)

A male was collected on the shore of Lake Utonai on 13 June 1986 (No.A 125:50). BL 4.00 mm, WL 2.39 mm. Body coloration is quite characteristic, i.e. ground color of scutum yellow, scutal stripes dark brown, scutellum yellow, postnotum dark brown, abdominal tergites yellowish brown, leg segments also yellowish brown. Small frontal tubercles present, 12 μ long, 7 μ wide, apart. AR 1.33, AHR 0.57, ER 0.34, so 14:14, cl 16. Anteprenotum (Fig. 4B1) widely separated in the middle and without lateral setae. dm 20, dl 9:10, pa 3:3, sc 8. Wing unmarked, with macrotrichiae almost on entire surface as in Fig. 4B2. Squama bare, anal lobe nearly flat, r-m almost parallel to wing axis. R₂₊₃ ending about midway between ends of R₁ and R₄₊₅, RR 0.43 (should be 0.50 when exactly on the midpoint). fCu slightly beyond r-m, VR 1.06, Cul ending also slightly beyond end of R₄₊₅, R/Cu 1.06. Tip of front tibia truncate and with a short terminal spur (Fig. 4B3). Tips of middle and hind tibiae with terminal comb scales which are low, broad, contiguous and without spur (Fig. 4B4). Front tarsus I only slightly longer than front tibia, fLR 1.02 (an unusual character as a member of Chironominae); mLR 0.58, hLR 0.71. Tips of tarsi V with an empodium, a pair of simple claws, and a pair of small pulvilli (Fig. 4B5).

Hypopygium in Fig. 4B6. Ninth tergite with a pair of small processes on posterior margin, and a small tubercle in the middle portion bearing very short setae. Anal point very short and small, parallel-sided and with rounded apex (Fig. 4B7). Bands of ninth tergite separated in the middle. Dorsal appendage (Fig. 4B8,9) thumb-like and apically rounded, with 9 short setae on dorsal and lateral parts and 2 or 3 longer setae on inner margin of the apical portion, and a long seta arising on a small tubercle at the base. Digitus rather small, parallel-sided and rounded apically, extending slightly beyond inner margin of dorsal appendage (Fig.4B9). Ventral appendage (Fig.4B10)

finger-like, slightly expanded apically, with 18 or 20 recurved setae on dorsal side of apical portion, and 4 caudally directed setae on apical margin. Median appendage (Fig.4B10) slender, with 21 spoon-shaped setae on distal half, and some 10 simple setae arising along the entire length of inner margin. Gonostylus slender, almost straight and parallel-sided, with long setae along inner margin.

Remarks. This species can be separated from other previously known Japanese species of this genus by the following key. Among species of this genus recorded from Europe, this is somewhat related to *P. redalensis* (Edwards), but again differs from it in the shape and structure of anal point, dorsal and median appendages (cf. Pinder, 1978, Fig.159A).

17. *Micropsectra yunoprime* Sasa, 1984

(Plate 5A)

A male was collected on the shore of Lake Toya on 13 June 1986 (No. A 123:17). Body length 5.86 mm, wing length 3.42 mm. Scutum, scutellum and postnotum almost uniformly black, abdominal tergites dark brown; halteres dark brown, leg segments uniformly black. Eyes bare, ER 0.37. Small frontal tubercles present. Antenna with 13 flagellar segments, AR 2.58, AHR 0.74. Anteprepronotum (Fig.5A1) well developed but slightly split in the middle, without lateral setae. dm 8, dl 12:12, pa 3:4, sc 10. Wing membrane bare, bluish, with macrotrichiae mainly on distal half. r-m parallel to wing axis, RR 0.43, VR 1.00, R/Cu 1.15. Squama bare, anal lobe quite flat. Tip of front tibia truncate, with a short spur but without terminal scale (Fig.5A2). Terminal scale of middle and hind tibiae contiguous and with a short spur or without spur (Fig.5A3). fLR 1.06 (unusually small), mLR 0.49, hLR 0.58, fTR 0.21, tarsi with very long beards, fBR 7.4, mBR 7.3, hBR 8.1. All legs with a pair of small pulvilli. Hypopygium as described and illustrated by Sasa (1984, p.26, Fig.1).

Remarks. This species was recorded originally by Sasa (1984, p.26) by male, female and pupa collected at Lake Yunoko (Tochigi). A key for identification of 9 species of this genus recorded from Japan was also presented in this paper. The present species is characteristic in that body is almost entirely black, with high AR, low LR, extremely long tarsal beards and in the peculiar structure of anal point, dorsal, median and ventral appendages of male hypopygium.

Key to males of Japanese *Micropsectra*

- 1- Large black midge with BL larger than 4.5 mm and WL larger than 3.5 mm; macrotrichiae on wing rather sparse and distributed mainly on distal half only; frontal tubercles present 2
- Body coloration paler, at most dark brown marks on brown ground color, sometimes entirely pale yellow; WL smaller than 3.2 mm; macrotrichiae distributed densely on entire wing length 3

- 2- AR extremely high, 2.72-3.51; fLR unusually small, 1.03-1.08; BR extremely high, 10.0-12.0; anal point narrow and parallel-sided; digitus short, finger-like and parallel-sided; median appendage very short, about 1/3 the length of ventral appendage including the terminal spatulate setae:
yunoprina Sasa, 1984
- AR about 1.4; fLR, fBR unknown; anal point short and triangular; digitus triangular and apically pointed; median appendage long and slender, reaching beyond middle of ventral appendage *taiwanus* (Tokunaga, 1939)
- 3- Body entirely greenish yellow or whitish yellow, without dark marks 4
 - Body largely brown or dark brown 6
- 4- Small midge, BL 2.82-2.84 mm, WL 1.64-1.67 mm; AR small, 0.90; fLR large, 2.11; fBR 3.7; anal point short, parallel-sided and apically rounded; dorsal appendage roughly egg-shaped; digitus long and slender, extending beyond inner margin of dorsal appendage; median appendage about half as long as ventral appendage, with spoon-like setae on distal 1/4; ninth tergite with a pair of tubercles on posterior margin *tanaprina* Sasa, 1980
- Larger midge, BL 3.3 mm or larger; AR 1.0-1.2; fLR 1.6-1.73; digitus shorter, not extending beyond inner margin of dorsal appendage; (ninth tergite probably without lateral tubercles) 5
- 5- Anal point almost parallel-sided and apically rounded; median appendage long, slender, reaching to tip of ventral appendage
daisenensis (Tokunaga, 1938)
- Anal point triangular, widest at base and apically pointed; median appendage shorter, reaching slightly beyond middle of ventral appendage; (hypopygium closely resembling that of *praecox* Meigen)
subviridis Goetghebuer, 1921, of Tokunaga, 1940
 (*subviridis* Goetghebuer was regarded as a synonym of *junci* Meigen and redescribed by Saewedal, 1976, p.131, and Pinder, 1978, p.144, fig.175A)
- 6- Dorsal appendage sickle-shaped, inner margin concave, tapering towards pointed apex, digitus absent; BL 3.6 mm, AR 0.81, fLR 1.63; anal point short and stout basally, abruptly narrowed near apex, excavated dorsally on basal part; median appendage about 3/4 the length of ventral appendage, bearing spoon-like setae on distal half; body largely brown, scutal stripes dark brown *shinaensis* (Tokunaga, 1940)
- Dorsal appendage thumb-like, more or less rounded apically, digitus present; frontal tubercles absent 7
- 7- Ninth tergite with a pair of lateral processes on posterior margin; anal point roughly triangular, broadest at base and apically pointed; digitus long, extending beyond inner margin of dorsal appendage 8
- Ninth tergite without lateral processes on posterior margin; anal point narrow, slender and almost parallel-sided; digitus short, not extending beyond inner margin of dorsal appendage 10

8- Anal point roughly rectangular, nearly as long as wide; dorsal appendage almost parallel-sided and smoothly rounded apically; digitus very long, straight and extending much beyond dorsal appendage; median appendage with long spatulate setae arising on distal 1/5 of the shaft; BL 3.16-3.60 mm, WL 2.16-2.26 mm, AR 1.39-1.50, fLR 1.66-1.72, fBR 3.7-4.5

chuzelonga Sasa, 1984

- Anal point much longer than wide; dorsal appendage and digitus differently shaped; ventral appendage with spoon-like setae arising on distal 1/2 of the shaft

9

9- Dorsal appendage with almost straight inner margin and convex lateral margin, somewhat tapering towards apex; digitus long, curved and apically pointed; anal point widest at about basal 1/3; BL 3.8-4.1 mm, AR 1.3, fLR 1.6-1.7

fossarum (Tokunaga, 1938)

- Dorsal appendage with concave inner margin, distal half curved inwards, digitus straight and extending only slightly beyond inner margin of dorsal appendage; anal point widest at base and apically forming a short and parallel-sided apical process; BL 4.00 mm, WL 2.39 mm, AR 1.33, fLR 1.02 (unusually small)

utoaitertia Sasa, sp. nov.

10- Body largely dark brown; WL 2.97-3.16mm, AR 1.34-1.54; dorsal appendage much longer than wide, triangularly pointed apically; median appendage relatively long and slender, with spoon-like setae on distal 1/4; fLR 1.52-1.54, fBR 4.0-4.3

chuzepima Sasa, 1984

- Body paler, ground color of scutum yellow, stripes brown; WL 1.93-2.28 mm, significantly smaller, AR 1.04-1.16; dorsal appendage almost as long as wide, nearly circular; median appendage very short, almost globular; fLR 1.41-1.52, fBR 4.0-4.3; ventral appendage short and stout, apically expanded

chuzenotescens Sasa, 1984

18. *Paratanytarsus toyaprimus* Sasa, sp. nov.

(Plate 5B)

Four males were collected on the shore of Lake Toya on 12 June 1986 (holotype: A 123:08; paratypes: A 123:09-11). Another 3 males and a female emerged in the laboratory from bottom samples collected on the same day at the same lake (paratypes: A 123:12-15).

Male. BL 2.78-3.68 (3.13 in average of 7) mm, WL 1.47-2.12 (1.80) mm, Ground color of scutum yellow, stripes and postnotum brown, scutellum yellow, abdominal tergites yellow; leg segments yellow. Eyes each with a long dorsomedial projection, ER 0.29-0.42 (0.34). Frontal tubercles absent. so 9-12 (10.0, most frequently 10), cl 12-17 (15.0). Antenna with 13 flagellar segments, AR 1.08-1.37 (1.20), AHR 0.52-0.56 (0.54). Anteprenotum (Fig.5B1) highly reduced in the middle, without lateral setae. dm 12-22 (16.0), dl 7-12 (9.6), pa 1 or 2 (1.36), sc 6 or 7 (6.3). Wing in Fig. 5B2. Squama bare, anal lobe nearly flat. Cross vein r-m almost parallel to wing axis, R₁ and R₄₊₅ running close with each other, R₂₊₃ ending nearer to end of R₄₊₅ than to end of R₁, RR 0.62-0.70 (0.66). fCu much beyond Cui, R/Cu 1.06-1.11 (1.08). Anal vein ending before fCu. Wing with macrotrichiae on membrane and on the

main veins.

Front tibia with a narrow and sharply pointed terminal spur (Fig.5B3). Terminal combs of middle and hind tibiae separated from each other, and one or both with a short spur (Figs. 5B4,5). fLR 1.52-1.71 (1.62), mLR 0.61-0.53 (0.62), hLR 0.70-0.71 (0.70), fTR 0.24-0.26 (0.25), fBR 3.8-5.2 (4.5), mBR 4.2-7.0 (5.9), hBR 5.0-7.1 (6.1). Pulvilli absent, empodium small.

Hypopygium in Fig. 5B6. Bands of ninth tergite separated in the middle. Ninth tergite with 3 or 4 setae arising on tubercles at the base of anal point, and 2 or 3 short setae on lateral sides of anal point. Anal point short, broad and apically rounded, with a pair of scale-like lateral ridges typical to members of this genus. Dorsal appendage roughly half-egg shaped, with 5 short setae on dorsal side of distal half, 2-3 setae on inner margin, and a long seta at the base on ventral side, which arise on a small tubercle. In addition, dorsal appendage bears microtrichiae on dorsal as well as ventral sides (Fig.5B7,8). Digitus long, extending much beyond inner margin of dorsal appendage, slightly curved and with pointed apex (Fig.5B8). Ventral appendage (Fig.5B9) short and stout, not apically expanded, with 12 or 13 recurved setae on dorsal side of distal 1/3, and 4 or 5 caudally directed setae on ventral side near apex. Median appendage relatively long and slender, apical setae reaching to almost tip of ventral appendage, with numerous lamellar setae on distal half, and numerous simple setae on basal half (Fig.5B9). Gonostylus widest at about basal 1/3, inner margin concave (Fig.5B6).

Remarks. The structure of wings of the present species is typical to the tribe Tanytarsini, especially in that wing membrane has numerous macrotrichiae, squama is bare, anal lobe is flat, and cross vein r-m is almost parallel to wing axis. The present species is judged as belonging to the genus *Paratanytarsus* Bause in view of the peculiar structure of anal point, dorsal, ventral and median appendages. However, the present species is unusual as a member of this genus in that both combs of posterior tibia are clearly separated and one or both with a spur (cf. Pinder, 1978, p.108). Among species of this genus known from Europe, the present species is somewhat related to *P.laetipes* (Zetterstedt) in that lamellar setae on median appendage are club-shaped and not tapered distally, but in the present species median appendage is much longer and with more numerous lamellar setae than in *P.laetipes*. Altogether 6 species of *Paratanytarsus* were recorded from Japan by Sasa & Kamimura (1987, p.24), among which the present species is most closely related to *P.inopertus* (Walker) which were recorded from Lake Akan, Hokkaido, especially in the structure of tibial combs, but in this species setae on median appendage are all simple and much shorter.

Key to male of Japanese *Paratanytarsus*

- 1- Wing membrane without macrotrichiae; tarsi II to IV of middle legs short and cordiform (other morphological characters are typical of this genus; antenna with 13 flagellar segments, AR 0.36, fLR 1.21, mLR 0.42, hLR 0.56) *biwatertius* Sasa et Kawai, 1987

- Wing with macrotrichiae; all tarsi cylindrical as usual 2

- 2- Antenna with 12 flagellar segments, AR 0.32-0.35; median appendage long, reaching to almost tip of ventral appendage, with numerous spoon-like setae on distal portion; fLR 1.6; tarsi without long beards; dorsal appendage hemispherical, inner margin convex; digitus long and apically pointed 4
tredecemarticulus (Tokunaga, 1938)
- Antenna with 13 flagellar segments as usual, AR larger than 1.0 3

- 3- Ninth tergite with a pair of processes on posterior margin flanking anal point; median appendage long, reaching to tip of ventral appendage 4
- Ninth tergite without processes on posterior margin; median appendage shorter, not reaching to tip of ventral appendage 5

- 4- Processes on ninth tergite much longer than wide; median appendage slender, setae shorter (AR about 1.3, fLR about 2, according to Tokunaga, 1938, p.341) 4
stagnarius (Tokunaga, 1938)
- Processes on ninth tergite roughly rectangular, wider than long; median appendage stouter, setae longer (AR 1.11-1.26, fLR 1.76-1.96, fBR 3.5-4.4 in the type specimens) 4
miikesecondus (Sasa, 1985)

- 6- Median appendage short, apical setae blade-like and reaching to only about middle of ventral appendage; terminal combs of middle and hind tibiae completely confluent and with two short spurs; small frontal tubercles present; AR about 1.3, fLR 1.5, tarsal beards absent (after Tokunaga, 1938, p.367) 4
telmatophilus (Tokunaga, 1938)
- Median appendage longer, apical setae reaching to near tip of ventral appendage; terminal combs of middle and hind tibiae clearly separated, one or both with a spur 7

- 7- Median appendage with simple setae only; dorsal appendage with a conspicuous tubercle bearing a long seta at the base of digitus; frontal tubercles present *inopertus* (Walker, 1856) sensu Sasa & Kamimura, 1987
- Median appendage with numerous lamellar setae apically; dorsal appendage without basal tubercles; frontal tubercles absent 7
toyaprimus, sp.nov

19. *Tanytarsus akantertius* Sasa et Kamimura, 1987

(Plate 5C)

A total of 46 males and 22 females were identified among the chironomid specimens collected on the shore of Lake Toya on 12 June 1986, either with insect net from bushes, or with a sucking tube on light (No.A 123:21-65, 67-89). Three males and 3 females were reared in the laboratory from bottom sediments collected from the same lake on the same day (No. A 123:91-96).

Male. Ten specimens collected as adults were measured. BL 3.42-3.90 (3.65 in average) mm, WL 2.03-2.28 (2.15) mm. Body almost entirely pale yellow, excepting eyes and tibial combs which are dark brown, and scutal stripes and postnotum which are slightly brownish (out of the total of 46

specimens examined, scutal stripes and postnotum were dark brown in 3). Small frontal tubercles may be present (in No. A 123:29, they are semiglobular, 7 μ wide and 5 μ high, 24 μ apart from each other). ER 0.58-0.78 (0.66), AR 1.03-1.14 (1.07), AHR 0.50-0.58 (0.54), so 6-12 (8.7), cl 10-18 (15.0), pn 0, dm 6-12 (8.3), dl 6-8 (6.6), pa 1-3 (most frequently 2, mean 2.2), sc 4 in all the specimens examined. Anteprenotum in Fig. 5C1. Wing cneiform, squama bare, with macrotrichiae sparsely distributed on apical half only, RR 0.25-0.39 (0.34), VR 1.22-1.33 (1.26), R/Cu 1.07-1.10 (1.08). Front tibia with a long, narrow and sharply pointed terminal spur. Terminal combs of middle and hind tibiae both narrow and each with a long spur. fLR 1.93-2.00 (1.98), mLR 0.54-0.60 (0.56), hLR 0.68-0.71 (0.69), fTR 0.29-0.31 (0.30), fBR 3.4-4.2 (3.8), mBR 4.5-5.6 (4.9), hBR 6.0-7.3 (6.7). Pulvilli absent.

Hypopygium in Fig. 5C2. Bands of ninth tergite separated in the middle. Anal point (Figs.5C2, 3) widest at base, tapering towards rounded apex, with a pair of lateral ridges, and with spine clusters on a single longitudinal row or irregularly distributed. The numbers of spine clusters on the anal point were 5 in 5, 6 in 6, 7 in 1, 8 in 4, 10 in 2, and 12 in 2, in examination of 20 specimens. Dorsal appendage (Figs.5C4, 5) roughly half-egg-shaped, inner margin concave, with 7 setae on dorsal side, 2 setae arising from conically produced bases, and a long inner seta arising from a long, cylindrical base on the ventral side. Digitus (Fig.5C5) long, straight and apically rounded, extending much beyond inner margin of dorsal appendage. Ventral appendage finger-like, not swollen apically, with some 12 recurved setae on dorsal side and 4 caudally directed setae on ventral side of apical portion. Median appendage (Fig.5C6) very short, with several simple (or slightly lamellar) setae all directed inwards. Gonostylus slender, almost parallel-sided, with slightly concave inner margin and rounded apex.

Female. Ten specimens (No. A 123:68-77) were measured. BL 2.78-3.28 (mean 2.96) mm. WL 1.90-2.40 (2.18) mm. Body coloration as in male, largely pale yellow, scutal stripes varying from yellow to brown. Head in Fig. 5C7. Antenna with 4 flagellar segments, AR 0.63-0.72 (0.67), AHR 0.38-0.50 (0.44). ER 0.37-0.62 (0.48), so 6-8 (6.2), cl 16-23 (18.7), pn 0, dm 8-14 (10.3), dl 6-8 (6.7), pa 1 or 2 (1.4), sc 2 or 4 (3.6). Wing with macrotrichiae rather sparsely on distal half, sq 0, RR 0.25-0.40 (0.33), VR 1.23-1.39 (1.29), R/Cu 1.10-1.23 (1.13). fLR 1.89-2.19 (2.03), mLR 0.56-0.60 (0.58), hLR 0.64-0.72 (0.68), fTR 0.28-0.32 (0.30), fBR 2.8-4.5 (3.7), mBR 4.1-4.5 (4.3), hBR 4.0-5.6 (4.8). Spermathecae in Fig. 5C8, cercus in Fig. 5C9.

Remarks. This species was described by Sasa & Kamimura (1987, p.21) with males collected on the shore of Lake Akan (Hokkaido). As pointed out in this original description, it is most closely related morphologically to *T. chinyensis* Goetghebuer, 1934, but was regarded as a new species in view of the differences in the shape of dorsal appendage (posterior process is narrow and sharply pointed in *chinyensis*, stout and rounded in this species). In the present study, large numbers of males and females were collected from Lake Toya, and by examination of these specimens it was shown that the numbers and distributions of spine clusters on anal point as well as the shape of dorsal appendage is rather variable. Therefore the independence of this species from *T. chinyensis* as well as from *T. chuzesecundus* described by Sasa (1984, p.38)

should be clarified in future studies.

20. *Tanytarsus mendax* Kieffer, 1925

(Plate 6B)

A total of 22 males and 2 females were collected with insect net on the shore of Lake Utonai on 13 June 1986 (No. A 126:01-24). A total of 42 males and 17 females were reared also from bottom samples collected in the same lake on the same day (No.A 126:26-78).

Male. Five males collected on the shore and another 5 males reared from larvae were measured. BL 3.64-4.72 (mean 4.13) mm, WL 2.04-2.60 (2.33) mm. Ground color of scutum yellow, scutal stripes and postnotum dark brown (in the dark form) or yellowish brown (in the light form), scutellum yellow, abdominal tergites brown to yellow, legs brownish yellow to yellow. Head in Fig. 6B1. Eyes relatively apart from each other, ER 0.55-0.82 (0.71). Frontal tubercles prominent, roughly conical, 30 μ high, 27 μ wide at base, and 55 μ apart from each other (the distance between centers of bases; Fig.6B2). Antenna with 13 flagellar segments, AR 1.22-1.55 (1.43), AHR 0.51-0.60 (0.55), so 10-15 (13.1), cl 18-27 (22.5). Palp with 4 flagellar segments, 30, 75, 70, 120 μ . Anteprepronotum reduced in the middle and without lateral setae. dm 8-16 (11.2), dl 8-13 (10.6), pa 1:1 excepting 2 specimens with 1:2 setae. sc 6-12 (8.2).

Wing in Fig. 6B3. Squama bare, anal lobe obtuse, wing membrane with macrotrichiae rather sparsely on distal half, and on R₁, R₄₊₅, M, Cu₁, Cu₂ and An. RR 0.29-0.42 (0.35), VR 1.04-1.15 (1.10), R/Cu 1.04-1.12 (1.09). Front tibia with a narrow and sharply pointed apical spur (Fig.6B4). Terminal combs of middle and hind tibiae separated, both with a long spur (Figs.6B5, 6). fLR 2.03-2.26 (2.17), mLR 0.58-0.66 (0.62), hLR 0.70-0.73 (0.71), fTR 0.29-0.34 (0.32), fBR 3.4-7.1 (4.4), mBR 4.8-7.2 (6.2), hBR 5.7-9.1 (6.6). Pulvilli absent.

Hypopygium in Fig. 6B7. Bands of ninth tergite separated in the middle. Ninth tergite with 3-7 short setae in the middle at the base of anal point. Posterior margin of ninth tergite forming an acute angle in the middle. Anal point parallel-sided or slightly tapering towards rounded apex, with a pair of lateral ridges, and 4-8 (mean 6.2) spine clusters situated on a longitudinal line. Dorsal appendage (Figs.6B8, 9) widest near base, with a neck near apex, with 7 short setae on lateral margin and dorsal side, and 3 long setae on inner margin, all arising on an elevated base. Digitus slender and tapering towards sharply pointed apex, extending much beyond inner margin of dorsal appendage (the size of digitus varies according to the specimens). Median and ventral appendages in Fig. 6B10. Ventral appendage slightly expanded apically, bearing 12 recurved setae on dorsal side and 3 caudally directed setae on ventral side of apical portion. Median appendage short, with slightly expanded setae arranged like a fan. Gonostylus widest at about distal 1/3.

Female. Seven mounted specimens among the laboratory reared samples were measured. BL 2.98-3.16 (mean 3.07) mm, WL 1.95-2.30 (2.13) mm, AR 0.60-0.70 (0.64), AHR 0.42-0.52 (0.55), ER 0.57-0.81 (0.71), so 10-12, cl 23-33 (27.3),

pn 0, dm 16-22 (27.6), dl 12-22 (15.8), pa 1 or 2 (1.6), sc 8-10 (9.0), sq 0, RR 0.25-0.34(0.30), VR 1.13-1.23 (1.17), R/Cu 1.11-1.16 (1.13), fLR 2.09-2.33 (2.16), mLR 0.56-0.60 (0.57), hLR 0.68-0.72 (0.70), fTR 0.30-0.33 (0.32), fBR 2.8-4.2 (3.3), mBR 3.0-4.4 (3.6), hBR 3.0-5.0 (3.8).

Head in Fig. 6B11. Frontal tubercles prominent, roughly conical (Fig.6B12). Spermathecae both elongate oval (Fig.8B13). Cercus in Fig. 6B14.

Remarks. The present specimens are morphologically almost identical with the species described from Europe by the name of *Tanytarsus holochlorus* Edwards, 1929, by Reiss & Fittkau (1971, p.120) and also by Pinder (1978, p.156). However, this species name was shown to be a synonym of *T.mendax* Kieffer, 1925 by Lindeberge (1976). This species is a new record to Japan.

21. *Tanytarsus utonaiquartus*, sp. nov.

(Plate 6A)

Altogether 7 males and a female emerges from bottom samples collected at Lake Utonai on 13 June 1986 (holotype: male, No.A 125:51; paratypes: 6 males and a females, A 125:52-58). A male was collected also on the shore of the same lake on the same day (A 125:59, paratype).

Male. BL 2.74-3.16 (2.91 in average of 8) mm, WL 1.39-1.59 (1.53) mm. Body coloration largely dark brown; ground color of scutum brown, scutal stripes dark brown, scutellum brown, postnotum dark brown, legs and abdominal tergites brown. Frontal tubercles absent. Eyes without dorsomedial projection, ER 0.96-1.37 (1.14). Antenna with 13 flagellar segments, AR 0.89-1.07 (0.99). so 8-11 (9.8), cl 12-17 (14.4). Anteprepronotum (Fig. 6A1) separated in the middle and without lateral setae. dm 6-9 (6.9), dl 7-10 (8.3), pa 1:1 excepting a specimen with 2:2. sc 4-6 (5.5). Wing (Fig.6A2) with macrotrichiae rather sparsely on distal half only, squama bare, anal lobe flat, RR 0.44-0.51 (0.49), VR 1.19-1.33 (1.24), R/Cu 1.04-1.07 (1.06). fLR 1.56-1.82 (1.68), mLR 0.49-0.54 (0.51), hLR 0.57-0.59 (0.58), fTR 0.28-0.30 (0.29), fBR 3.0-4.6 (3.7), mBR 3.6-6.0 (4.7), hBR 4.2-6.6 (5.1). Pulvilli absent. Front tibia with a long, narrow and sharply pointed terminal spur (Fig.6A3). Both combs of middle and hind tibiae with a long spur (Fig.6A4).

Hypopygium in Fig. 6A5. Bands of ninth tergite separated. Posterior margin of ninth tergite almost on a line rectangular to body axis. Anal point (Fig. 6AG) stout and parallel-sided for the basal 2/3, apically pointed, with short basal and lateral setae, lateral ridges, and 6-12 (mean 8.0) spine clusters distributed irregularly but not on a line (a characteristic of this species). Dorsal appendage composed of a broad base bearing 1 basal and 3 inner setae, and a beak-like distal process bearing 5 dorsal setae (Fig.6A7). Digitus long, parallel-sided and apically rounded, extending much beyond distal process of dorsal appendage (Fig.6A7). Ventral appendage short and very stout, thumb-like, and bearing 12 short recurved setae (Fig.6A8). Median appendage long, slender, bearing numerous long and simple setae which extend to near tip of ventral appendage (Fig.6A8). Gonostylus widest at about middle, inner margin almost straight.

Female. Wing length 1.55 mm. Body almost entirely yellow, scutal stripes

and postnotum brown. Head as illustrated by Sasa (1985a, Fig.5-H-9). Frontal tubercles absent. Eyes reniform and without dorsomedial projection, ER 1.02, so 8:8, cl 23. Anteprepronotum without lateral setae. dm 8, dl 9:10, pa 1:1, sc 6. Wing with macrotrichiae on distal half only, as in male. RR 0.33, VR 1.26, R/Cu 1.06. fLR 1.49, mLR 0.49, hLR 0.56, fTR 0.28. Spermathecae and cercus as illustrated by Sasa (1985a, Figs.5-H-9,10).

Remarks. This species was described by Sasa (1985a, p.9) by a male and a female emerged from a bottom sample collected on 3 December, 1981, from the same lake, with a provisional name of *Tanytarsus* sp. "utonai", and is now redescribed with a new scientific name with ample numbers of specimens collected from the same lake. It is morphologically closely related to the species described as member of the genus *Cladotanytarsus* Kieffer, in that wing with macrotrichiae on distal half only, and also in the shape and structure of anal point, dorsal and ventral appendages. However, the present species differs essentially from the previously known species of this group in that the setae on median appendage are all long and simple (long, branched and lamellar in other *Cladotanytarsus* species). The present species is provisionally placed as belonging to genus *Tanytarsus*, since its morphological characters are somewhat intermediate between the known characters of the two genera.

22. *Tanytarsus yunosecundus* Sasa, 1984.

A male emerged from a bottom sample collected from Lake Toya on 12 June 1986 (No. A 123:19). BL 3.44 mm, WL 2.04 mm. Body almost entirely pale yellow excepting scutal stripes and postnotum, which are brownish yellow. ER 0.70, so 10:10, cl 14, AR 1.55, AHR 0.54, pn 0, dm 12. dl 8:8, pa 1:1, sc 6. Wing with macrotrichiae rather sparsely on distal half, squama bare, anal lobe flat. RR 0.46, VR 1.21, R/Cu 1.11. Front tibia with a narrow and sharply pointed terminal spur. Terminal scales of middle and hind tibiae widely separated, both with a long spur. fLR 2.35, mLR 0.62, hLR 0.68, fTR 0.32, mBR 5.0, hBR 6.3. All legs with small pulvilli. Hypopygium as illustrated by Sasa (1984, p.133). Anal point stout and parallel-sided, apically truncate, with lateral ridges and 8 spine clusters on a longitudinal row. Dorsal appendage roughly egg-shaped but inner margin concave. Digitus stout, inner margin concave, extending beyond inner margin of dorsal appendage and with rather pointed apex. Median appendage long, slender, apical setae very long and extending beyond tip of ventral appendage.

Remarks. The above morphological characters and measurement data are coincident with those of *T. yunosecundus* recorded by Sasa (1984, p.36) from Lake Yunoko (Tochigi).

Subfamily ORTHOCLADIINAE

23. *Brillia longifurca* Kieffer, 1921.

Four males were collected on the shore of Lake Shikotsu, at Josuijo (water treatment plant), on 12 June 1986 (No.121:51-54). Two males were collected also with a sucking tube while resting on a tree at the side of Lake Toya on 13 June 1986 (No.A 124:51,52). This species was recorded in Japan from small mountain streams in Nikko (Tochigi) by Sasa (1984, p.81), and in Toyama by Sasa & Kawai (1987b, p.36).

24. *Cricotopus osarudigitatus*, Sasa, sp. nov.

(Plate 7A)

A male was collected at the side of Osaru River on 12 June 1986 (No.A 128: 10, holotype).

Male. BL 2.72 mm, WL 1.92 mm. Body largely black, with white markings on abdomen and legs. Ground color of scutum dark brown, scutal stripes black, scutellum and postnotum black, abdominal tergites I and II white, other tergites all black, gonocoxite brown, gonostylus whitish. Basal 1/3 of front femur and basal 1/4 of middle and hind femora whitish, the distal parts of femora black; basal 1/2 of front tibia and basal 1/3 of middle and hind tibiae whitish, the distal parts black; basal 2/3 of front tarsus I and basal 1/2 of middle and hind tarsi I brown, the distal parts brownish yellow; tarsi II to V of all legs brownish yellow. Head in Fig. 7A1. Eyes highly pubescent, each with a long and narrow dorsomedial projection, ER 0.45. Antenna with 13 flagellar segments, AR 0.69, AHR 0.43. so 10:10, cl 16. Anteprepronotum (Fig.7A2) well developed and united thickly in the middle, with 6 and 8 lateral setae. dm 20, dl 25:26, all minute, decumbent and arising from small pits. pa 4:5, sc 16, all long and stout as usual. Wing in Fig. 7A3. Wing membrane bare, smooth and without dark marks. RR 0.52, VR 1.11, R/Cu 1.11, sq 8:9. Costa slightly extending beyond end of R₄₊₅. Anal vein extends much beyond fCu. Terminal structures of tibiae as in other *Cricotopus* species, tarsi without terminal spur, pulvilli absent. fLR 0.63, mLR 0.45, hLR 0.58, fTR 0.13, fBR 2.0, mBR 2.3, hBR 2.4.

Abdominal tergites with reduced numbers of setae, arranged into the middle, posterior and lateral groups. Hypopygium in Fig. 7A7. Ninth tergite with a long, and sharply pointed anal point, which is hyaline in contour and may be easily overlooked. There are 7 or 8 short setae on both sides of the base of anal point. Both gonocoxite and gonostylus bear highly complicated appendages. Basal lobes of gonocoxite double, the basal arm being roughly quadrangulate but slightly constricted at base, bearing numerous orally directed microtrichiae; the distal arm is smaller, roughly semiglobular and bearing numerous short setae. Gonostylus has a large conical basal arm bearing 3 lamellar and strong terminal setae and numerous strong setae on inner side. The terminal structure of gonostylus is also highly complicated and deformed, the terminal spur and two accessory spines are unusually large and arising on a large conical terminal lobe.

Remarks. This is the fourth species of the *digitatus* group (to be designated as a new subgenus of *Cricotopus*) recorded from Japan, which show morphological characters typical to genus *Cricotopus* but have stout gonostylus directed backwards, and bear highly complicated appendages on gonostylus and gonocoxite. The four species so far recorded from Japan also have the common characters, gonostylus has a finger-like basal process bearing terminal setae, and abdominal tergites I and II are more or less paler than the rest tergites, which are all black. Males of these 4 species may be differentiated by the following key.

Key to males of the *digitatus* group of genus *Cricotopus*

- 1 - Gonostylus with a long and stout spur near base 2
 - Gonostylus with a long and stout spur near base but not near apex 3

- 2 - Abdominal tergites I and II white, basal half of front tibia largely white ; AR about 1.2; anal point small, conical and transparent; gonocoxite with two inner lobes, the basal arm roughly quadrangular, the distal arm rectangular *montanus* Tokunaga, 1936
 - Abdominal tergites I and II brown and only slightly paler than the preceding tergites, tibiae largely dark; AR about 1.8; anal point long and narrow; gonocoxite with only one small lobe *matudigitatus* Sasa et Kawai, 1987

- 3 - Gonostylus triangularly produced apically and with a long and stout apical seta and two long accessory setae on it; anal point long, slender and apically pointed; basal arm of inner lobes roughly quadrangular; AR about 0.7. *osarudigitatus*, sp. nov.
 - Gonostylus not produced apically; anal point absent; basal arm of inner lobes of gonocoxite long, slender and finger-like; AR about 1.0. *tamadigitatus* Sasa, 1981

25. *Cricotopus osaruquartus* Sasa, sp. nov.

(Plate 7B)

Six males and 3 females were collected at the side of Osaru River on 12 June 1986. Holotype: male, No.A 128:01. Paratypes: males, No.A 128:02-06. A female was collected also on the shore of Lake Utonai on 13 June 1986 (No.A 125:73).

Male. BL 3.00-3.52 (3.31 in average of 6) mm, WL 2.01-2.17 (2.09) mm. Body largely black, i.e. ground color of scutum dark brown, scutal stripes and postnotum black, scutellum dark brown, abdominal tergites also entirely black, gonocoxite and gonostylus whitish; halteres brown, wing unmarked; front femur dark brown for basal half and gradually darkened towards tip, front tibia dark brown at basal end and distal half, basal half largely white, front tarsus I entirely brown, II largely white excepting distal end being brown, III, IV and V brown; in the middle and hind legs, femora dark brown, tibiae dark brown at

base and distal 2/3, basal 1/3 largely whitish, tarsi yellowish brown.

Head in Fig. 7B1. Eyes highly pubescent, inner margin strongly concave, ER 0.48-0.62 (0.56). Antenna with 13 flagellar segments, AR 0.71-0.78 (0.74), AHR 0.49-0.55 (0.52). so 10-14 (11.7), cl 13-16 (15.0). Anteprenotum (Fig.7B2) united in the middle, with 4-8 (4.9) lateral setae. dm 20-28 (23.2), dl 30-36 (33.4), both all minute and arising from small pits. pa 4 or 5 (4.6), sc 18-26 (21.3), both long and stout as usual. Scutum and scutellum in Fig. 7B4. Wing in Fig.7B3. Costa extending slightly beyond end of R₄₊₅. R₂₊₃ ending beyond middle between ends of R₁ and R₄₊₅, RR 0.54-0.61 (0.57), VR 1.10-1.14 (1.12), R/Cu 1.04-1.09 (1.06). Anal vein extending beyond fCu. sq 10-20 (14.9). Tip of front tibia (Fig.7B5) with a long terminal spur (78 μ). Tip of middle tibia (Fig.7B6) with two short terminal spurs (22, 37 μ). Tip of hind tibia (Fig.7B7) with a long terminal spur (78 μ), a short terminal spur (44 μ), and a terminal comb composed of 13 free spurs (31-60 μ). fLR 0.55-0.60 (0.57), mLR 0.46-0.47 (0.47), hLR 0.54-0.58 (0.56), fTR 0.10-0.12 (0.11), fBR 1.8-2.2 (2.0), mBR 2.0-2.4 (2.2), hBR 2.4-2.9 (2.7). Pulvilli absent. Abdominal tergites with reduced numbers of setae, as in Fig. 7B8.

Hypopygium in Fig.7B9. Ninth tergite without anal point, and with some 12 short setae in the middle. Inner lobes of gonocoxite double, the basal lobe semicircular and bearing numerous short setae and microtrichiae, the distal lobe thumb-like and entirely bare (Fig.7B10). Bases of inner margin of gonocoxite not expanded, such as seen in species of subgenus *Isocladius*. Gonostylus simple, with a strong terminal spur, and an acutely angular large subapical tooth.

Female. BL 3.20, 3.34, 3.48 mm, WL 2.16, 2.42 mm. Body coloration as in male, thorax entirely black, distal half of all tibiae largely white, front tarsus II white, other leg segments largely brown. Head in Fig. 7B11. Eyes highly pubescent, inner margin strongly concave, ER 0.70, 0.84, 0.84. Antenna with 5 flagellar segments, AR 0.52, last segment with a long subterminal seta. so 10-14 (11.3), cl 20, 20, 30, pn 6:6, 6:6, 6:8, dm 20, 24, 28, dl 34:34, 36:38, 40:40, pa 5:5, 5:6, 6:6, sc 14, 16, 18. Wing bare, sq 14, 14, 16, RR 0.51, 0.53, VR 1.11, 1.19, R/Cu 1.08-1.16. Terminal structure of tibiae as in male, fLR 1.08, 1.12, mLR 0.43, 0.45, hLR 0.53, 0.54, fTR 0.11, 0.12, fBR 1.3, 1.9, mBR 1.4, 1.8, hBR 1.6, 2.0. Pulvilli absent. Spermathecae in Fig.7B12, both oval and darkly pigmented, cercus in Fig.7B12.

Remarks. This species obviously belongs to the genus *Cricotopus* van der Wulp, since eyes are pubescent, both dorsomedian and dorsolateral setae of scutum are minute, squama with fringe hairs, anal point is absent, and hypopygium is white in color. It belongs to the subgenus *Cricotopus* s. str., since pulvilli are absent and inner margin of gonocoxite has no hump at the base. However, it is quite unique as a member of this group in that abdominal tergites are entirely black and without pale marks, basal half of tibiae and front tarsus II are white and other leg segments are dark, gonocoxite has two distinct inner lobes, and gonostylus has a conspicuous acute angular subapical tooth. Among the *Cricotopus* species known from Europe, it is somewhat related to *C. annulator* Goetghebuer, 1927, in that inner lobes of gonocoxite are double and the anterior arm is parallel-sided, with rounded apex, and longer than the posterior arm, but in the latter abdominal tergites show distinct

pale markings, anterior arm of gonocoxite lobes are not bare but highly setigerous, and gonostylus has no subapical tooth (Hirvenoja 1973, p.202; Pinder 1978, p.58). Among *Cricotopus* species recorded from Japan, it is somewhat related also to *C. bituberculatus* Tokunaga, 1940, and *C. triannulatus* Tokunaga, 1936, but in both species abdominal tergites show distinct pale markings, anterior lobe of gonocoxite is setigerous, AR is larger than 1.0, and gonostylus has no subapical tooth.

26. *Cricotopus sylvestris* (Fabricius, 1794)

A total of 12 males and 3 females emerged in the laboratory from bottom samples collected from Lake Shikotsu on 12 June 1986 (No.A 121:61-75). This is a species commonly breeding in lakes in Japan, and the larvae are often found abundantly on the surface of water plants.

27. *Cricotopus triannulatus* (Macquart, 1826)

Two females were collected on the shore of Lake Shikotsu on 12 June 1986 (No.A 121:78, 79). This species was recorded by Tokunaga (1936, p.12) from Kyoto and Shiga, by Sasa (1981, p.13; 1983, p.72) from polluted parts of River Tama, and by Sasa & Kawai (1987a, p.41; 1987b, p.35) from Lake Biwa (Shiga) and River Itachi (Toyama).

28. *Nanocladius tamabicolor* Sasa, 1981

A male and a female were collected at the side of Lake Utonai on 13 June 1986 (No. A 125:71, 72). Standard measurement data of male: BL 2.08 mm, WL 1.22 mm, AR 1.00, AHR 0.56, ER 1.68, so 2:2, cl 10, pn 1:1, dm 0, dl 7:8, pa 1:1, sc 2, sq 2:2, RR 1.00 (R_{2+3} is completely fused with R_{4+5}), VR 1.17, R/Cu 1.04, fLR 0.64, mLR 0.49, hLR 0.58, fTR 0.15.

Remarks. This species was described by Sasa (1981, p.22) by male, female and pupa collected at lower and more polluted sites of River Minimiasakawa (Tokyo), and was later recorded also from the most polluted sites of Lake Biwa (Shiga) by Sasa & Kawai (1987a, p.41), and from River Itachi (Toyama) by Sasa & Kawai (1987b, p.36). The adults are characteristic in that eyes are highly pubescent, roughly oval and widely apart from each other, the numbers of various setae on thorax and abdomen are highly reduced, scutum has a pale median hole bearing a pair of minute setae, proximal half of femora (also proximal end of tibiae in the present specimen) is dark brown and other leg parts are yellow, and the male hypopygium has a long, narrow and needle-like anal point, inner lobe of gonocoxite is broad and obtuse, and gonostylus is narrow and conspicuously bent inwards near apex.

29. *Paratrichocladius tamaater* Sasa, 1981

(Plate 8A)

Two males were collected at the side of Osaru River on 12 June 1986 (No.A 128:19, 20). BL 2.92, 2.94 mm, WL 1.76, 2.00 mm. Scutum, scutellum and postnotum black, abdominal tergites and legs dark brown, halteres yellowish brown. Head in Fig. 8A1. Eyes pubescent, inner margin strongly concave, ER 0.90, 1.05. Antennal flagellum 13 segmented, AR 1.21, 1.23, AHR 0.53, 0.56. Supraorbitalis composed of 1 or 2 inner and 4 outer pairs. cl 10, 10. Anteprepronotum (Fig.8A2) narrowly connected in the middle, with 3:3, 3:4 lateral setae. Scutum (Fig.8A4) with a pair of large humeral pits, dm 6, 6, all minute; dl 11:13, 13:15, all arising from a large pale pit; pa 3:3, 3:4, sc 8, 10. Wing (Fig.8A3) bare, squama with 7:8, 9:10 fringe hairs, RR 0.54, 0.59, VR 1.08, 1.10, R/Cu 1.04, 1.08. Costa not or slightly extending beyond tip of R₄₊₅, Cu₂ slightly curved near tip, anal vein extending beyond tip of fCu. Wing membrane finely granular. fLR 0.60, 0.62, mLR 0.50, 0.52, hLR 0.58, 0.60, fTR 0.14, fBR 2.0, mBR 2.2, hBR 2.4. Pulvilli absent.

Abdominal tergites (Fig.8A4) with reduced numbers of setae. Hypopygium in Fig. 8A5, 6. Anal point absent, ninth tergite with 6 short setae in the middle portion. Inner lobe of gonocoxite angularly produced, bearing short setae arising on elevated bases, and numerous microtrichiae. Gonostylus with broad and rounded subapical tooth. Other morphological characters as described in the original paper by Sasa (1981, p.20).

Note. A male, possibly belonging to *Paratrichocladius rufiventris* (Meigen, 1830), was collected also on light on the shore of Lake Toya on 12 June 1986 (No.A 124:39). BL 3.54 mm, WL 1.80 mm, ER 0.75, AR 1.52, AHR 0.52, so 8:8, cl 16, pn 5:6, dm 8, dl 16:17, pa 3:3, sc 12, sq 12:13, RR 0.51, VR 1.08, R/Cu 1.04, fLR 0.57, mLR 0.46, hLR 0.57, fTR 0.14, fBR 2.3, mBR 3.3, hBR 3.4. In this specimens, AR larger, ER smaller, cl, pn, dm, dl and sc all larger, LR generally smaller, and BR larger than in the two specimens collected at the side of Osaru River.

Remarks. *P. rufiventris* was recorded by Sasa (1979, p.34) from an artificial stream constructed in NIES (Ibaraki), and also by Sasa (1983, p.71) from the more polluted downstream sites of River Tama. On the other hand, *P. tamaater* was recorded by Sasa (1981, p.20; 1983, p.70) from the unpolluted upstream sites of River Tama. These two species were most clearly differentiated by the number of flagellar segments of female antenna (5 in *tamaater*, 6 in *rufiventris*), but also in male by the value of AR (larger in the latter) and in the number of setae on abdominal tergites.

Key to adults of the Japanese species of
genus *Paratrichocladius* Santos Abreu

- 1 - Female antenna composed of a pedicel and 5 flagellar segments; setae on male abdominal tergites are composed of 4 or 5 pairs of lateral groups, and the anterior and the posterior groups each represented by 10-12 setae distributed in transverse rows; AR 1.05-1.26; subapical tooth of gonostylus broad and rounded; larvae breeding in the unpolluted upstream parts of river. *tamaater* Sasa, 1981

- Female antenna composed of a pedicel and 6 flagellar segments; setae on abdominal tergites are more numerous and distributed more evenly on entire surface; AR 1.35-1.63; subapical tooth of gonostylus narrower and pointed; larvae breeding in the more polluted downstream parts of river.

rufiventris (Meigen, 1830) sensu Sasa, 1979.

30. *Eukiefferiella coerulescens* (Kieffer, 1926)

(Plate 10B)

A male was collected on light at the side of Lake Toya on 12 June 1986 (No.A 124:55). BL 1.80 mm, WL 1.14 mm. Ground color of scutum yellow, stripes dark brown, scutellum largely yellow, postnotum dark brown, abdominal tergites brown, leg segments yellow. Eyes pubescent, inner margin only slightly concave and widely apart from each other, ER 1.53. Antenna with only 12 flagellar segments, last segment very short and apically expanded, AR 0.31, AHR 0.34 (both very small). Head with a pair of large, broad and rounded frontal processes between bases of antenna. so 2:2, cl 4. Antepronotum narrowly united in the middle, with only one lateral seta on each side. dm 8, all minute. dl 6:8, all arising from a large pale pit. pa 3:3, sc 4. Squama bare, wing membrane bare and smooth. The structure of wing vein is characteristic to this species (Fig.10B1); R₂₊₃ entirely fused with R₄₊₅, R₁ very short and 1/2.8 times as long as R₄₊₅, costa extending much beyond end of R₄₊₅ but ending much proximal to tip of wing, tip of R₄₊₅ far proximal to tip of Cu₁ (R/Cu 0.83), fCu much beyond r-m (VR 1.40), Cu₂ almost straight. Terminal structure of tibiae as in other Orthoclaadiinae. Anal point absent, inner lobe of gonocoxite large, broad and rounded. Gonostylus simple, without subapical tooth and with a small terminal spur.

Remarks. *E. coerulescens* is a species known from northern Europe and was described and illustrated by Edwards (1929, p.354), Brundin (1956, p.87) and Pinder (1978, p.64), and also by Sasa & Kawai (1987b, p.41) from Itachi River (Toyama). Especially characteristic is the structure of wing veins, pubescent eyes, small AR and AHR, the number of antennal flagellum being only 12, and the structure of hypopygium. The measurement data and morphological characters of the present specimen are almost coincident with that described and illustrated by Sasa & Kawai (1987, p.41).

31. *Heterotrissocladius subpilosus* (Kieffer, 1911)

Three males were identified among the midges collected on light at the side of Lake Toya on 12 June 1986 (No.A 124:58-60). BL 4.24, 4.64, 4.92 mm, WL 2.56, 2.70, 2.75 mm. Body largely dark brown. Eyes bare, each with a conspicuous dorsomedial projection, ER 0.59, 0.74, 0.77. Antenna with 13 flagellar segments, AR 1.67, 2.00, AHR 0.50, 0.54. so 16:16, 16:16, 18:18, cl 10, 14, 14. Antepronotum well developed and thickly united in the middle, with 4:5, 5:5, 5:7 lateral setae. dm 0, dl 13:14, 14:18, 17:19, all arising in large pale pits. pa 6:6, 8:10, 10:11, sc 16, 19, 20, sq 26-32 (29.7). Wing with macrotrichiae rather sparsely on distal 1/3. RR 0.35, 0.38, 0.39, VR

1.15, 1.16, 1.22, R/Cu 1.05, 1.11, 1.11. Cu₂ curved near the tip. Anal vein extending much beyond fCu. Terminal structure of tibiae as usual, tarsi without terminal spurs. fLR 0.86, 0.87, 0.89 (relatively large), mLR 0.53, 0.55, 0.56, hLR 0.61, 0.64, 0.67, fTR 0.14, 0.15, fBR 2.3, 2.4, 2.8, mBR 3.4, 4.2, 4.8, hBR 4.0, 4.3, 5.2. Pulvilli absent. Hypopygium has a large anal point with rounded apex, gonocoxite has a wide and rounded inner lobe, gonostylus simple, widest at apex and with an angulate subapical tooth.

Remarks. *H. subpilosus* is a species reported by various authors as being an important bottom fauna of mountain lakes in northern Europe, and was recorded also from Lake Kussharo, a mountain lake in northern Hokkaido, by Sasa & Kamimura (1987, p.33).

32. *Orthocladus frigidus* (Zetterstadt, 1852)

(Plate 8B)

Two males were collected with sucking tube on light at the side of Lake Toya on 12 June 1986 (No. A 124:49, 50). BL 4.20, 4.34 mm, WL 2.60, 2.62 mm. Ground color of scutum brown, scutal stripes dark brown, scutellum brown, postnotum dark brown, abdominal tergites brown, femora brown, tibiae and tarsi yellowish brown. Head in Fig. 8B1. Eyes bare, inner margin strongly concave, ER 0.86, 0.88. Antenna with 13 flagellar segments, AR 1.72, AHR 0.58. so 14:14, 14:14, cl 10, 12. Anteprenotum (Fig.8B2) united in the middle, with 10:10, 10:10 lateral setae. Scutum and scutellum in Fig. 8B4. dm 12, 16, all very short; dl 10:10, 10:11, pa 5:5, 5:7. Scutal setae 18, 26, in multiple rows.

Wing in Fig. 8B3. Squama with 21-26 fringe hairs. Wing membrane bare, smooth and brownish. Costa not extending beyond end of R₄₊₅. RR 0.29, 0.39, VR 1.04, 1.11, R/Cu 1.06, 1.06. Anal lobe nearly rectangular. Terminal structure of tibiae as in other *Orthocladus* species, tarsi I and II of middle and hind legs each with two short terminal spurs. fLR 0.70, mLR 0.51, 0.53, hBR 0.53, 0.56, fBR 3.7, mBR 4.2, hBR 5.6. Pulvilli absent.

Hypopygium in Fig. 8B5. Anal point finger-like, parallel-sided and with rounded apex, bearing 3 basal and 5 lateral setae on both sides. Inner lobes of gonocoxite composed of double blades, the dorsal lobe much longer than wide, bearing strong setae and covered with microtrichiae on only the inner portion (Fig.8B6), while the ventral blade is wider, lower and entirely covered with microtrichiae (Fig.8B7). Gonostylus simple, with a strong apical spine, and a small subapical tooth.

Remarks. This is a species widely distributed in Europe (Edwards, 1929, p. 346; Goetghebuer, 1940, p.43; Brundin, 1947, p.21; Pinder, 1978, p.70), and was also recorded from Lake Akan (Hokkaido) by Sasa & Kamimura (1987, p.28).

33. *Orthocladus kanii* (Tokunaga, 1939)

(Plate 9A)

Eight males were collected on light at the side of Lake Toya on 12 June 1986 (No. A 124:41-48). BL 2.78-3.64 (3.13 in average of 8) mm, WL 1.66-2.15 (1.80) mm. Ground color of scutum yellow, stripes dark brown, scutellum

brown, postnotum dark brown, abdominal tergites brown, legs brown. Head in Fig. 9A1. Eyes bare, inner margin concave but without dorsomedial projection, ER 1.04-1.23 (1.14). Antenna with 13 flagellar segments, AR 1.28-1.51 (1.38), AHR 0.52-0.57 (0.54). so 10-14 (13.8), cl 10.16 (12.9). Anteprenotum (Fig. 9A2) well developed and united in the middle, with 6-13 (9.2) dorsolateral setae. Scutum and scutellum in Fig. 9A4, dm 0 in all, dl 8-12 (10.0), pa 4 or 5 (4.7), sc 18-24 (20.4), distributed in multiple rows. Wing in Fig. 9A3. Anal lobe conspicuously produced inwards. Squama with 14-30 (21.0) fringe hairs. Costa slightly extending beyond end of R₄₊₅. RR 0.30-0.36 (0.33), VR 1.03-1.09 (1.06), R/Cu 1.03-1.07 (1.05). Anal vein extending much beyond fCu. Cu₂ almost straight. Terminal structure of tibiae as in other *Orthocladus* species, tarsi I and II of middle and hind tibiae with two short terminal spurs. Pulvilli absent.

Hypopygium in Fig. 9A5-8. Anal point almost parallel-sided and with rounded apex, with 1-3 basal and 4-6 lateral setae but without microtrichiae excepting at base. Inner lobes of gonocoxite double (Fig. 9A7, 8), dorsal blade nearly as long as wide and rounded, ventral blade much wider than long. Gonostylus with a broad and rounded subapical tooth.

34. *Orthocladus glabripennis* complex

(Plate 9B)

A total of 34 males, 19 females and 9 pupal exuviae were identified among the specimens collected from Lake Shikotsu and Toya; namely, 9 males and 8 females emerged in the laboratory from bottom samples of Lake Shikotsu collected on 12 June (No. A 121:81-97); 6 males and 6 females were collected at the side of Lake Toya on 12 June (No. A 124:01-13); 19 males and 5 females emerged from bottom samples of Lake Toya on 13 June, 1986 (No. A 124:92-97).

Male. BL varying from 3.60 to 5.26 mm, WL 1.92 to 2.46 mm in measurements of 25. Body largely black in some specimens, dark brown to reddish brown in others. Head in Fig. 9B1. Eyes bare, reniform, inner margin concave but without dorsomedial projection, ER 0.93-1.25. Antenna with 13 flagellar segments, AR 1.62-2.55, AHR 0.48-0.6. so 10-20, cl 12-23. Anteprenotum well developed, thickly united in the middle, with 5-14 (most frequently 8) lateral setae. Scutum and scutellum in Fig. 9B2. dm 5-14, all minute; dl 6-14 on each side, all strong and arising from large pale pits; pa 4-6. Scutellar setae varying from 8 to 20 (8 in 3, 9 in 1, 10 in 3, 11 in 1, 12 in 9, 13 in 1, 14 in 5, 16 in 1, 18 in 3, and 20 in 1), on a single transverse line in those with 12 or less, and in two lines in those with larger numbers of setae (Fig. 9B4-6).

Wing in Fig. 9B3. Squama with 20-30 fringe hairs. Anal lobe strongly produced. Costa hardly extending beyond end of R₄₊₅. RR ending slightly closer to end of R₁ than to end of R₄₊₅, RR 0.32-0.44. VR 1.03-1.10, R/Cu 1.03-1.09. Terminal structure of tibiae as in other *Orthocladus*. Tarsi I and II of middle and hind tibiae each with two short terminal spurs. fLR 0.70-0.78, mLR 0.52-0.56, hLR 0.56-0.63, fTR 0.13-0.16, fBR 3.1-5.2, mBR 3.6-6.6, hBR 4.0-6.8. Pulvilli absent.

Hypopygium in Fig. 9B7-10. Anal point slender and tapering towards

sharply pointed apex, with 4-6 lateral setae and 2-5 basal setae on both sides. Inner lobe of gonocoxite composed of two blades, the dorsal blade nearly as long as wide, with rounded margin, and bearing 5-7 short setae but devoid of microtrichiae excepting at base (Fig. 9B8), and the ventral blade which is much longer than wide, extending beyond margin of dorsal blade, and bearing some 10 long marginal setae (Fig. 9B9). Gonostylus simple, inner margin concave, with a strong terminal spur, but without subterminal tooth and not expanded apically.

Female and pupa. The structure is essentially the same as those described by Sasa (1985b, p.53) with specimens collected from Lake Unagi (Kagoshima).

Remarks. The specimens grouped here by the name of the *Orthocladius glabripennis* complex possibly include two different species, one with more numerous scutellar setae arranged in double rows, and another with fewer numbers of scutellar setae arranged in a single transverse row. The former represents a type which belong to the subgenus *Euorthocladius* and the latter to subgenus *Orthocladius* in the sense of Brundin (1956, p.55). In the case of Lake Chuzenji (Sasa, 1984, p.67), only the former type was collected and was named as *Orthocladius (Euorthocladius) chuzeseptimus*, while in Lake Unagi (Sasa, 1985b, p.53) the two types were mixed and could not be separated clearly from each other, such as seen in the present collections, and thus were treated as the *Orthocladius glabripennis* complex. In both types, the shape of anal point is the *Orthocladius* form, i.e. tapering towards sharply pointed apex and not parallel-sided and with rounded apex such as seen in other *Euorthocladius* species. The morphology of pupal exuviae collected in the present samples were all of the *O. chuzeseptimus* type.

35. *Heleniella osarumaculata* Sasa, sp. nov.

(Plate 10A)

Two males were collected at the side of Osaru River on 12 June 1986. Holotype, No. A 128:21. Paratype, A 128:22

Male. BL 2.24, 2.26 mm, WL 1.41, 1.51 mm. Ground color of scutum dark brown, scutal stripes, scutellum and postnotum black, abdominal tergites dark brown, halteres brown; all femora dark brown, front tibia largely yellow but both ends brown, front tarsi entirely yellowish brown; tibiae and tarsi of middle and hind legs entirely yellow; wing with two large dark purplish marks, as in Fig. 10A3. Head in Fig. 10A1. Eyes pubescent, roughly reniform and with concave inner margin, ER 1.04, 1.08. Supraorbital setae 18:18, 24:24, in double rows. Clypeal setae 10, 12. Antenna with 13 flagellar segments, AR 0.81, AHR 0.52. Anteprepronotum (Fig.10A2) well developed, thickly united in the middle, and bearing numerous setae on entire surface. Scutum and scutellum in Fig. 10A4. Dorsomedian setae possibly absent (this portion is twisted under dark scutum in both specimens and should be confirmed when additional specimens become available). dl 64:64, 80, 80, distributed in multiple rows. pa 20:20, 23:23, sc 28, 32.

Wing in Fig. 10A3. Wing membrane with two large and conspicuous dark

marks, and very finely granular. Squama bare, anal lobe obtuse. R_{2+3} nearly in contact with R_{4+5} , RR 0.72, 0.76. Costa extending much beyond end of R_{4+5} . VR 1.14, 1.16. Cul ending almost under tip of R_{4+5} , R/Cu 1.01, 1.03. Cu_2 strongly curved in the middle portion. Anal vein extending beyond fCu. Front tibia with a long and curved terminal spur (35 μ , Fig.10A5). Middle tibia with one (not two) short terminal spur (20 μ , Fig. 10A6). Hind tibia triangularly expanded at apex, with a long terminal spur (45 μ), a short terminal spur (25 μ), and a terminal comb composed of 15 free spurs (22-35 μ , Figs. 10A7, 8). fLR 0.57, 0.60, mLR 0.51, hLR 0.56, fTR 0.14, 0.15, fBR 2.7, 2.9, mBR 3.8, hBR 4.2. All tarsi without terminal spur. Tarsi IV cylindrical and almost as long as tarsi V in all legs. Pulvilli absent, claws and empodium well developed, the former bearing strong setae at the base (Fig.10A9). Abdominal tergites with reduced numbers of setae (Fig.10A10).

Hypopygium in Fig.10A11. Ninth tergite with broad and rounded posterior margin, with several short setae on posterior margin, anal point absent. Gonocoxite with a large rectangularly produced inner lobe bearing short setae and microtrichiae. Long vigra (100 μ) present on the ventral side between gonocoxite. Gonostylus short (52 μ long), stout and parallel-sided, with a simple terminal spur.

Remarks. The genus *Heleniella* was created by Gowin (1943) with his new species, *thienemanni*, as the genotype, and based on the morphology of larva and pupa. However, Brundin (1956, p.144) regarded this species as a synonym of *Smittia ornaticollis* Edwards, 1929, and redefined the generic character based on the following adult characters. "Eyes pubescent, without dorsomedial projection. Frontal hairs numerous and in multiple rows. Last antennal segment of male not swollen apically, with about 10 minute setae in distal part but apical seta is absent. AR smaller than 1.0. Pronotum well developed and densely pubescent all over. Dorsolateral setae 40-60 on both sides and arising from near anterior end of scutum in 3-4 rows. Prealar setae also numerous, 30-40 in number. Dorsomedian setae absent. Scutellum with numerous setae distributed all over. Wing without macrotrichiae and very finely granular. Squama bare. Wing veins as in *Smittia*. R_{4+5} above end of Cu_1 , and costa is extending beyond it. R_{2+3} ending about middle of ends of R_1 and R_{4+5} . fCu only slightly distal to r-m. Cu_2 strongly curved. Anal vein extending beyond fCu. The longer terminal spur of hind tibia slender and straight. Pulvilli absent. Setae on abdominal tergites relatively small in numbers and forming irregular transverse bands. Anal point very small, hyaline. Anal tergite with numerous setae on posterior margin. Terminal spur of gonostylus very large and deeply inserted."

The present species is provisionally placed in the genus *Heleniella* because almost all the above characteristics are also applicable. However, it differs remarkably from the type species in having two large and conspicuous dark marks on the wing, and vein R_{2+3} ends closer to the tip of R_{4+5} than to the tip of R_1 .

36. *Limnophyes akannonus* Sasa et Kamimura, 1987

A male was collected at the side of Lake Toya on 13 June 1986 (No.A 124:68). Three males were collected while swarming at the side of Lake Utonai on 13 June 1986 (No. A 125:76-78). BL 2.20-2.50 (2.36 in average of 4) mm, WL 1.32-1.56 (1.44) mm. ER 1.43-1.56 (1.50). Antenna with 12 (in 2) or 13 (1) flagellar segments, AR 0.79-0.88 (0.84), AHR 0.48-0.55 (0.51). so 5-7 (5.9), cl 18-26 (22.5). Anteprenotum with 2 or 3 (2.3) dorsal and 2-4 (3.0) lateral setae. dm 0, 2, 4, 6, dl 48:54, 58:64, 64:67, 71:73, among which those in the humeral and prescutellar areas are partly very short and slightly expanded (10-12 μ long, 3 μ wide), the others are long and slender (42-60 μ long). pa 6-8 (7.0), sc 6-8 (6.5), sq 2-5 (3.6). Wing membrane coarsely granular, costa extending much beyond end of R₄₊₅, Cu₂ strongly curved, anal vein ending below fCu. RR 0.28-0.32 (0.30), VR 1.26-1.31 (1.28), R/Cu 1.04-1.07 (1.05). fLR 0.54-0.56 (0.55), mLR 0.46-0.49 (0.47), hLR 0.57-0.59 (0.58), fTR 0.12 in all, fBR 0.29-0.32 (0.30), mBR 2.9-3.3 (3.2), hBR 3.1-4.2 (3.6). Pulvilli absent.

Hypopygium without anal point, inner lobe of gonocoxite small, longer than wide and rounded. Gonostylus strongly expanded in the middle, lateral margin almost straight and inner margin strongly convex, with a very long spur subapically, and tapering towards sharply pointed apex.

Remarks. The present specimens are morphologically almost coincident with the type specimens of *L. akannonus* described and illustrated by Sasa & Kamimura (1987, p.37).

37. *Limnophyes hudsoni* Saether, 1975

Six males were collected with insect net at the side of Lake Toya on 13 June 1986 (No. A 124:61-66). Two males were collected also at the side of Osaru River on 12 June 1986 (No. A 128:26, 27). BL 1.72-2.20 (1.91 in average of 8) mm, WL 1.00-1.32 (1.08) mm, ER 1.27-1.64 (1.48). Antenna with 11 flagellar segments, AR 0.25-0.57 (0.43), AHR 0.31-0.61 (0.43). so 4 or 5 (4.5), cl 10-15 (12.3). Anteprenotum well developed, united in the middle, with 1 or 2 (1.5) dorsal and 2 or 3 (2.6) lateral setae on each side. dm 0 in 4, 2 in 2, 4 in 1, and 6 in 1 specimens. dl 10-16 (12.9) all simple, pa 4-6 (5.3), sc 6 in 7 and 8 in 1 specimen. Squama with 1-4 (2.2) fringe hairs. Wing membrane bare but coarsely granular in appearance. RR 0.29-0.36 (0.32), VR 1.25-1.44 (1.33), R/Cu 1.04-1.06 (1.05). Costa extending much beyond end of R₄₊₅. Cu₂ strongly curved near apex. Anal vein ending proximal to fCu. Anal lobe obtuse. fLR 0.47-0.49 (0.48), mLR 0.42-0.45 (0.44), hLR 0.52-0.56 (0.54), fTR 0.11-0.14 (0.12), fBR 2.1-2.4 (2.3), mBR 2.0-3.1 (2.6), hBR 2.0-3.1 (0.28). Pulvilli absent.

Hypopygium as illustrated by Sasa & Kikuchi (1986, p.31) and Sasa & Kawai (1987b, p.44) with Japanese specimens. Ninth tergite without anal point, but may be produced posteriorly in the middle forming a broad rounded process. Inner lobe of gonocoxite usually longer than wide and acute angularly produced, and often with low and broad ventral blade. Gonostylus simple,

nearly parallel-sided, and with a strong apical spur, and a small rectangular subapical tooth.

Remarks. The present specimens show morphological characters and measurement data almost within the variation ranges of *L. hudsoni* described from Tokushima by Sasa & Kikuchi (1986, p.44) and from Toyama by Sasa & Kawai (1987b, p.44). The measurement data and the structure of hypopygium of these population groups have shown variations within the specimens of the same localities and between those collected at different localities. *L. hudsoni* was described by Saether (1975, p.1032) as being common and widespread in North America, and also to have a very wide variations, or may be divided into different species. In his original description, antenna composed of 11 or 12 (13 in 1) flagellar segments, AR 0.56-0.80, dm 4-10 (0-6, most frequently 0 in the present specimens), dl 9-14, pa 4-6, sc 3-7, and inner lobe of gonocoxite is somewhat finger-like or rounded.

38. *Limnophyes prolongatus* Kieffer, 1921

Three males were collected at the side of Lake Toya on 12 or 13 June 1986 (No. A 124:69-70). BL 1.92, 1.94, 2.24 mm, WL 1.34, 1.38 mm. Eyes bare, reniform, ER 1.36, 1.48, 1.48. Antenna with 13 flagellar segments, AR 0.77, 0.82, AHR 0.44, 0.46. so 5 or 6 (5.7), cl 12, 16, 16. Antepronotum with 1-3 (1.5) dorsal and 2 or 3 (2.3) lateral setae. Scutum and scutellum in Fig. 10C1. dm 0, dl 38:40, 38:40, 42:42, among which 6-8 in the humeral areas and 6-8 in the prescutellar areas are short and slightly expanded (22-24 μ long and 3-4 μ wide), and the other setae are long and slender (60-68 μ long and 2 μ wide). pa 6:6, 6:6, 7:7, sc all 6. Squama with 2:2, 3:3 fringe hairs. Wing membrane without macrotrichiae, and coarsely granular. RR 0.23, VR 1.19, R/Cu 1.07. Costa extending much beyond end of R₄₊₅, Cuz strongly curved at about middle. Anal vein ending under fCu. fLR 0.50, 0.57, mLR 0.44, 0.46, hLR 0.57, 0.59, fTR 0.12, 0.13, fBR 2.6, 2.9, mBR 2.6, 2.9, hBR 3.2, 3.7. Pulvilli absent.

Hypopygium in Fig. 10C2, 3. Ninth tergite slightly produced in the middle but without distinct anal point. Inner lobe of gonocoxite small, longer than wide and more or less pointed. Gonostylus simple, widest at about basal 1/3 and tapering towards pointed apex, apically blackened, without apical spur but with 1 or 2 relatively long setae on lateral margin near apex.

Remarks. *L. prolongatus* is a species commonly and widely recorded from Europe (Edwards, 1929, p.356; Goetghebuer, 1940, p.139; Brundin, 1947, p.35; Pinder, 1978, p.88), and also by Tokunaga (1965, p.40) from Kyoto. The present specimens roughly fit to descriptions of the previous authors in that antenna with 13 flagellar segments, AR 0.77-0.82 (0.5-0.6 in European specimens), scutum with short and narrow lamellar setae on both humeral and prescutellar areas, inner lobe of gonocoxite is small and longer than wide, gonostylus is tapering towards blackened apex and without apical spur. This species is somewhat related to *L. tamakireides* recorded from small mountain streams of Tama by Sasa (1983, p.78) and of Nikko by Sasa (1985, p.86), but the latter has no lamellar setae in prescutellar areas, and antenna is

composed of 12 flagellar segments, with smaller AR value of 0.22-0.32. The specimens recorded by Sasa & Kawai (1987, p.47) from Itachi River (Toyama) showed characters somewhat intermediate between the two species, with 10 or 11 antennal flagellar segments, AR 0.72-0.86, and with lamellar setae in the prescutellar areas.

Revised key to males of genus *Limnophyes* recorded from Japan

- 1 - Gonostylus without apical spine, angularly produced dorsally and tapering towards pointed apex 2
 - Gonostylus with apical spine 3
- 2 - Anal point present; antenna with 13 flagellar segments, AR 0.56-0.60; pre-scutellar area with numerous lamellar setae 2
 - prolongatus* Kieffer 1921, sensu Tokunaga, 1965
 - Anal point absent; antenna with only 12 flagellar segments, AR 0.22-0.30; no lamellar setae in prescutellar area 3
tamakireides Sasa, 1983
- 3 - Dorsolateral setae of scutum usually 8-12, all simple 4
 - Dorsolateral setae of scutum usually 18 or more (sometimes more than 50), and with lamellar setae in humeral or prescutellar area 7
- 4 - Antenna with 13 flagellar segments, AR about 0.9; anal point present 4
 - akanundecimus* Sasa et Kamimura, 1987
 - Antenna with 12 or less flagellar segments 5
- 5 - Anal point present; inner lobe of gonocoxite broad and with angulate margin; gonostylus truncate apically, and with an angulate subapical tooth 5
 - fujinonus* Sasa, 1985
 - Anal point absent; inner lobe of gonocoxite with rounded margin; gonostylus without angulate subapical tooth 6
- 6 - Antenna with 10 flagellar segments, AR 0.37; inner lobe of gonocoxite single, broad and with rounded margin 6
 - tamakiyoides* Sasa, 1983
 - Antenna with 11 or 12 flagellar segments, AR 0.64-0.82; inner lobe of gonocoxite double, the dorsal lobe somewhat finger-like, the ventral lobe broad and low 7
hudsoni Saether, 1975
- 7 - Gonostylus with convex inner margin, widest at about basal 1/3 and tapering towards pointed apex, with a long (about 30 ulong) and stout subapical spine; antenna with 13 flagellar segments, AR 0.85-0.90; inner lobe of gonocoxite double, the dorsal lobe finger-like, the ventral lobe broad and low 7
 - akannonus* Sasa et Kamimura, 1987
 - Gonostylus apically rounded or truncate, apical spine much shorter 8

- 8 - Antenna with 13 flagellar segments, AR 1.50-1.55; gonostylus very flat and broad, somewhat egg-shaped when seen from above; low and broad anal point present; inner lobe of gonocoxite low and flat, with short and stout setae; dorsomedian scutal setae about 20; antepronotum without dorsal setae and with some 20 lateral setae *fujidecimus* Sasa, 1985
- Antenna with 11-13 flagellar segments, AR 0.8 or less; gonostylus slender and nearly parallel-sided; anal point absent; inner lobe of gonocoxite without such stout setae; dorsomedian setae 10 or less; antepronotum with dorsal setae, and 1-4 lateral setae 9
- 9 - Antenna with 13 flagellar segments, AR 0.8; scutum with some 20 lamellar setae on prescutellar area and without lamellar setae in humeral area; inner lobe of gonocoxite broad and rounded *tamakitanoides* Sasa, 1981
- Antenna with 11 or 12 flagellar segments, AR 0.50-0.63; scutum with 3-5 short lamellar setae on humeral area and 4-6 short lamellar setae in prescutellar area; inner lobe of gonocoxite almost rectangular *akanangularius* Sasa et Kamimura, 1987

39. *Metriocnemus tamaokui* Sasa, 1983

A male was collected from a bush at the side of Lake Shikotsu on 12 June 1986 (No.A 121:58). Bl 2.76, WL 1.67 mm. Body almost entirely black. Eyes bare, inner margin concave and rather strongly produced medially, ER 1.00. Antenna with 13 flagellar segments, AR 1.09, AHR 0.52. so 20:21, ci 18, pn 6:6, dm 28, dl 34:35, pa 18:18, sc 26. Wing with numerous macrotrichiae on entire surface, sq 22:22, RR 0.16, VR 1.13, R/Cu 1.01. Costa extending much beyond end of R₄₊₅. Cu₂ almost straight, anal vein extending much beyond fCu. fLR 0.67, mLR 0.46, hLR 0.56, fTR 0.16. Terminal structure of tibiae as in usual Orthoclaadiinae, tarsi I and II of middle and hind legs with two short terminal spurs. Pulvilli absent. Hypopygium with a large narrowly conical anal point. Inner lobe of gonocoxite broad and rounded, occupying about half the inner margin, and bearing numerous strong setae. Gonostylus simple, almost parallel-sided and with a strong apical spur, and a small rectangular subapical tooth.

Remarks. The above morphological characters of the present specimens are almost coincident with that of *M. tamaokui* described by Sasa (1983, p.77) by male and pupa emerged in the laboratory at NIES from a bottom sample collected at a small mountain stream in the River Tama basin, Tokyo, and is most closely related to *M. cavicola* Kieffer among the species described previous to it.

40. *Parakiefferiella osaruflava* Sasa, sp. nov.

(Plate 11A)

Four males were collected at the side of a small mountain stream Osaru River on 12 June 1986 (No. 128:11-14).

Male. Very small midge with BL 1.30-1.54 (mean 1.44) mm and WL 0.79-1.02 (0.94) mm. Body almost entirely pale yellow; ground color of scutum pale

yellow, stripes and postnotum brownish yellow, scutellum yellow, abdominal tergites and legs pale yellow, wing unmarked. Head in Fig. 11A1. Eyes bare, egg-shaped and inner margin convex. ER 1.37-1.60 (1.48). Antenna with 13 flagellar segments, last segment (Fig.11A2) very short, AR 0.23-0.26 (0.25), AHR 0.34-0.42 (0.38). so 3 or 4 on each side, cl 4 (in 2) or 6 (in 2). Anteprepronotum (Fig. 11A3) highly reduced in the middle, and without lateral setae. Scutum and scutellum in Fig. 11A8. Scutum with a prominent tubercle (Mesonotalhöcker of Brundin, 1956, p.166) in the center. dm 0, dl 4, 5 or 6 (mean 5.1), pa 3 in all, sc 2 (in 2) or 4 (in 2). Wing venation in Fig. 11A4. Squama bare. Wing membrane without macrotrichiae. Costa extending much beyond end of R₄₊₅. R₂₊₃ fused with R₄₊₅. fCu much beyond r-m, VR 1.23-1.37 (1.28). R₄₊₅ ending much proximal to end of Cu₁, R/Cu 0.91-0.93 (0.92). Cu₂ strongly curved in the middle. Front tibia with a long terminal spur (24 μ ; Fig. 11A5), middle tibia with two short terminal spurs (10 μ , 13 μ ; Fig.11A6), hind tibia with a long terminal spur (27 μ), a short terminal spur (10 μ), and a terminal comb composed of 9 free spurs (12-21 μ ; Fig.11A7). Tarsus IV slightly longer than tarsus V in all legs. Pulvilli absent. fLR 0.44-0.50 (0.47, unusually small), mLR 0.42-0.48 (0.45), hLR 0.50-0.55 (0.52), fTR 0.13, fBR 2.6-2.8 (2.7), mBR 2.7-4.0 (3.2), hBR 3.3-4.3 (3.7).

Hypopygium in Fig. 11A9, 10. Ninth tergite with a pair of long setae in the middle and a pair of short setae on both sides of anal point. Anal point roughly semicircular in contour, bare and hyaline. Gonocoxite with a large, semicircular inner lobe bearing numerous short setae and microtrichiae. Gonostylus simple, apically truncate, without subapical tooth, and with a long terminal spur (7 μ). Long and large virga present on the ventral side between gonocoxite (45 μ long; Fig.11A10).

Remarks. This species is regarded as a member of genus *Parakiefferiella* Thienemann, 1936, as redefined by Brundin (1956, p.148), since eyes are bare and without dorsomedial projection, last antennal segment swollen but without apical seta, AR small, scutum with a median tubercle and without dorsomedian setae, dl and sc small in numbers, setae on abdominal tergites also reduced, squama bare, R₂₊₃ almost fused with R₄₊₅, R₄₊₅ ending much proximal to end of Cu₁, costa extending much beyond end of R₄₊₅, wing membrane bare and very finely granular, pulvilli absent, anal point broad, short and bare, and gonostylus has a large inner lobe. Among the species of this genus described by Brundin (1956, p.151), the present species apparently belongs to subgenus *Rheosmittia* Brundin, 1956, since scutum is anteriorly produced over anteprepronotum, R₂₊₃ is fused with R₄₊₅, and wing length is only about 1 mm. Of the two species described by this author, the present species is somewhat similar to *P. languida* Brundin, 1956, in that AR is only about 0.3 and body color is pale, but this species differs from the present one in the shape of inner lobe of gonocoxite (inner margin produced in the middle), in the shape of gonostylus (strongly curved inwards, not straight as in the present species), in the absence of mesonotal tubercle (present in the present species), and in that postnotum is black (also yellow in the present species). So far a total of 7 species have been recorded as a member of genus *Parakiefferiella* from Japan, including the present and the following species.

41. *Parakiefferiella osarufusca*, Sasa, sp. nov.

(Plate 11B)

Two males were collected at the side of Osaru River on 12 June 1987. Holotype: No. A 128:16; paratype: A 128:17.

Male. BL 1.72, 1.62 mm, WL 1.12, 1.10 mm, slightly larger than in the preceding species. Body generally darker than in the preceding species, ground color of scutum yellow, stripes, scutellum and postnotum dark brown, abdominal tergites brown, legs brownish yellow. Head in Fig. 11B1. Eyes elongate oval, inner margin convex, ER 1.33, 1.24. Antenna with 13 flagellar segments, last segment very short, swollen in the middle and with numerous sensory setae but without terminal seta, AR 0.37, 0.36 (larger than in the preceding species), AHR 0.23, 0.26. so 4:4, 4:4, cl 6, 8. Anteprenotum (Fig. 11B2) highly reduced towards middle, and without lateral setae. Scutum and scutellum in Fig. 11B4. Mesonotal tubercle on scutum rather inconspicuous, dm 0 in both, dl 7:6, 6:7, pa 4:4, 4:4, sc 4, 2. Wing in Fig. 11B3. Costa extending much beyond end of R₄₊₅. R₂₊₃ running close to, but not fused with R₄₊₅, RR 0.71, 0.76. fCu much beyond r-m, VR 1.27, 1.20. Cu₁ ending almost at the level of end of R₄₊₅, R/Cu 1.04. Anal vein ending under fCu. Squama bare. Wing membrane very finely granular. Terminal structure of tibiae as in Fig. 11B5-7 (I could make out only one short terminal spur on middle tibia, not two terminal spurs as in other related species). fLR 0.40, 0.43 (unusually small), mLR 0.44, 0.46, hLR 0.50, 0.51, fTR 0.11, fBR 2.3, 2.5, mBR 2.9, 3.8, hBR 3.3, 3.8. Pulvilli absent. Tarsus IV slightly shorter than tarsus V in the front leg (22:24 μ), almost as equal in the middle and hind legs.

Hypopygium in Fig. 11B8. Anal point relatively long and narrow, widest at base and distal half roughly parallel-sided, with rounded apex. Inner lobe of gonocoxite large and angulate, with a small tubercle on posterior margin. Long virga (47 μ) present on ventral side between gonostylus. Gonostylus simple, almost straight, parallel-sided and with pointed apex, apical spur relatively small.

Remarks. This species was collected at the same site as the preceding species, but both differ from each other in the body coloration (much darker in the present species), in wing venation (especially in that R₄₊₅ ending at the same level as end of Cu₁ in the present species), and in the shape of anal point (longer and more slender in the present species). Key for identification of male of the Japanese species of this genus is as follows.

Key to males of Japanese *Parakiefferiella*

- 1- Gonostylus tapering towards sharply pointed apex; Cu₂ almost straight; abdominal tergites each with a narrow dark band on caudal margin; BL about 3 mm, AR about 1.0; inner lobe of gonocoxite very broad and with rounded margin *tipuliformis* (Tokunaga, 1940)
- Gonostylus truncate, or rounded apically; Cu₂ strongly curved at middle; abdominal tergites almost uniform in color, without caudal dark bands; AR 0.85 or less, BL 2.2 mm or less, WL 1.5 mm or less 2

- 2- Gonostylus apically expanded and abruptly curved inwards; R₂₊₃ ending about midway between ends of R₁ and R₄₊₅ (RR about 0.5); VR about 1.0, R/Cu about 1.0 (body largely brown, with dark brown marks; WL 1.34-1.43 mm, AR 0.67-0.69, fLR 0.53-0.54, fBR 3.4-3.6; anal point small and triangular; inner lobe of gonocoxite large, wide and rounded
chuzeundecima (Sasa, 1984)
- Gonostylus not expanded and not curved apically; R₂₊₃ ending closer to end of R₄₊₅ (RR less than 0.5) or fused with it 3
- 3- Body entirely pale yellow; AR 0.23-0.26; R₂₊₃ completely fused with R₄₊₅; R₄₊₅ ending proximal to end of Cu₁, R/Cu 0.91-0.93; (WL 0.79-1.02; fLR 0.44-0.50; anal point semicircular; inner lobe of gonocoxite broad and rounded) *osaruflava*, sp. nov.
- Body largely brown or dark brown; AR 0.36 or larger; R₂₊₃ separated from R₄₊₅; R/Cu 1.0 or larger 4
- 4- Anal point longer than wide, almost parallel-sided; fLR 0.40-0.43 (body with dark brown marks on yellow ground color; AR 0.36-0.37; R/Cu 1.04; gonostylus pointed apically) *osarufusca*, sp. nov.
- Anal point wider than long, roughly rectangular or semicircular; fLR larger than 0.5. 5
- 5- Anal point semicircular; inner lobe of gonocoxite double (WL 1.31-1.38 mm; AR 0.44-0.45; VR large, 1.30-1.35; body largely brown, with dark brown stripes; gonostylus straight and swollen apically) *itachiquarta* Sasa et Kawai, 1987
- Anal point roughly rectangular; inner lobe of gonocoxite single 6
- 6- Ground color of scutum yellow, stripes reddish brown, abdominal tergites brown; WL 1.05-1.18 mm; AR 0.38-0.48; inner lobe of gonocoxite broad and roughly rectangular. *tamatriangulata* Sasa, 1981
- Ground color of scutum brown, stripes and postnotum black, abdominal tergites yellow; WL 1.38-1.48mm, AR 0.71-0.85; inner lobe of gonocoxite broad and rounded. *bathophilia* (Kieffer, 1912) of Sasa, 1985b, p.60

42. *Paraphaenocladus penerasus* (Edwards, 1929)

(Plate 12A)

A male was collected on the wall of a house at the side of Lake Toya on 13 June 1986 (No.A 124:77). BL 1.84 mm, WL 1.04. Ground color of scutum yellow, scutal stripes brown, scutellum yellow, postnotum dark brown, abdominal tergites yellowish brown, sternites yellow, leg segments brownish yellow. Head in Fig. 12A1. Eyes bare, inner margin strongly concave, ER 0.89. Antenna composed of a pedicel and 13 flagellar segments, last segment very short, AR only 0.27, apical half of last segment expanded and bearing numerous short sensory setae. Antennal hairs on the penultimate segment short, AHR 0.24, Palp 4 segmented. so 10:10, cl 6. Anteprepronotum narrowly connected in the middle, with only one lateral seta on each side. Scutum and scutellum in Fig. 12A2. dm 10, all minute, dl 12:13, all well developed and arising

from large pale pits. pa 5:6, sc 6. Wing in Fig. 12A3. Wing membrane very finely granular, and with macrotrichiae on distal 3/4, and on veins R, R₁, R₄₊₅, M, Cu, Cu₁, Cu₂ and An. Costa extending much beyond end of R₄₊₅. R₂₊₃ running very close to R₄₊₅, RR 0.74. Anal vein extending beyond fCu. Squama with only 2 fringe hairs. fLR 0.63, mLR 0.49, hLR 0.64, fTR 0.14, fBR 1.5, mBR 1.7, hBR 2.0. Front tibia with a long terminal spur 35 μ (Fig.12A4). Middle tibia with two short terminal spurs, 20, 25 μ (Fig.12A5). Hind tibia with a long terminal spur (38 μ), a short terminal spur (18 μ), and a terminal comb composed of 10 free spurs (22-35 μ) as in Fig. 12A6. Pulvilli absent.

Hypopygium in Fig. 12A8. Anal point rather long and robust, widest at base and tapering towards pointed apex, thickly covered with microtrichiae on basal 2/3, with 4 short lateral setae at about middle, and bare for apical 1/3. Inner lobe of gonocoxite almost triangular. Gonostylus simple, with a rectangularly produced subapical tooth, and a strong apical spur.

Remarks. This specimen is a member of genus *Paraphaenocladus* Sparck et Thienemann in the sense of Brundin (1956, p.136) and Pinder (1978, p.92), since wing has macrotrichiae, the tip of vein R₄₊₅ is located much proximal to tip of Cu₁ and R/Cu is smaller than 1.0, anal point is well developed, Cu₂ is strongly curved, and eyes are bare. Among the known species of this genus, it is morphologically closest to *P. penerasus* (Edwards, 1929) and is provisionally identified as to belong to this species. However, the antennal ratio is still much smaller than in the type specimens of this species (0.4-0.6, according to Edwards, 1929, p.314), the ratio of the length of R₁ to R₄₊₅ is larger (0.51 in the present specimen, R₁ is much less than half the length of R₄₊₅ in the type specimens), inner lobe of gonocoxite is more acutely produced, and subapical tooth of gonostylus is more strongly produced in the present specimen than in the types illustrated by Pinder (1978, Fig.134D).

43. *Pseudosmittia toyanigra* Sasa, sp. nov.

(Plate 12B)

A male was collected on light at the side of Lake Toya on 12 June 1986 (No. A 124:79). BL 2.52 mm, WL 1.47 mm. Body almost entirely black, including leg segments and abdomen. Head in Fig. 12B1. Eyes bare, inner margin slightly convex and without dorsomedial projection, ER 1.33. Antenna with 13 flagellar segments, AR 1.49, AHR 0.49, last segment only slightly swollen apically and without apical seta. so 6:6, cl 8. Antepronotum well developed, with 4:4 lateral setae (Fig.12B2). Scutum and scutellum in Fig. 12B3. dm 0, dl 8:8, pa 5:5, sc 6. Wing in Fig. 12B4. Squama bare (?). Costa not extending beyond end of R₄₊₅. Tip of R₄₊₅ proximal to tip of Cu₁, R/Cu 0.96. R₂₊₃ ending beyond midway between tips of R₁ and R₄₊₅, RR 0.53. fCu much beyond r-m, VR 1.37. Cu₂ strongly curved. Anal vein extending beyond fCu but not reaching to wing margin. Tips of tibiae in Fig. 12B5-8. fLR 0.42 (unusually small), mLR 0.46, hLR 0.49, fTR 0.13, fBR 3.0. Pulvilli absent.

Hypopygium in Fig. 12B9. Anal point long and stout, almost parallel-sided and with rounded apex, entirely covered with microtrichiae. Inner lobes of gonostylus double, the dorsal blade longer than wide and finger like, ventral blade small, low and bearing numerous setae (Fig.12B10). Inner margin

of gonocoxite (Fig.12B11) broadly swollen basally, small virga present. Gonostylus simple, widest at about basal 1/3 and tapering towards apex, with a short but stout apical spine.

Remarks. This specimen is considered as to belong to genus *Pseudosmittia* Goetghebuer, since wings are bare, squama probably has no fringe hairs, costa is not extending beyond end of R₄₊₅, R₄₊₅ ending proximal to tip of Cu₁, pulvilli are absent, and anal vein does not reach to wing margin. Among the previously known species of this genus, it seems to be most closely related to *P. curtica* (Edwards, 1929) in that inner lobes of gonocoxite are less than 3, anal point is well developed, and AR is relatively high, but the shape and structure of inner lobes of gonocoxite is quite different (single and angulate in *curtica*), the shape of anal point is also quite different (widest at base in *curtica*), gonostylus is widest at tip in *curtica*, and AR is smaller in *curtica* (0.9-1.0 according to Edwards, 1929, p.364).

44. *Smittia aterrima* (Meigen, 1818)

Two males were collected on light at the side of Lake Toya on 12 June 1986 (No. A 124:74, 75). BL 2.84, 3.06 mm, WL 1.74, 1.75 mm, ER 1.24, 1.42, AR 1.54, 1.81, AHR 0.54, 0.61, so 7:7, 8:8, cl 8, 8, pn 3:3, dm 12, 14 (all very small), dl 12:12, 13:13, pa 4:4, 5:5, sc 7, 8, sq 0, RR 0.42, 0.45, VR 1.29, 1.32, R/Cu 1.04, 1.04, fLR 0.56, 0.57, mLR 0.46, 0.48, hLR 0.61, fTR 0.11, 0.12, fBR 3.2, 3.6, mBR 4.2.

Remarks. This is a species widely distributed in Europe, and was recorded by Tokunaga (1940, p.289) from Omu (Hokkaido), by Sasa (1985c) from Motosu and Yamanaka (Yamanashi), by Sasa & Kawai (1978a, p.53) from Lake Biwa, and by Sasa & Kamimura (1987, p.41) from Lake Akan (Hokkaido). Morphological descriptions were made by Sasa (1985c, p.121).

45. *Smittia nudipennis* (Goetghebuer, 1913)

A male provisionally identified as this species was collected by sweeping bushes with insect net at the side of Osaru River on 12 June 1986 (No. A 128:28). BL 1.88 mm. WL 1.13 mm, ER 1.26, AR 0.75, AHR 0.43, so 4:4, cl 6, pn 1:2, dm 0, dl 12:12, pa 5:5, sc 6, sq 0, RR 0.38, VR 1.30, R/Cu 1.06, fLR 0.50, mLR 0.44, hLR 0.57, fTR 0.13, fBR 6.1, mBR 5.0, hBR 5.2. The structure of hypopygium and other body parts are not distinguishable from that of *S. nudipennis* described by Sasa (1985c, p.122), but the values of AR in the present specimen is smaller than 1.03-1.30 (mean 1.13), and fBR is larger than 2.7-3.6 (3.1) of this report.

46. *Toyamayusurika shiotanii* Sasa et Kawai, 1987

(Plate 13A)

A male was collected at the side of Osaru River on 12 June 1986 (No. A 128:24). BL 2.58, WL 1.58. Body almost entirely black. Eyes bare, reniform

and inner margin slightly concave, ER 1.31. Antenna composed of a pedicel and 13 flagellar segments, AR 1.39, AHR 0.57. so 10:10, cl 5. Anteprenotum (Fig.13A1) well developed, almost parallel-sided and thickly united in the middle, with 6:6 lateral setae. Dorsomedian setae of scutum present but minute. Dorsolateral setae 22 on each side, all arising from large pale pits. pa 9:9, sc 12. Wing without macrotrichiae, granular in appearance. Wing venation in Fig. 13A2. Costa extending much beyond end of R₄₊₅. RR 0.50, VR 1.13, R/Cu 1.06, sq 18:21. fLR 0.55, mLR 0.40, hLR 0.59, fTR 0.15, fBR 2.6, mBR 2.8, hBR 3.0. Front tibia with a long terminal spur (55 μ). Middle tibia with two short terminal spurs (17, 20 μ). Hind tibia with a long terminal spur (64 μ), a short terminal spur (35 μ), and a terminal comb composed of 15 free spurs (30-46 μ). Middle tarsus I with two short terminal spurs, middle tarsus II with a short terminal spur, hind tarsus I with a short terminal spur, other tarsal segments without terminal spur. Tarsi IV longer than tarsi V in all legs. Pulvilli well developed. (Fig.13A3)

Hypopygium in Figs.13A4, 5. Ninth tergite with a conical anal point bearing 8 long and stout setae and numerous microtrichiae. Inner lobe of gonocoxite double, the basal lobe being conspicuously produced towards middle and bearing numerous long microtrichiae, the distal lobe flat and rather inconspicuous. Gonostylus peculiar to this species, composed of a very long, slender, curved and apically pointed posterior arm, and the inner arm with a stout apical spur, and a large subapical tooth with rounded margin.

Remarks. This species was described by Sasa & Kawai (1987b, p.62) based on males collected at the side of Itachi River, Toyama. It is morphologically somewhat related to species of the genus *Pseudorthocladius* in the sense of Brundin (1956, p.137), since eyes are bare, squama fringed, legs with large pulvilli, and anal point is roughly triangular and bearing strong setae and numerous microtrichiae, but the present species is quite unique in the structure of gonostylus, being roughly V-shaped by having a long basolateral process which cannot be seen in other chironomid species so far recorded. The present specimen shows measurement data similar to that obtained with the two type specimens collected in Toyama (in these type specimens, AR 1.02, 1.05, AHR 0.52, 0.57, so 8:8, 8:8, cl 8, 10; these data were missed in the original description by Sasa & Kawai, 1987b).

47. *Corynoneura lobata* Edwards, 1924

(Plate 13B)

A male was collected at the side of Osaru River on 12 June 1986 (No. A 128:29). BL 1.24 mm, WL 0.80 mm. Scutum, scutellum and postnotum almost uniformly dark brown, abdominal tergites brown, leg segments yellow. Head in Fig. 13B1. Eyes bare, reniform, inner margin concave but without dorsomedial projection, ER 1.42. Antenna with only 10 flagellar segments, last segment short and only as long as three preceding segments combined, AR 0.41, AHR 0.33; last antennal segment (Fig.13B2) swollen apically and with a group of short sensory setae at tip. so 0:0, cl 8. Anteprenotum (Fig.13B3) well developed, united in the middle but without lateral setae. Scutum and scutellum in Fig. 13B4. dm 0, dl 4:4, sc 2. Wing in Fig. 13B5. sq 0:0. R₁

and R₄₊₅ are fused with short and thickened costa, forming a clavus. A false vein commences at r-m, runs below the clavus and then close to the anterior wing margin to almost the tip. Wing membrane bare. fCu is located at about distal 1/4 of the wing. Anal lobe obtuse. Tip of front tibia with a spur (Fig.13B6). Tip of middle tibia with two spurs (Fig.13B7). Tip of hind tibia enlarged and obliquely truncate, with a long and a short terminal spur, and a terminal comb composed of 15 free spurs (Fig.13B8). Tarsi IV of all legs shorter than tarsi V (Fig.13B9). Empodium vestigial, pulvilli absent. Tarsi I and II of middle and hind legs with two short terminal spurs. Hypopygium in Fig. 13B10.

Remarks. *C.lobata* is a species recorded from England, and is characterized by that antenna is composed of only 10 flagellar segments. Morphological characters of the present specimen are almost coincident with that described for this species by Edwards (1929, p.368) and Pinder (1978, p.84, Fig.12C).

48. *Psilodiamesa montium* (Edwards, 1929)

(Plate 14A)

Two males were collected on light at the side of Lake Toya on 12 June 1986 (No. A 124:89). BL 5.34, 5.36 mm, WL 2.72, 2.98 mm. Body almost uniformly black. Head in Fig. 14A1. Eyes bare, without dorsomedial projection, ER 1.24, 1.42. Antenna with 13 flagellar segments, AR 2.02 (tip is lost in another), AHR 0.55. so 24:26, cl 20, 20. Anteprenotum (Fig.14A2) well developed, thickly united in the middle, with 8:8, 10:10 lateral setae. dm 0, dl 21:23, 24:25, pa 10:10, 12:13, sc 36, 36. Wing in Fig. 14A3. Squama with 60-78 (69.0) fringe hairs. Anal lobe strongly produced. Costa extending beyond end of R₄₊₅ and almost reaching to tip of wing, RR 0.42, 0.48, R/Cu 1.11, 1.13. Cross vein m-cu present, proximal to r-m and slightly distal to fCu, the latter situated proximal to the former, VR 0.88, 0.89. Cu₂ only slightly bent near apex. Anal vein extending to near wing margin. fLR 0.82, 0.84, mLR 0.52, 0.54, hLR 0.58, 0.59, fTR 0.09, 0.09 (unusually small), fBR 5.2, 6.2, mBR 4.9, 5.0, hBR 5.3, 6.6. Front tibia with a long terminal spur (Fig.14A4). Middle tibia with two short terminal spurs (Fig.14A5). Hind tibia with a long and a short terminal spur, a terminal comb composed of 11 free spurs, and with numerous short spurs in the apical portion (Figs.14A8, 9). Tarsi I and II of middle and hind legs with two short terminal spurs (Figs.14 A6, 7). Tarsi III without terminal spurs, tarsi IV cordiform and shorter than tarsi V in all legs (Figs.14A10, 11). Pulvilli absent, empodium vestigial.

Hypopygium in Fig. 14A12. Ninth tergite with 12 or 14 setae at the base of anal point. Anal point very wide, low and rounded, covered with microtrichiae. Gonocoxite without distinct inner lobes. Gonostylus simple, inner margin convex and widest at about middle, and with an apical spur.

Remarks. The above mentioned morphological characters are almost coincident with the description of *P. montium* of Edwards (1929, p.307) and of *Potthastia montium* of Pinder (1978, p42). However, because the descriptions and illustrations of these papers are very short, further studies are needed

to confirm such a diagnosis.

49. *Clinotanypus sugiyamai* Tokunaga, 1937

Seven males and 4 females emerged from bottom samples collected in Lake Utonai on 13 June 1986 (No. A 125:89-100). This is one of the six species of genus *Clinotanypus* recorded from Japan by Tokunaga (1937a, p.57), and was described by male collected in Kyoto. Both male and female of this species were recorded and described by Sasa & kawai (1987a, p.57) with specimens collected from Lake Biwa (Shiga). The adults of this genus are characterized especially by the shape of tarsi IV, being cordiform and shorter than tarsi V in all legs (Fig.15C1).

50. *Conchapelopia melanops* (Meigen, 1818)

(Plate 14B)

A male emerged from a bottom sample of Lake Shikotsu collected on 12 June 1986 (No. A 121:20). BL 4.94 mm, WL 2.56 mm. Body largely pale yellow; scutum largely pale yellow and with 3 pairs of dark brown spots, one pair at the anterior end of median stripes, two pairs at the anterior and the posterior ends of lateral stripes (Fig.14B2); scutellum pale, postnotum brownish yellow, abdominal tergites I, II, VIII and IX entirely yellow, III to VI each with a transverse brown band near anterior margin and the rest anterior and posterior parts yellow, VII brown for anterior half and yellow for posterior half; wing unmarked, leg segments yellow. Eyes each with a long and narrow dorsomedial projection and only narrowly separated from each other, ER 0.14. so 12:12, cl 21. Antennal segments difficult to be differentiated in the present specimen, AR presumably about 3.0, AHR 0.49. Anteprepronotum narrowly united in the middle, with 11:12 lateral setae. Scutum and scutellum in Fig. 14B2. dm 42, dl 38:40, pa 25:29, sc 40. Wing in Fig. 4B1. Squama with 38:40 fringe hairs. Wing membrane thickly covered with macrotrichiae. R₂₊₃ clearly forked near apex and R₂ is united with R₁. R₃ ending about midway between ends of R₁ and R₄₊₅, RR 0.52. Tip of R₄₊₅ situated distal to end of Cu₁, R/Cu 1.14. Cross vein m-cu present, and united with Cu₁ near its proximal end, fCu is situated proximal to r-m and thus VR (the ratio of length of Cu to length of R) is 0.85. Anal vein extending much beyond fCu.

Terminal structure of tibiae as in Figs. 14B3-6. Front tibia with a short (49 μ long) and forked terminal scale. Middle tibia with two short (34, 38 μ) and basally forked terminal scales. Hind tibia with a long (105 μ) and basally forked scale, a short (60 μ) and basally forked scale, and a terminal comb composed of 8 free spurs (53-80 μ). fLR 0.80, mLR 0.62, fTR 0.12, fBR 8.0, mBR 5.4 (hind tarsi lost). Small pulvilli present at the base of claws.

Hypopygium in Fig. 14B7. Ninth tergite low, with 13 setae near posterior margin, anal point absent. Gonocoxite with a basal lobe with complicated structure, roughly L shaped, basal arm long, slender and pointed, posterior arm longer, curved laterally near apex, and bearing 7 long setae on lateral margin of apex. Gonostylus long, strongly curved inwards, and with a strong

apical spur.

Remarks. The above morphological characters are almost coincident with the descriptions of *C. melanops* by various authors in Europe (Edwards, 1929, p.292, with a generic name of *Pentaneura*), Goetghebuer (1943, p.43; *Ablabesmyia*), Fittkau (1962, p.242), and Pinder (1978, p.32). This species was recorded also by Tokunaga (1937a, p.51; 1937b, p.94) from Kyoto. Fittkau (1957, p.233) gave a new name, *Conchapelopia quatromaculata*, to Tokunaga's species, without giving accounts on the reason why it was separated from *melanops*.

51. *Pentaneura japonica* Tokunaga, 1937

A female provisionally identified as this species was collected as resting on the leaf of a tree at the side of Lake Toya on 13 June 1986 (No. A 124:90). BL 4.22 mm, WL 3.47 mm. Body largely yellowish white, scutum with 8 dark spots, scutellum white, postnotum largely white and with a pair of dark spots, abdominal tergites almost uniformly white; leg segments largely white, femora with an apical dark ring, tibiae with a basal and an apical dark ring, tarsi entirely pale. Eyes each with a long dorsomedial projection, ER 0.27. Antenna composed of a pedicel and 11 flagellar segments, last segment 0.27 times as long as the combined length of the preceding flagellar segments. so 18:18, cl 28, pn 6:6, dm 54, dl 56:60, pa 38:40, sc 86. Wing thickly covered with numerous macrotrichiae. Wing venation in Fig. 15D1. RR 0.55, VR 0.85, R/Cu 1.16, fLR 0.75, mLR 0.58, hLR 0.62, fTR 0.11, fBR 6.5, mBR 5.5, hBR 5.5. Pulvilli absent. Spermathecae three, all globular, 136X112, 120X112, 112X94 μ . Cercus small, nearly circular, 54X60 μ

Remarks. This species was recorded by Tokunaga (1937a, p.50; 1937b, p.94) by female collected in Kyoto. The present specimen is almost coincident with these descriptions, excepting that femora and tibiae have dark rings as stated above (according to Tokunaga, 1937, legs are entirely white).

52. *Procladius choreus* (Meigen, 1804)

(Plate 15B)

Two males emerged from a bottom sample collected in Lake Utonai on 13 June 1986 (No. A 125:83,84). BL 5.04, 5.24 mm, WL 2.16, 2.45 mm. Body coloration with yellow ground color and brown marks. AR 2.24, 2.62, AHR 0.54, 0.56, ER 0.33, 0.36, so 40:40, 42:42, cl 26, 30, pn 12:13, 20:23, dm 56, 68, dl 34:36, 34:37, pa 20:20, 20:21, sc 45, 68, sq 44:48, 56:57, RR 0.46, 0.47 VR 1.39, 1.43, R/Cu 1.08, 1.14, fLR 0.73, 0.75, mLR 0.66, 0.67, hLR 0.71, 0.77, fTR 0.13, 0.14, fBR 1.9, 2.4, mBR 1.9, 2.5, hBR 2.0, 2.4. Pulvilli absent. Gonostylus as in Fig. 15B1, posterior process about twice as long as broad.

Another male specimen with similar body coloration and the structure of hypopygium and wing venation, but with somewhat different measurement data emerged from a bottom sample of Lake Shikotsu collected on 12 June 1986 (No. A 121:19). BL 4.06 mm, WL 1.67 mm, AR 1.67 (all much smaller than in the preceding specimens), AHR 0.49, ER 0.38, pn 12:12, dm 44, dl 19:22, pa 12:14,

sc 28 (all smaller), sq 32, RR 0.46, VR 1.35, R/Cu 1.10, fLR 0.71, mLR 0.61, hLR 0.68, fTR 0.14, fBR 4.0, mBR 3.8, hBR 4.7 (tarsal beards longer). Shape of gonostylus as in the preceding specimens, posterior process about twice as long as wide.

Remarks. This is a species commonly distributed in Europe, and was recorded also from Japan by Tokunaga (1937a, p.29; 1937b, p.72) and by Sasa & Kawai (1987a, p.59) from Lake Biwa (Shiga).

53. *Procladius sagittalis* (Kieffer, 1909)

(Plate 15A)

Two males emerged in the laboratory from a bottom sample collected in Lake Utonai on 13 June 1986 (No. A 125:81, 82). BL 4.54, 4.64 mm, WL 2.18, 2.25 mm. Body largely dark brown on yellow ground color; ground color of scutum yellow, scutal stripes dark brown, postnotum dark brown, abdominal tergites largely dark brown but each with a narrow pale band along caudal margin; all femora brown, tibiae brown for basal half, largely yellow for distal half, and with a dark apical ring; tarsi I and II largely yellow and each with an apical dark ring; tarsi III, IV and V entirely dark brown.

Head in Fig. 15A1. Eyes each with a long and narrow dorsomedial projection, ER 0.39, 0.40. Antenna composed of a pedicel and 14 flagellar segments, the penultimate segment longest, AR (combined length of last and penultimate segments divided by the length of the rest proximal segments) 2.18, 2.25. so 40:40, cl 26, 30. Anteprenotum (Fig.15A2) without setae in the upper and middle portions, with 16:16, 16:17 lateral setae. Scutum and scutellum in Fig. 15A4. dm 80, 91, divided into two arms in the posterior portion. dl 32:35, 40:41, pa 16:18, 18:18, sc 58, 78 in multiple rows. Wing in Fig. 15A3. Wing membrane without dark marks, and with numerous macrotrichiae. R₂₊₃ forked near apex, R₂ connected with R₁. m-cu present, located proximal to r-m, and connected with Cu at the position much proximal to fCu, the Cu/Cu₂ ratio (the distance between m-cu and fCu divided by length of Cu₂, or "mediocubital ratio" of Tokunaga, 1973a, p.27) being 0.83, 0.86. The area around r-m and m-cu is slightly darkened. Costa extending much beyond end of R₄₊₅. Anal vein extending beyond fCu and almost reaching to wing margin. The terminal spurs of tibiae as in Figs. 15A5-8. Front tarsus I, and middle and hind tarsi I and II each with a short terminal spur (Figs.15A6, 9, 10). Tarsi IV and V of hind legs in Fig. 15A11, pulvilli absent.

Hypopygium in Fig. 15A12. Ninth tergite broad and low, without anal point. Gonocoxite very stout and without inner lobe. Gonostylus simple, tapering towards sharply pointed apex, with a strong apical spur, and a posterior process which is about as long as broad (Fig.15A13).

Remarks. Tokunaga (1937a, p.28) separated *Procladius sagittalis* (Kieffer) from *P. choreus* (Meigen) by the value of his "mediocubital ratio", being 0.8 in the latter and 0.6-0.7 in the former. Pinder (1978, p.28) in his key to males of British Chironomidae, separated the two species by the shape of posterior process of gonostylus, being about twice as long as broad in the latter but scarcely as long as wide in the former. The four specimens of male *Procladius* collected on the shore of Lake Utonai are provisionally separated

into *P. choreus* and *P. sagittalis* since they suffice the differentiating points of both authors, but are quite similar in the other morphological characters. *P. choreus* was recorded also by Sasa & Kawai (1987a, p.59) on the shore of Lake Biwa (Shiga).

REFERENCES

- Brundin, L.(1847): Zur Kenntnis der schwedischen Chironomidae. Ark. f. Zool. 39 A. 3:1-95
- Brundin, L. (1949): Chironomiden und andere Bodentiere der schwedischen Urgebirgsseen. Rep. Inst. Freshw. Res., Drottningholm, 30:1-914
- Brundin, L. (1953): Zur Kenntnis der Orthocladiinae (Chironomidae). Rep. Inst. Freshw. Res. Drottningholm, 37:1-175
- Edwards, F.W. (1924): Some British species of *Corynoneura*. Entom. Mon. Mag. 60:182-189
- Edwards, F.W. (1929): British non-biting midges (Diptera, Chironomidae). Trans. Roy. Entom. Soc. London 77:279-429
- Fittkau, E.J. (1962): Die Tanypodinae (Diptera, Chironomidae); Die Tribus Anotopiniini, Macropelopiini und Pentaneurini. Abh. z. Larvalsystematik der Insekten, Nr.6, 433pp. Akademie-Verlag, Berlin
- Goetghebuer, M. (1937): Tendipedidae (Chironomidae). b) Subfamilie Tendipedinae (Chironominae). in Lindner, E. (ed.) Die Fliegen der palaearktischen Region. 13g: 1-208
- Goetghebuer, M. (1940): Tendipedidae (Chironomidae). f) Subfamilie Orthocladiinae. in Lindner, E.(ed). Die Fliegen der palaearktischen Region. 13g: 1-208
- Gowin, F. (1943): Orthocladiinen aus Lunzer Fliessgewaessern. II. Arch. Hydrobiol. 40:114-122
- Hashimoto, H. (1982): Four species of Chironomidae (Diptera) obtained from the Ozegahara Moor. Ozegahara: Scientific Researches of the Highmoor in central Japan. 367-370
- Hashimoto, H. (1983): *Pentapedilum* (Diptera, chironomidae) from Japan with description of a new species. Kontyu 51: 17-24
- Lindeberge, B. (1976): Taxonomy of some species of the *Tanytarsus eminulus* group (Dip. Chironomidae). Ann. Zool. Fen. 42:47-53
- Pinder, L.C.V. (1978): A key to adult males of British Chironomidae. 1:1-162, 2:figs.77-184. Freshw. Biol. Assoc. Publ. No.37
- Reiss, F. & Fittkau, E.J. (1971): Taxonomie und Oekologie ueropaeisch verbreiteter *Tanytarsus* Arten (Chironomidae, Diptera). Arch. Hydrobiol. Suppl. 40:75-200
- Saether, O. A. (1975): Twelve new species of *Limnophyes* Eaton, with keys to Nearctic males of the genus (Diptera, Chironomidae). Canad. Entom. 107:1029-1056
- Saewedal, L. (1976): Revision of the *notescens*-group of the genus *Micropsectra* Kieffer, 1909 (Diptera, Chironomidae). Entom. scand. 7:109-144
- Sasa, M. (1978): A comparative study of adults and immature stages of nine Japanese species of the genus *Chironomus* (Diptera, Chironomidae).

- Res. Rep. NIES No.3:1-63
- Sasa, M. (1979): A morphological study of adults and immature stages of 20 Japanese species of the family Chironomidae (Diptera). Res. Rep. NIES 7:1-148
- Sasa, M. (1980): Studies on chironomid midges of the Tama River. Pt 2. Description of 20 species of Chironominae recovered from a tributary. Res. Rep. NIES No.13:9-107
- Sasa, M. (1981): do, Pt. 3. Species of the subfamily Orthoclaadiinae recorded at the summer survey and their distribution in relation to the pollution with sewage waters. Pt. 4. Chironomidae recorded at a winter survey. Res. Rep. NIES No.29:1-148
- Sasa, M. (1983): do, Pt. 5. An observation on the distribution of Chironominae along the main stream in June, with description of 15 new species. Pt. 6. Description of the species of the subfamily Orthoclaadiinae recovered from the main stream in the June survey. Res. Rep. NIES No.43:1-99
- Sasa, M. (1984): Taxonomical and morphological studies on the chironomid species collected from lakes in the Nikko National Park. Res. Rep. NIES No.70:16-215
- Sasa, M. (1985): a. A report on the chironomids collected in winter from Sapporo area, Hokkaido. b. Studies on the chironomids collected from lakes in southern Kyushu. c. Studies on the chironomids collected from lakes in the Mount Fuji area. Res. Rep. NIES No.83:1-160
- Sasa, M. & Kamimura, K. (1987): Studies on the chironomid midges of the lakes in the Akan National Park, Hokkaido. Res. Rep. NIES No.104:1-61
- Sasa, M. & Kawai, K. (1987a): Studies on the chironomid midges of Lake Biwa (Diptera, Chironomidae). Lake Biwa Study Monograph No. 3: 1-119
- Sasa, M. & Kawai, K. (1987b): Studies on the chironomid midges of the stream Itachigawa, Toyama. Bull. Toyama Sci. Mus. No.10:25-72
- Sasa, M. & Kikuchi, M. (1986): Notes on the chironomid midges of the subfamilies Chironominae and Orthoclaadiinae collected by light traps in a rice paddy area in Tokushima (Diptera, Chironomidae). Jpn J. Sanit. Zool. 37:17-39
- Strenzke, K. (1959): Revision der Gattung *Chironomus* Meig. 1. Die Imagines von 15 norddeutschen Arten und Unterarten. Arch. Hydrobiol. 56:1-42
- Thienemann, A. & Strenzke, K. (1951): Larventyp und Imaginalart bei *Chironomus*. Entom. Tidskr. 72:1-21
- Tokunaga, M. (1936): Japanese *Cricotopus* and *Corynoneura* species (Chironomidae, Diptera). Tenthredo 1:9-52
- Tokunaga, M. (1937a): Chironomidae from Japan. IX. Tanypodinae und Diamesinae. Phil. J. Sci. 62:21-65
- Tokunaga, M. (1937b): Family Chironomidae. Nihon Dobutsu Bunrui (Fauna Nipponica) Vol.10, Fasc.7, No.1:1-110
- Tokunaga, M. (1938): Chironomidae from Japan. X. New or little known midges, with descriptions of the metamorphoses of several species. Phil. J. Sci. 65:318-383
- Tokunaga, M. (1939): Chironomidae from Japan. XI. New or little known midges, with special references to the metamorphoses of torrential species. Phil.

- Tokunaga, M. (1940): Chironomidae from Japan. XII. New or little known Ceratopogonidae and Chironomidae. Phil. J. Sci. 72:255-317
- Tokunaga, M. (1965): Chironomidae as winter bait of overwintering swallow. Akitu 12:39-41
- Townes, H. K. Jr. (1945): The Nearctic species of Tendipedini (Diptera, Tendipedidae=Chironomidae). Amer. Midl. Nat. 34:1-206

EXPLANATION OF FIGURES

Plate 1.

A. *Camptochironomus biwaprimum* Sasa et Kawai. Male. A1: frontal tubercles. A2: antepronotum. A3: scutum and scutellum, showing bases of setae. A4: wing. A5: tip of front tibia. A6: tip of hind tibia. A7: hypopygium, dorsal view. A8: dorsal appendage. A9: ventral appendage.

B. *Pentapedilum tigrinum* Hashimoto. Male. B1: head. B2: scutum and scutellum. B3: wing. B4: tip of front tibia. B5: tip of hind tibia. B6: dorsal view of abdomen. B7: hypopygium. B8: dorsal appendage. B9: ventral appendage.

Plate 2.

A. *Pentapedilum utonaiprimum*, sp. nov. Male. A1: antepronotum. A2: wing. A3: scutum and scutellum. A4: tip of front tibia. A5: tip of hind tibia. A6: hypopygium. A7: dorsal appendage. A8: ventral appendage.

B. *Polypedilum arundineti* Goetghebuer. Male. B1: scutum and scutellum. B2: tip of front tibia. B3: tip of middle tibia. B4: tip of hind tibia. B5: abdomen, dorsal view. B6: hypopygium. B7: dorsal appendage. B8: ventral appendage.

Plate 3.

A. *Polypedilum scalaenum* (Schrank). Female. A1: head. A2: frontal tubercles. A3: antepronotum. A4: spermathecae. A5: cercus. A6: scutum and scutellum. Male. A7: antepronotum. A8: hypopygium.

B. *Polypedilum tsukubaense* (Sasa). Male. B1: antepronotum. B2: wing. B3: scutum and scutellum. B4: tip of front tibia. B5: tip of middle tibia. B6: tip of hind tibia. B7: hypopygium. B8: dorsal appendage. B9: ventral appendage.

Plate 4.

A. *Micropsectra shinaensis* (Tokunaga). Male. A1: antepronotum. A2: wing. A3: tip of front tibia. A4: tip of hind tibia. A5: hypopygium, dorsal view. A6: dorsal appendage, dorsal view. A7: dorsal appendage, ventral view. A8: median and ventral appendages.

B. *Micropsectra utonaitertia*, sp. nov. Male. B1: antepronotum. B2: wing. B3: tip of front tibia. B4: tip of hind tibia. B5: middle tarsus V. B6: hypopygium. B7: anal point. B8: dorsal appendage, dorsal view. B9: dorsal appendage, ventral view. B10: median and ventral appendages.

Plate 5.

A. *Micropsectra yunoprime* Sasa. Male. A1: antep pronotum. A2: tip of front tibia. A3: tip of hind tibia.

B. *Paratanytarsus toyaprimus*, sp. nov. Male. B1: antep pronotum. B2: wing. B3: tip of front tibia. B4: tip of middle tibia. B5: tip of hind tibia. B6: hypopygium. B7: dorsal appendage, dorsal view. B8: dorsal appendage and digitus, ventral view. B9: median and ventral appendages. B10: tip of ventral appendage, ventral view.

C. *Tanytarsus akantertius* Sasa et Kamimura. Male. C1: antep pronotum. C2: hypopygium. C3: anal point. C4: dorsal appendage, dorsal view. C5: dorsal appendage and digitus, ventral view. C6: median appendage. Female. C7: head. C8: spermathecae. C9: cercus.

Plate 6.

A. *Tanytarsus utonaiquartus*, sp. nov. Male. A1: antep pronotum. A2: wing. A3: tip of front tibia. A4: tip of hind tibia. A5: hypopygium. A6: anal point. A7: dorsal appendage. A8: median and ventral appendages.

B. *Tanytarsus mendax* Kieffer. Male. B1: head. B2: frontal tubercles. B3: wing. B4: tip of front tibia. B5: tip of middle tibia. B6: tip of hind tibia. B7: hypopygium. B8: dorsal appendage, dorsal view. B9: dorsal appendage and digitus, ventral view. B10: median and ventral appendages, and inner margin of gonocoxite. Female. B11: head. B12: frontal tubercles. B13: spermathecae. B14: cercus.

Plate 7.

A. *Cricotopus osarudigitatus*, sp. nov. Male. A1: head. A2: antep pronotum. A3: wing. A4: tip of front tibia. A5: tip of middle tibia. A6: tip of hind tibia. A7: hypopygium.

B. *Cricotopus osaruquartus*, sp. nov. Male. B1: head. B2: antep pronotum. B3: wing. B4: scutum and scutellum. B5: tip of front tibia. B6: tip of middle tibia. B7: tip of hind tibia. B8: distribution of setae on abdominal tergites. B9: hypopygium. B10: inner lobes of gonocoxite. Female. B11: head. B12: spermathecae. B13: cercus.

Plate 8.

A. *Paratrachocladus tamaater* Sasa. Male. A1: head. A2: antep pronotum. A3: scutum and scutellum. A4: abdominal tergites, II, III and IV, showing distribution of bases of setae. A5: hypopygium, dorsal view. A6: hypopygium, ventral view.

B. *Orthocladus frigidus* (Zetterstedt). Male. B1: head. B2: antep pronotum. B3: wing. B4: scutum and scutellum. B5: hypopygium. B6: inner lobes of gonocoxite, dorsal view. B7: do, ventral view.

Plate 9.

A. *Orthocladus kanii* (Tokunaga). Male. A1: head. A2: antep pronotum. A3: wing. A4: scutum and scutellum. A5: hypopygium. A6: inner margin of gonocoxites. A7: inner lobes of gonocoxite, dorsal view. A8: do, ventral

view.

B. *Orthocladus glabripennis* complex. Male. B1: head. B2: scutum and scutellum. B3: wing. B4, 5, 6: variation in the distribution of scutellar setae. B7: hypopygium. B8: inner lobes of gonocoxite, dorsal view. B9: do, ventral view. B10: inner margin of gonocoxite.

Plate 10.

A. *Heleniella osarumaculata*, sp. nov. Male. A1: head. A2: ante- pronotum. A3: wing. A4: scutum and scutellum, left half. A5: tip of front tibia. A6: tip of middle tibia. A7, 8: tip of hind tibia. A9: tarsi IV and V of hind leg. A10: distribution of setae on abdominal tergite. A11: hypopygium.

B. *Eukiefferiella coerulescens* (Kieffer). B1: male wing.

C. *Limnophyes prolongatus* Kieffer. Male. C1: scutum and scutellum. C2: hypopygium, dorsal view. C3: do, ventral view.

Plate 11.

A. *Parakiefferiella osaruflava*, sp. nov. Male. A1: head. A2: last segments of antenna. A3: antepronotum. A4: wing. A5: tip of front tibia. A6: tip of middle tibia. A7: tip of hind tibia. A8: scutum and scutellum, showing distribution of bases of setae. A9: hypopygium, dorsal view. A10: hypopygium, ventral view.

B. *Parakiefferiella osarufusca*, sp. nov. Male. B1: head. B2: antepronotum. B3: wing. B4: scutum and scutellum. B5: tip of front tibia. B6: tip of middle tibia. B7: tip of hind tibia. B8: hypopygium.

Plate 12.

A. *Paraphaenocladus penerasus* (Edwards). Male. A1: head. A2: scutum and scutellum. A3: wing. A4: tip of frontal tibia. A5: tip of middle tibia. A6, 7: tip of hind tibia. A8: hypopygium, semilateral view.

B. *Pseudosmittia toyanigra*, sp. nov, Male. B1: head. B2: antepronotum. B3: scutum and scutellum. B4: wing. B5: tip of frontal tibia. B6: tip of middle tibia. B7, 8: tip of hind tibia. B9: hypopygium. B10, 11: inner margin of gonocoxites, dorsal and ventral view.

Plate 13.

A. *Toyamayusurika shiotanii* Sasa et Kawai. Male. A1: antepronotum. A2: wing. A3: hind tarsus V, showing pulvilli, empodium and claws. A4: hypopygium, dorsal view. A5: do, ventral view.

B. *Corynoneura lobata* Edwards. Male. B1: head. B2: tip of antenna. B3: antepronotum. B4: scutum and scutellum. B5: wing. B6: tip of frontal tibia. B7: tip of middle tibia. B8: tip of hind tibia. B9: hind tarsi II to V. B10: hypopygium.

Plate 14.

A. *Psilodiamesa montium* (Edwards). Male. A1: head. A2: ante- pronotum. A3: wing. A4: tip of frontal tibia. A5: tip of middle tibia. A6: tip of middle tarsus I. A7: tip of middle tarsus II. A8, 9: tip of hind tibia. A10, 11: hind tarsi III, IV and V, ventral and lateral views. A12:

hypopygium.

B. *Conchapelopia melanopus* (Meigen). Male. B1: wing. B2: scutum and scutellum. B3: tip of frontal tibia. B4: tip of middle tibia. B5, 6: tip of hind tibia. B7: hypopygium.

Plate 15.

A. *Procladius sagittalis* (Kieffer) Male. A1: head. A2: ante-pronotum. A3: wing. A4: scutum and scutellum. A5: tip of frontal tibia. A6: tip of frontal tarsus I. A7: tip of middle tibia. A8: tip of hind tibia. A9: tip of hind tarsus I. A10: tip of hind tarsus II. A11: hind tarsi IV and V. A12: hypopygium. A13: gonostylus.

B. *Procladius choreus* (Meigen). Male. B1: gonostylus.

C. *Clinotanytus sugiyamai* Tokunaga. Male. C1: front tarsi IV and V.

D. *Pentaneura japonica* Tokunaga, Female. D1: wing.

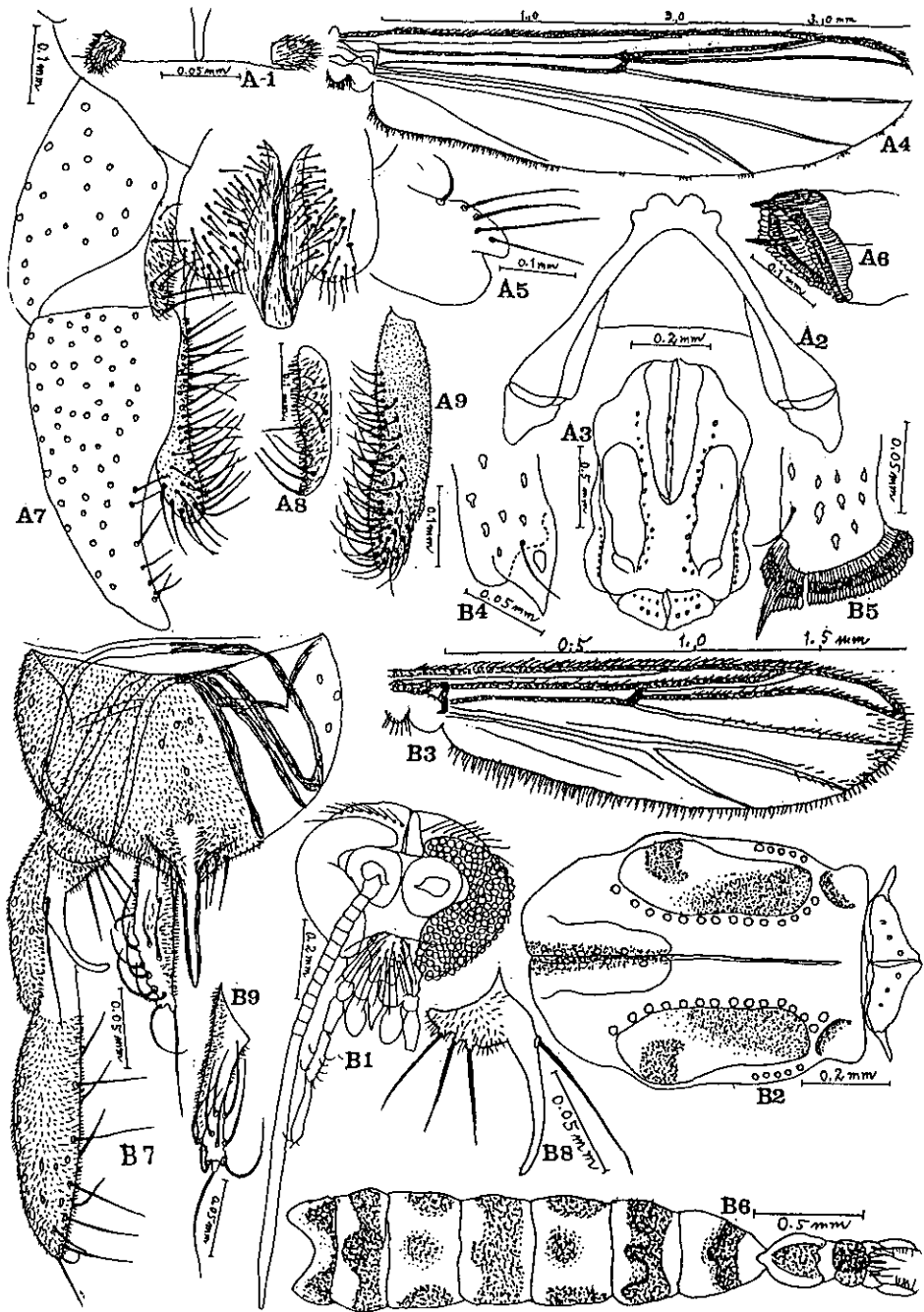
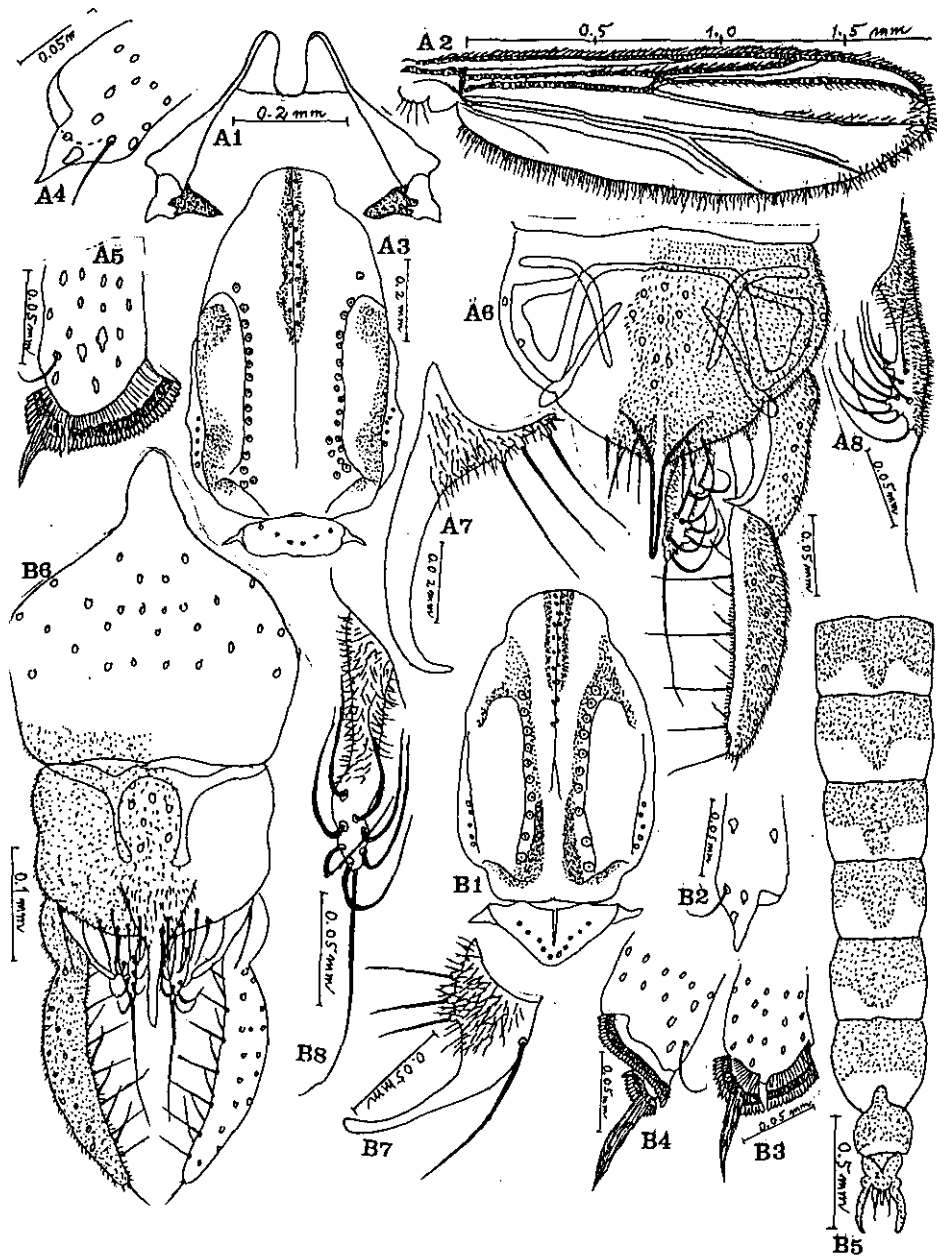


Plate 1. A. *Camptochironomus biwapurimus* Sasa et Kawai.

B. *Pentapedilum tigrinus* Hashimoto



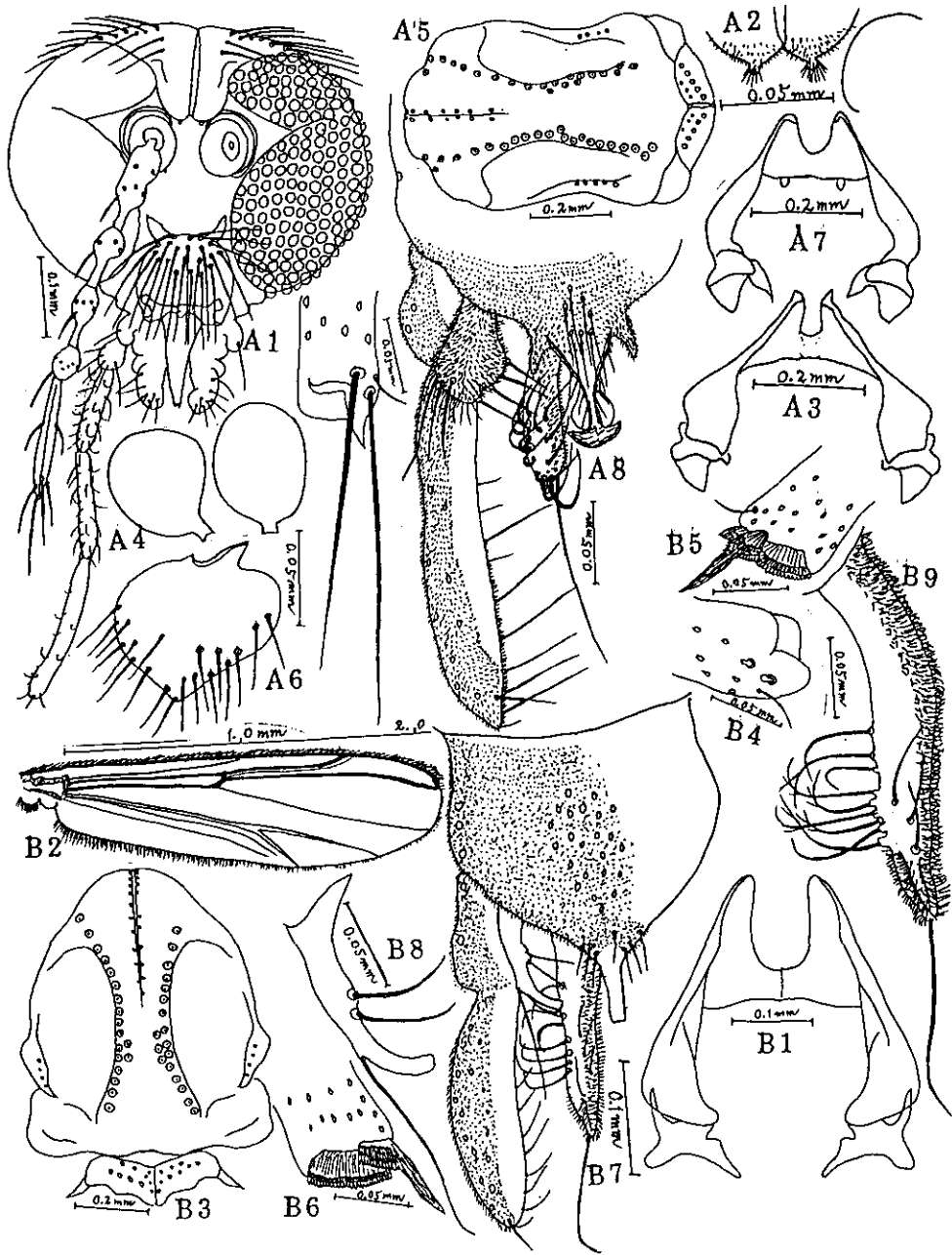


Plate 3. A. *Polypedilum scalaenum* (Schrank).

B. *Polypedilum tsukubaenese* (Sasa).

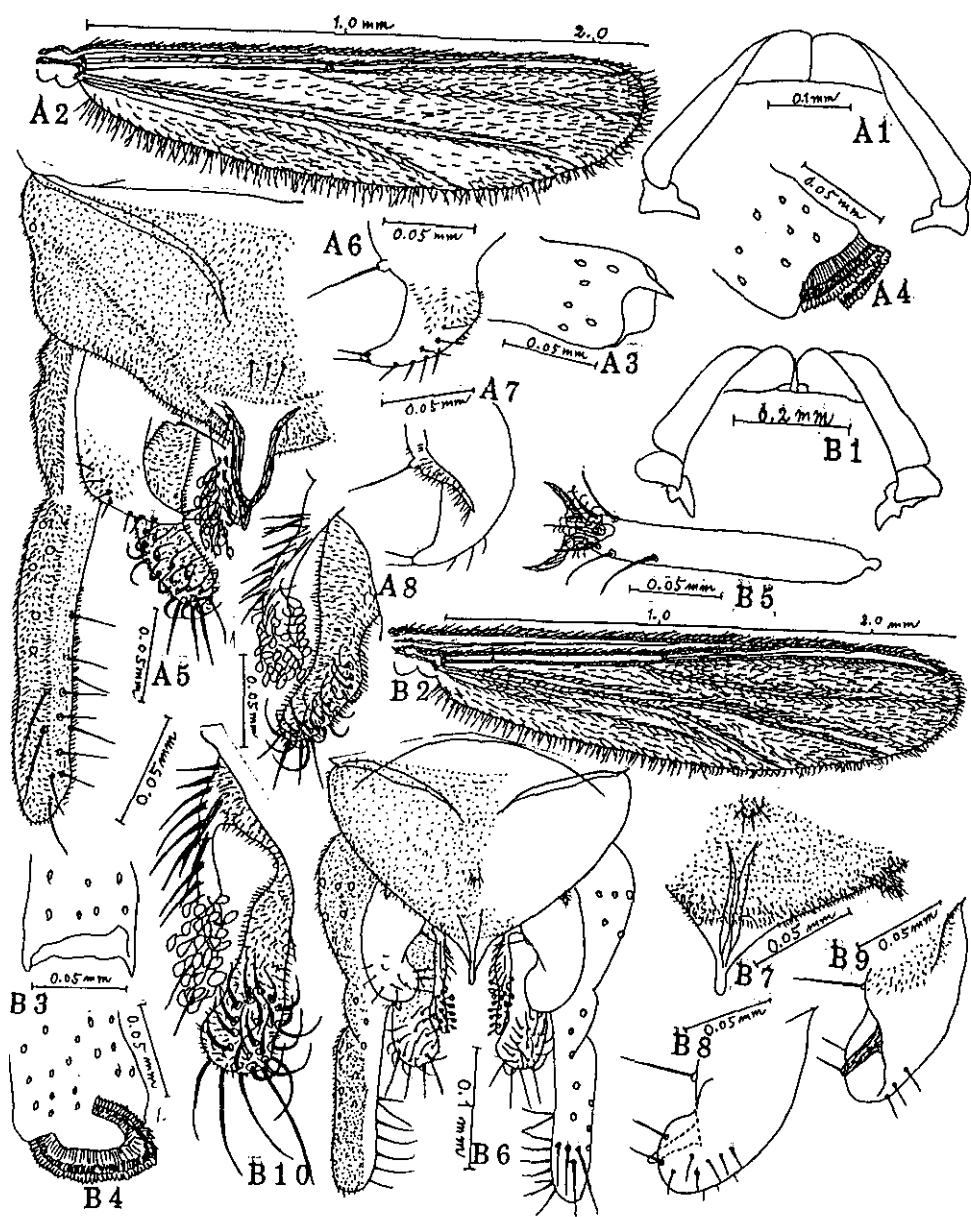


Plate 4. A. *Micropsectra shinaensis* (Tokunaga)

B. *Micropsectra utonaitertia*, sp. nov.

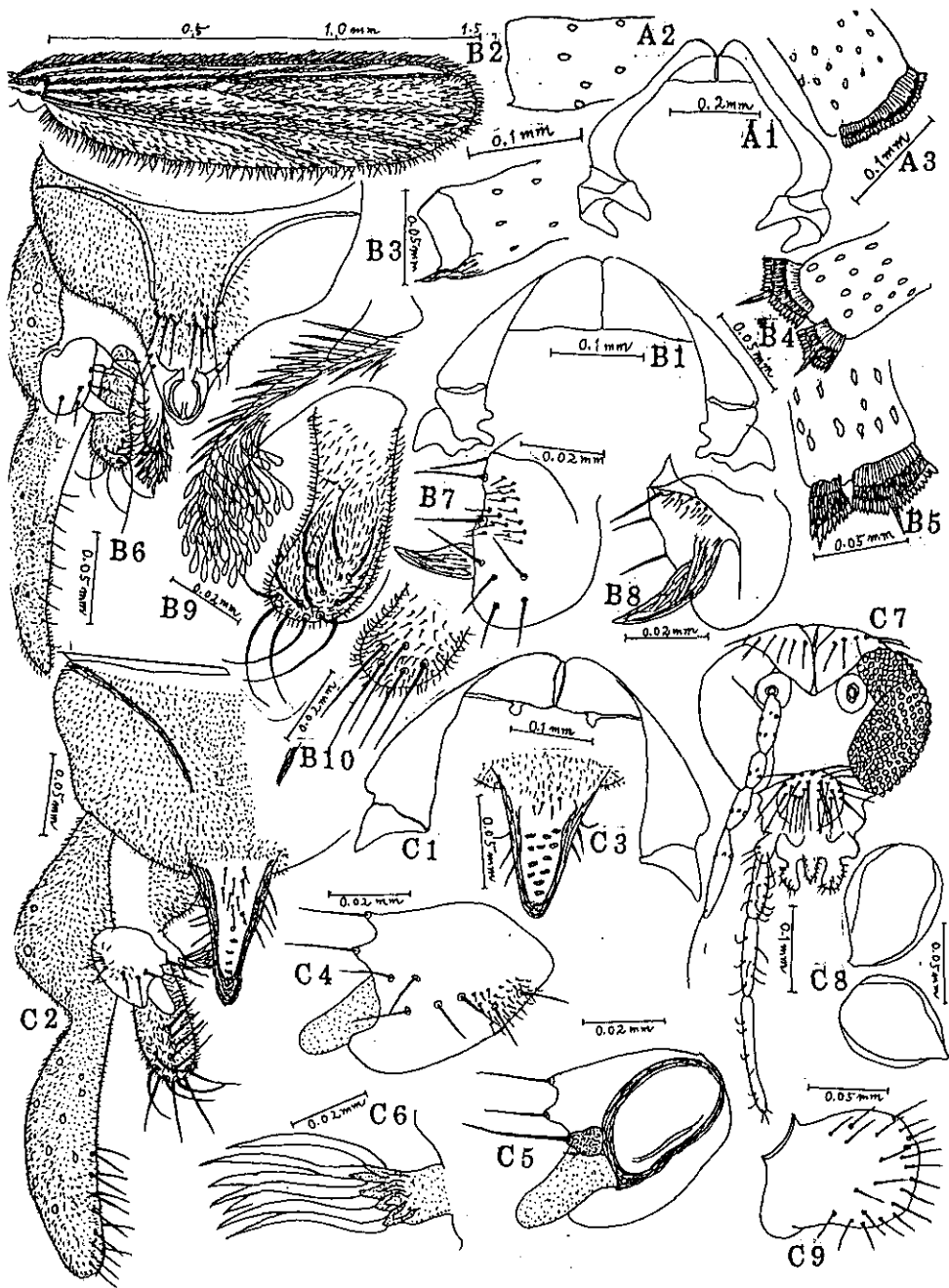


Plate 5. A. *Micropsectra yunoprimsa* Sasa
 B. *Paratanytarsus touyaprimus*, sp. nov.
 C. *Tanytarsus akantertius* Sasa et Kamimura

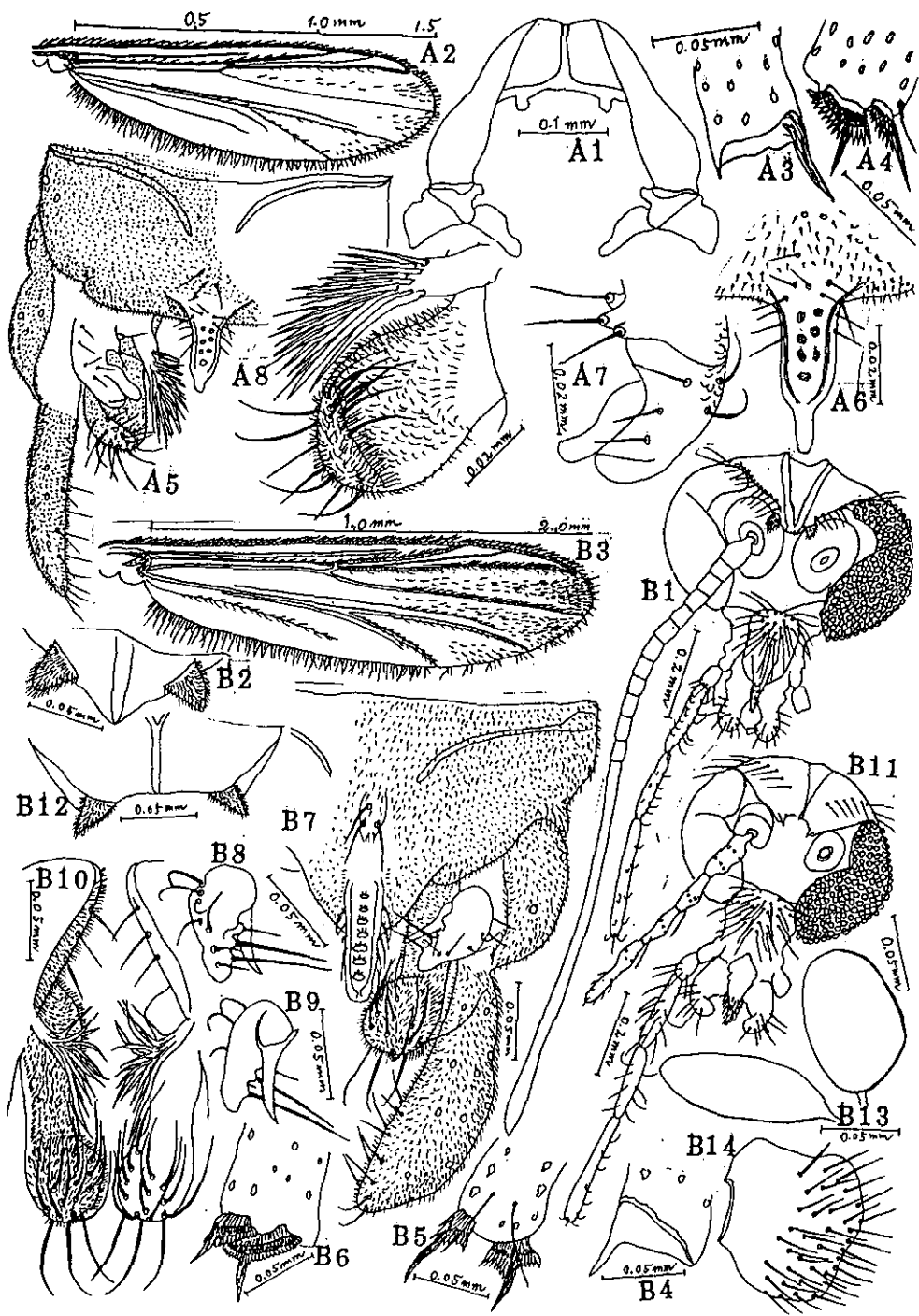


Plate 6. A. *Tanytarsus utonaiquartus*, sp, nov.

B. *Tanytarsus mendax* Kieffer

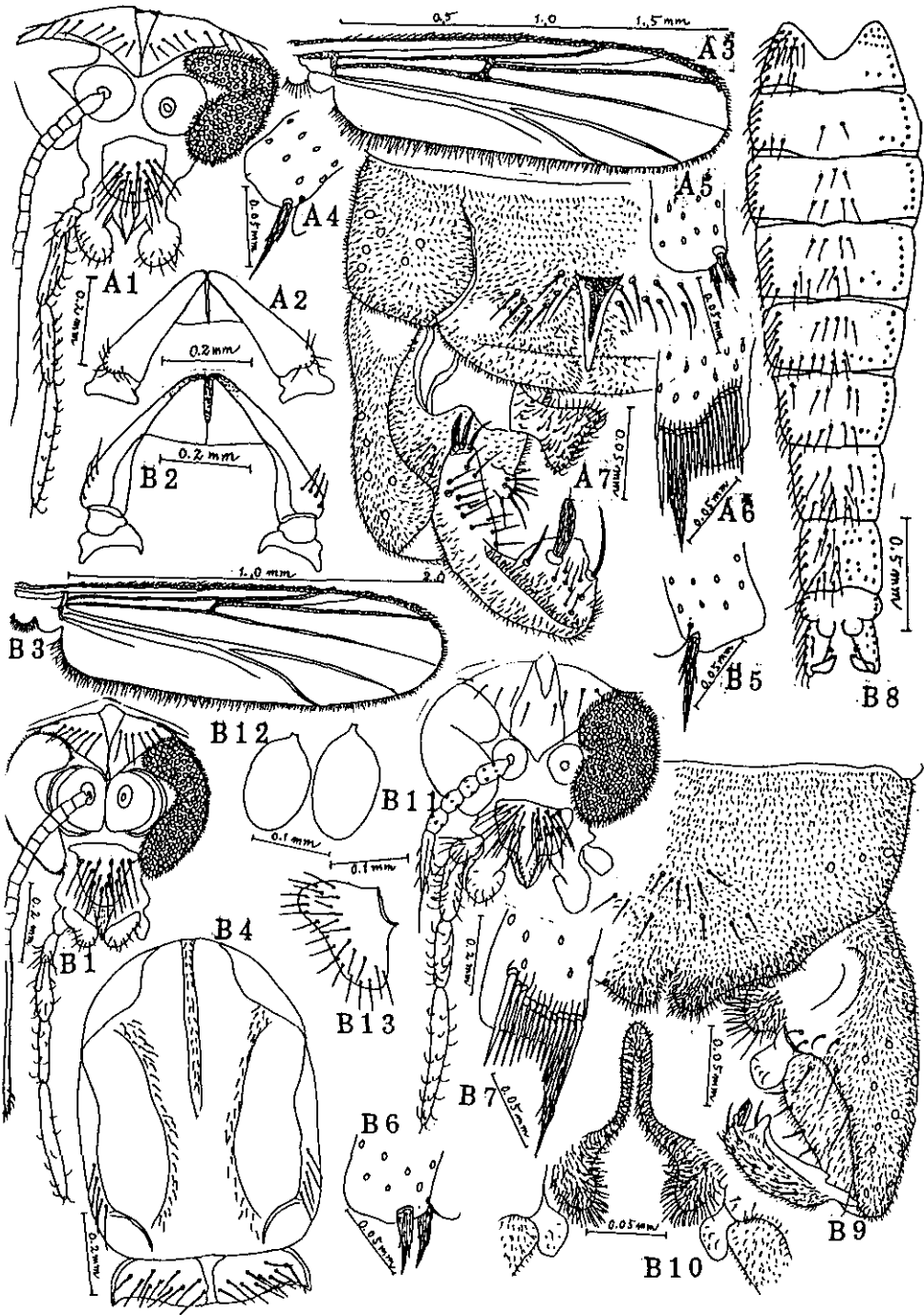


Plate 7. A. *Cricotopus osarudigitatus*, sp. nov.
 B. *Cricotopus osaruquadratus*, sp. nov.

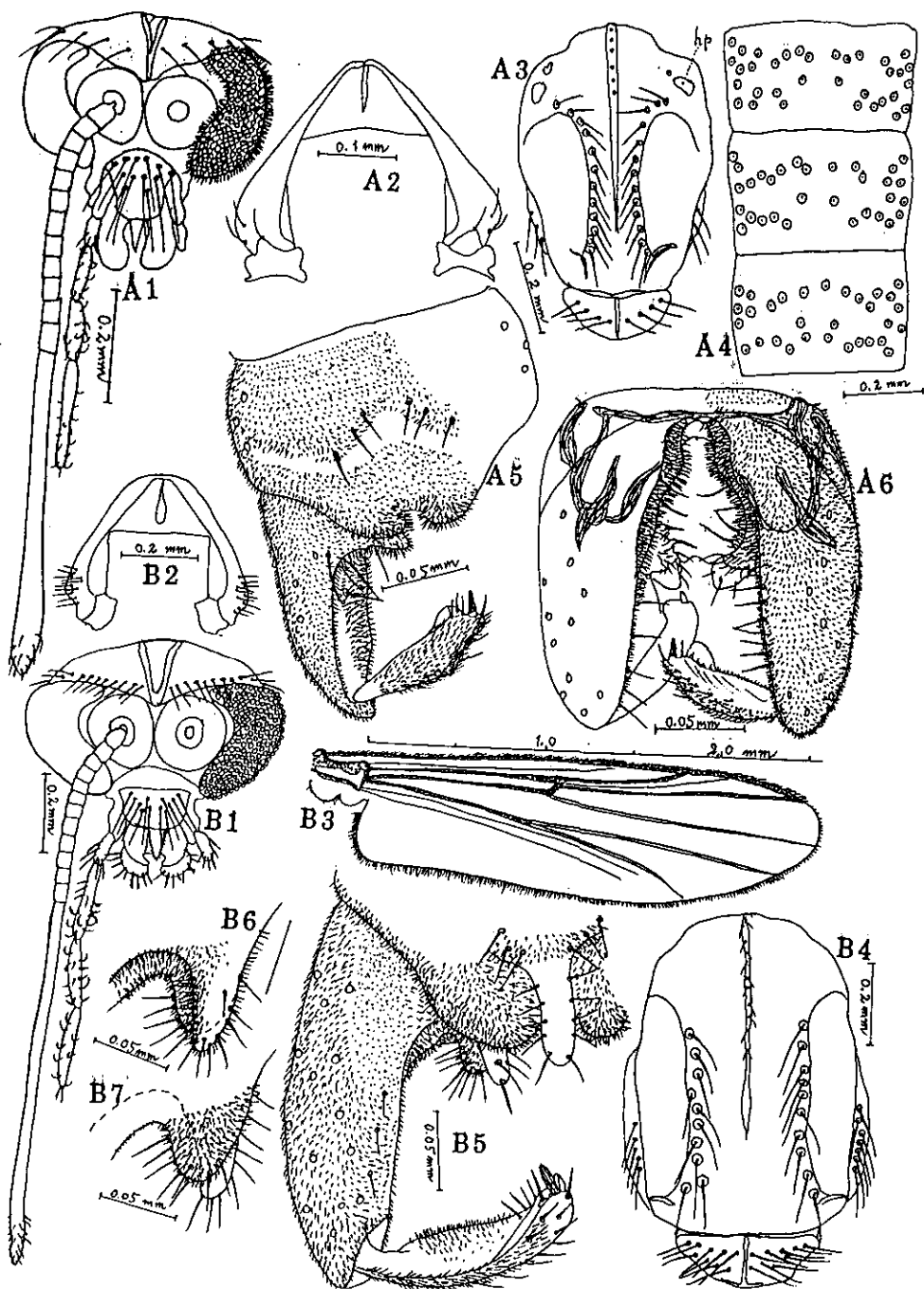


Plate 8. A. *Paratrichocladus tamaater*, Sasa
 B. *Orthocladus frigidus* (Zetterstedt)

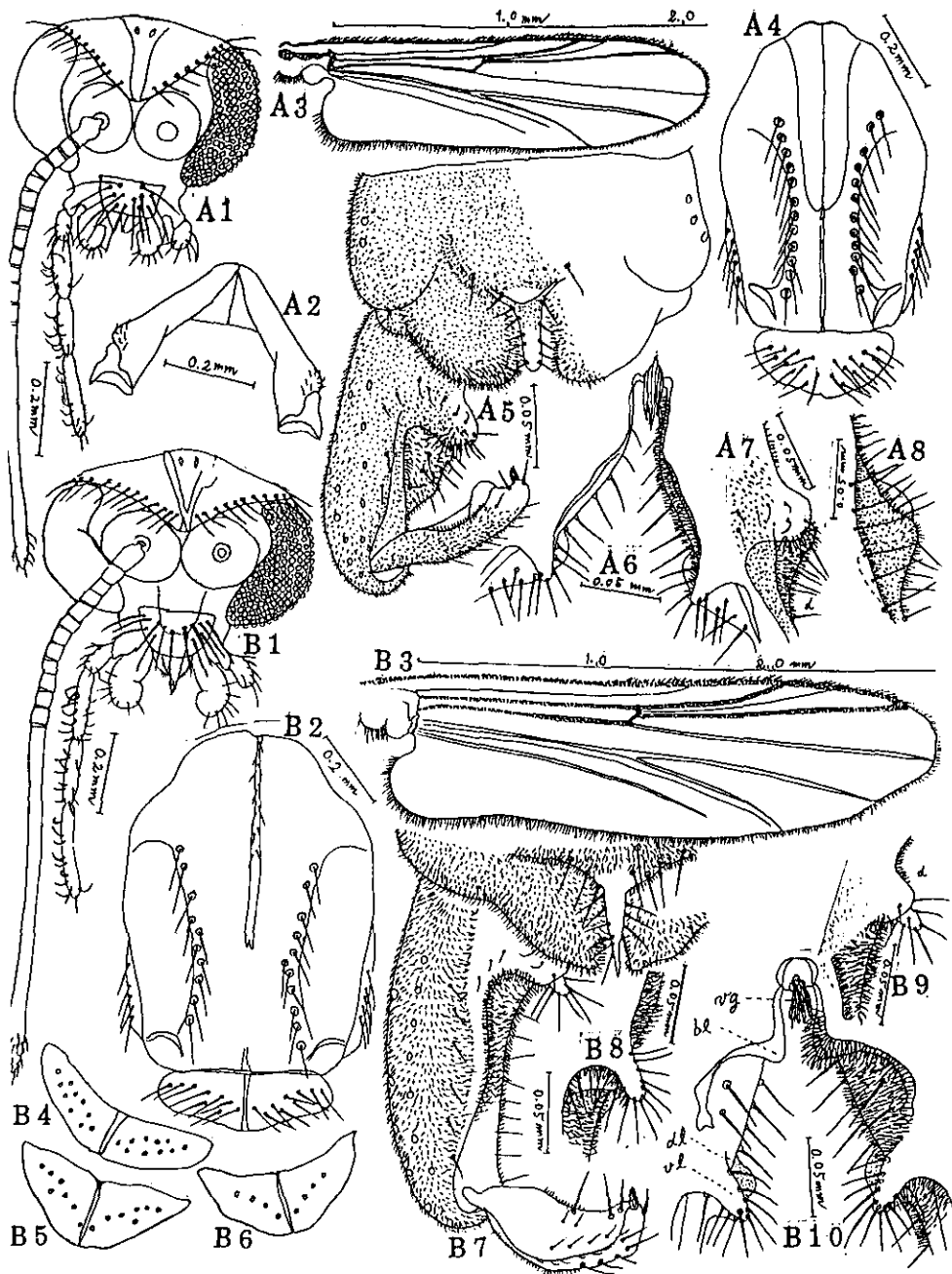


Plate 9. A. *Orthocladus Kanii* (Tokunaga)

B. *Orthocladus chuzeseptimus* Sasa

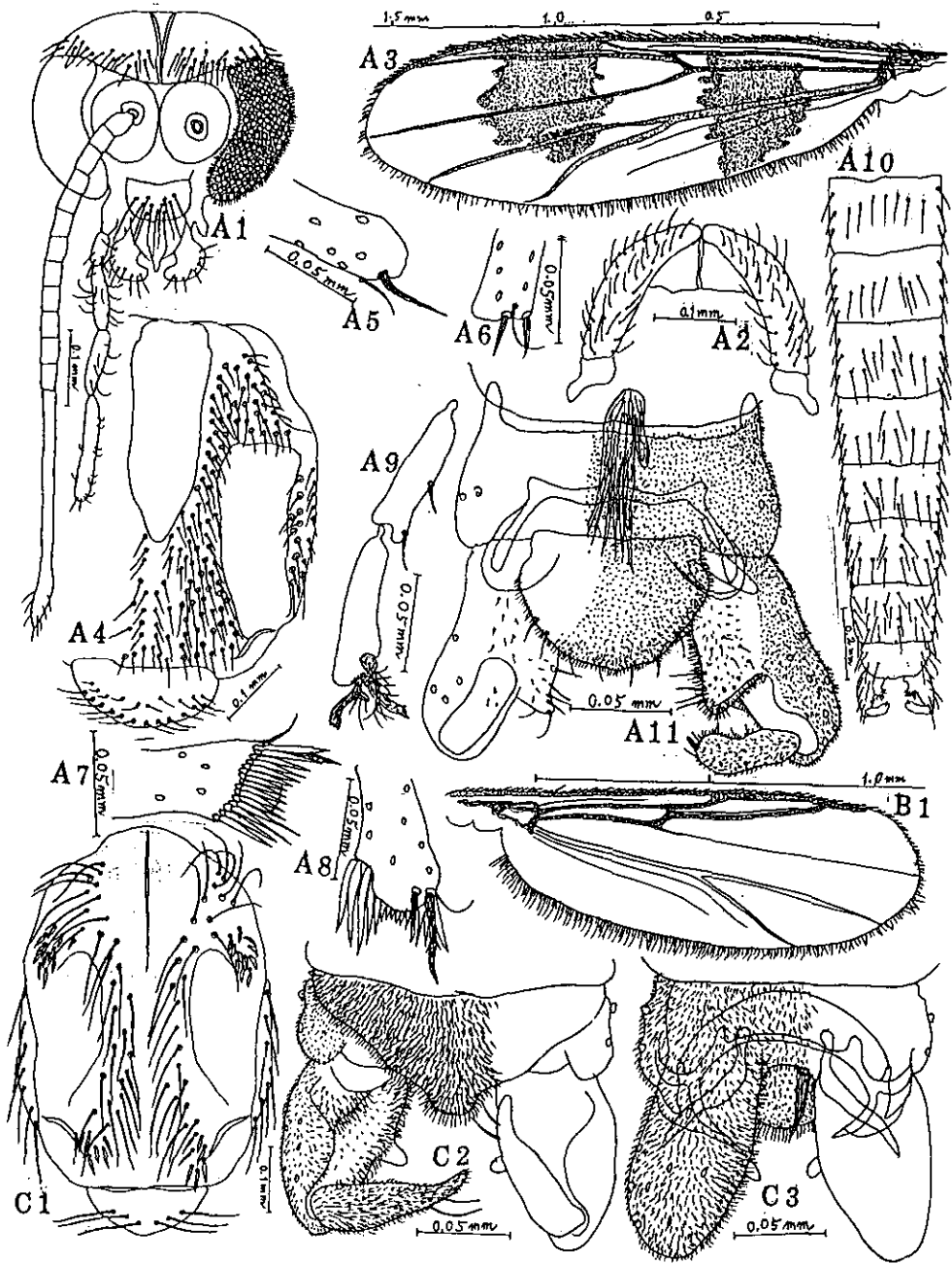
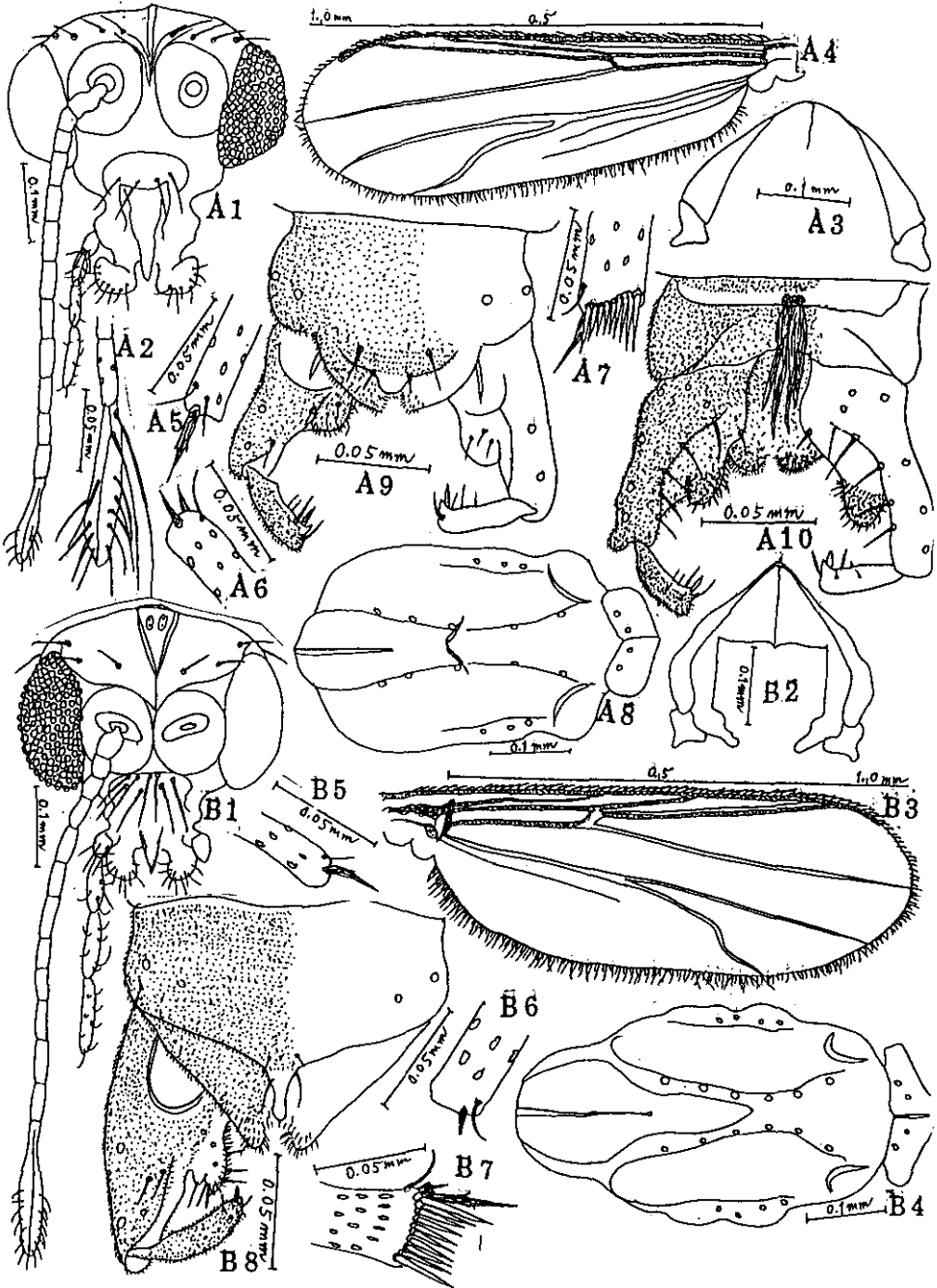


Plate 10. A. *Heleniella osarumaculate*, sp. nov.

B. *Eukiefferiella coerulescens* (Kieffer)

C. *Limnophyes prolongatus* Kieffer



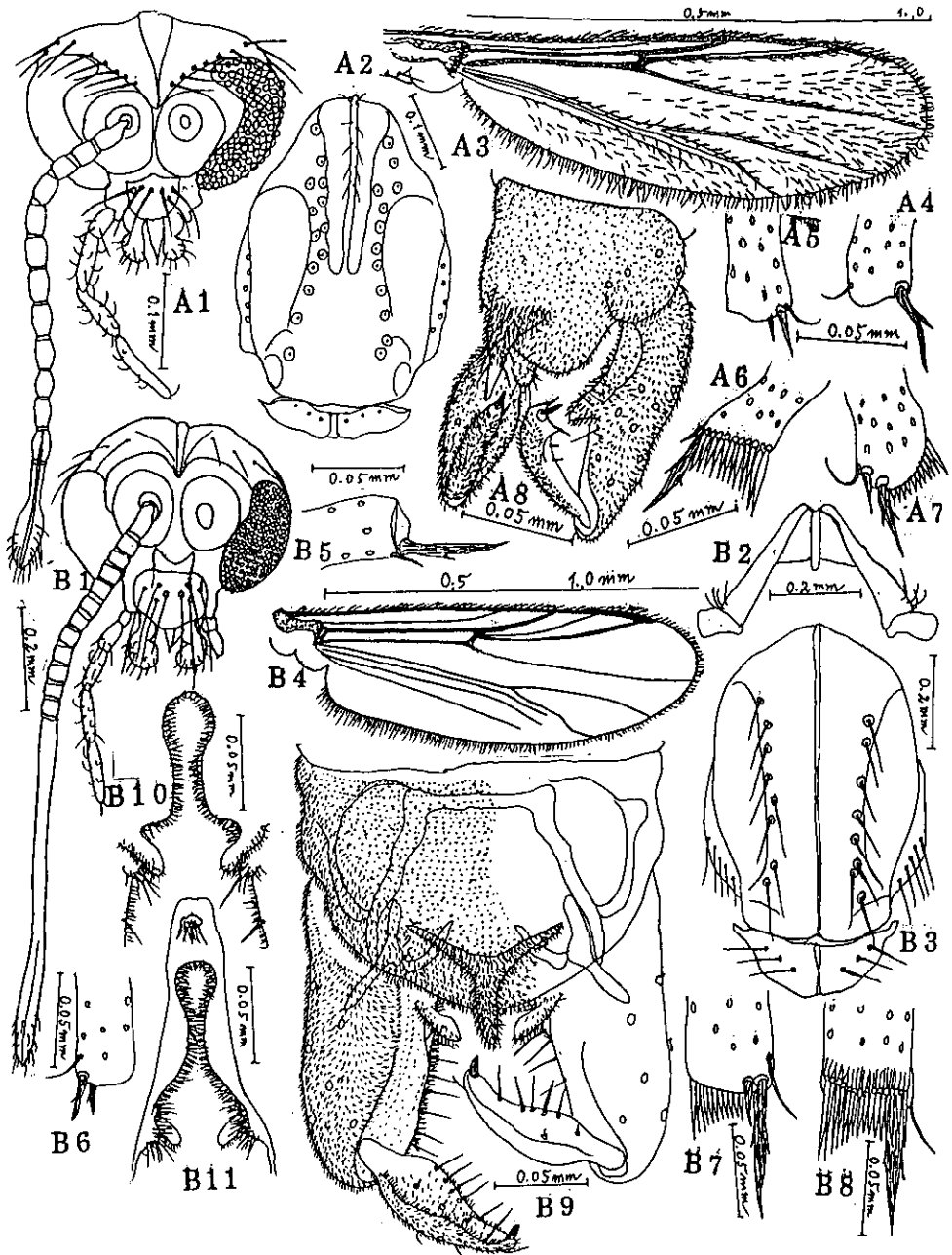


Plate 12. A. *Paraphaenocladus penerasus* (edwards)

B. *Pseudosmittia touyanigra*, sp. nov.

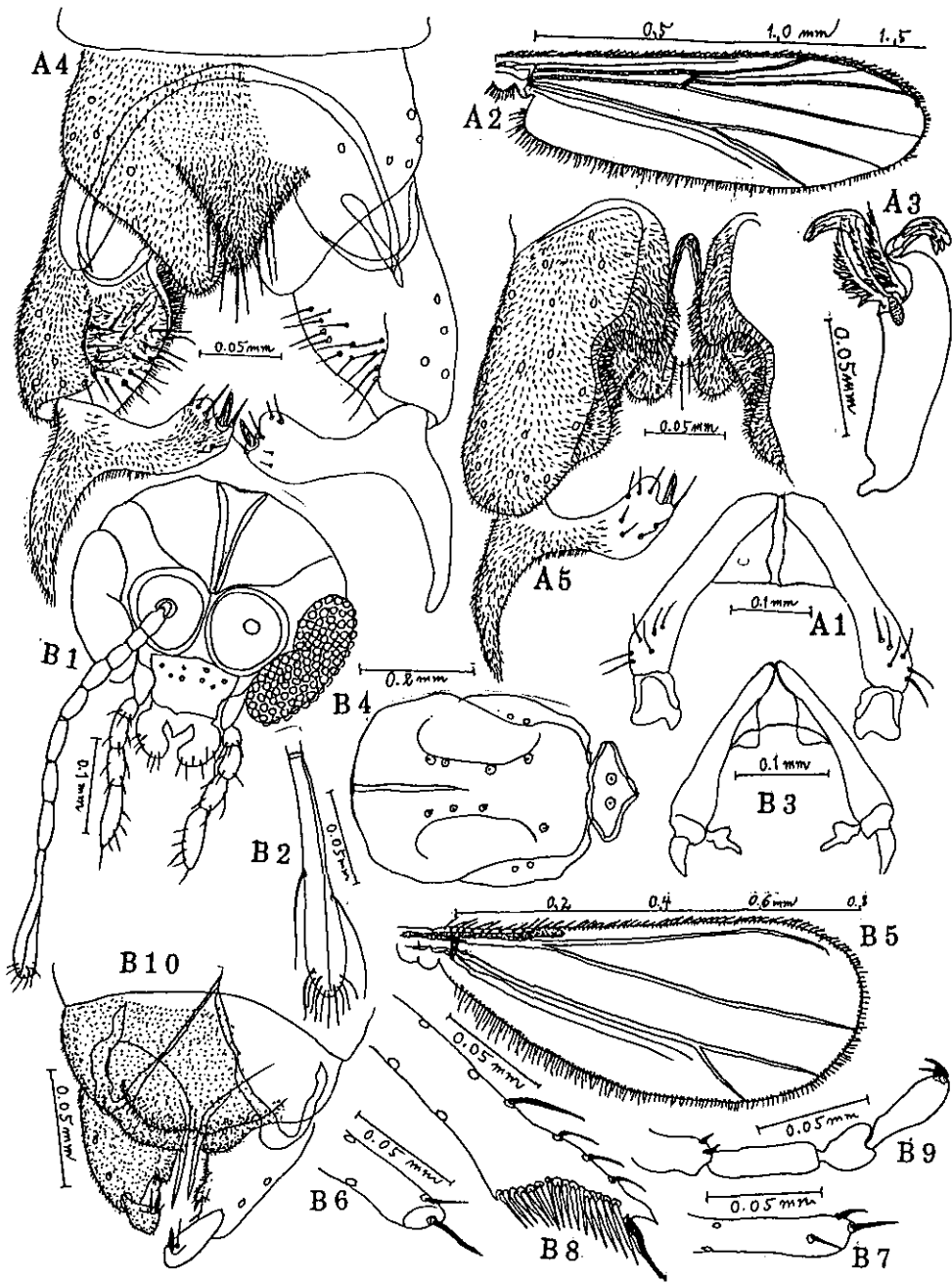


Plate 13. A. *Toyamayusurika shiotanii* Sasa et Kawai

B. *Corynoneura lobata* Edwards

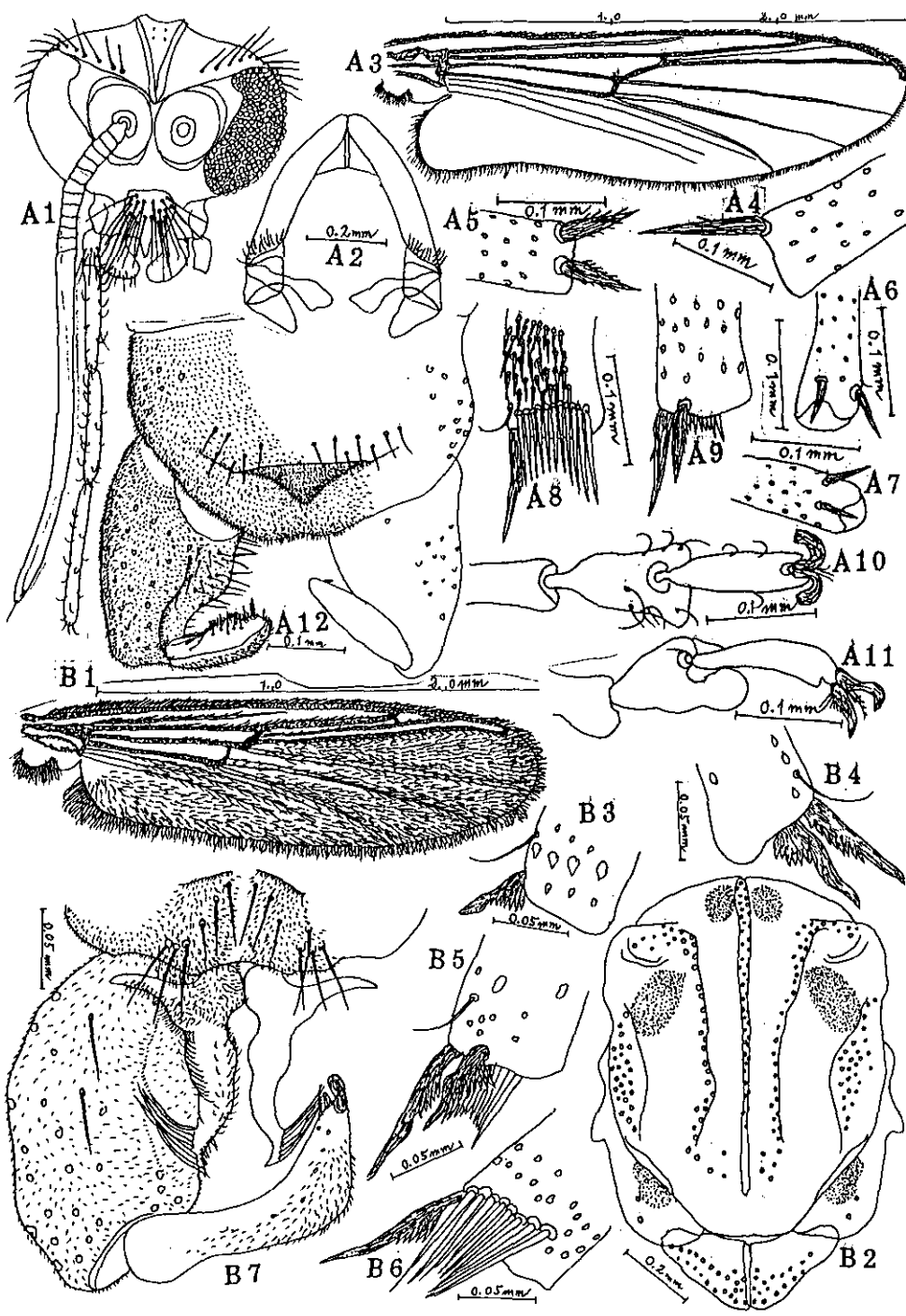


Plate 14. A. *Psiloiamesa montium* (Edwards)

B. *Conchapelopia melanopus* (Meigen)

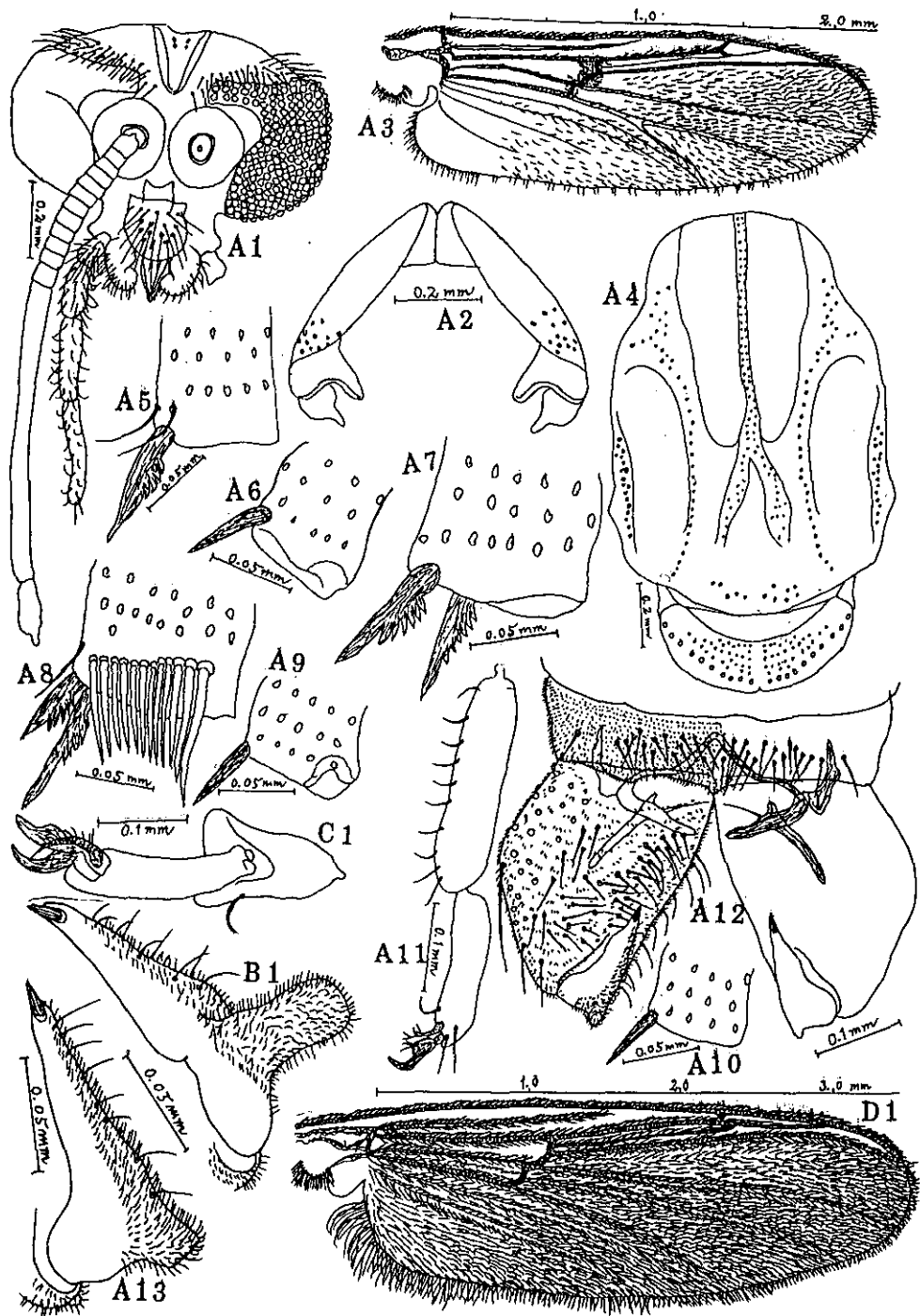


Plate 15. A. *Procladius sagittalis* (Kieffer)

B. *Procladius choreus* (Meigen)

C. *Clinotanypus sugiyamai* Tokunaga

D. *Pentaneura japonica* Tokunaga

北海道南部の湖と溪流で採集されたユスリカについて

佐々 学¹

北海道の南部にある「洞爺湖」, 「支笏湖」, 「ウトナイ湖」と, 洞爺湖に流入する「長流(おさる)川」のユスリカの採集を1986年6月12日と13日に行った。湖についてはそれぞれ湖岸に休息する成虫を吸虫管ないし捕虫網で採集したほか, 採泥器を用いて湖底の泥を取り, 研究室に持ち帰った後, 水を張ったプラスチック水槽に移し, それから羽化した成虫やサナギの抜殻を標本として種類を検索した。その結果, 全部でユスリカ科として53種が同定された。そのうち13種は日本未記録種10種は新種としてここに記載した。それぞれの水域から採集した種類の数は, 洞爺湖29, 支笏湖8, ウトナイ湖13, 長流川11であった。それらのうち, 洞爺湖と支笏湖の共通種は4, 洞爺湖とウトナイ湖は2, 支笏湖とウトナイ湖は1に過ぎなかった。長流川で採集された種類は1がウトナイ湖と, 他の1が洞爺湖と共通しているに過ぎなかった。これらの分布の差は主としてそれら水域の水質の差を反映しているものと思われる。これら53種のうち, 23種はヨーロッパ, ないし北米で報告されたユスリカ種と共通の種類と判断した。

1. 国立公害研究所客員研究員 富山医科薬科大学 〒930-03 富山市杉谷 2630

Chironomid midges collected on the shore of lakes
in the coastal region of Abasiri, northern Hokkaido

Manabu Sasa¹

SUMMARY

As a part of the joint studies on the distribution and biology of chironomid midges in and around the lakes in Hokkaido sponsored by the National Institute for Environmental Studies, collections of the adult chironomid were made by Dr. Akiko Shirasaka during the period from 12 to 14 June 1986, mainly on the shore of lakes in the Abasiri region, i.e. Kutcharoko, Toufutsuko, Notoroko, Mokotoko, Saromako and Komukeko. These lakes are located on the low coastal region, and some of them contain brackish water, and all exposed to extremely low temperatures during the winter season. As the results, a total of 9 species were identified by adult males (Table 1), i.e. *Chironomus nipponensis* Tokunaga, *Ch. salinarius* Kieffer, 1921, *Dicrotendipes lobiger* (Kieffer, 1921), *Ainuyusurika tuberculata*, (Tokunaga, 1940) gen. nov., *Stictochironomus abasirisecondus* sp. nov., *Limnophyes akanundecimus* Sasa et Kamimura, 1987, *Pseudorthocladus akanseptimus* Sasa et Kamimura, 1987, *Smittia nudipennis* (Goetghebuer, 1913), and *Ablabesmyia monilis* (Linnaeus, 1763). Four species among them were identified as those already recorded from Europe, while the rest five species are apparently indigenous to Japan and the neighboring region. Large numbers of males and females of a species described by Tokunaga (1940) from Sakhalin by the name of *Pentapedilum tuberculatus* were collected, and was placed in new genus, *Ainuyusurika*. A new species of genus *Stictochironomus* was collected, which is characteristic in having no lateral seta on dorsal appendage.

INTRODUCTION

This report deals with the results of the studies in the distribution of the chironomid midges in the lakes along the coast of Abasiri region, northern Hokkaido. The collections of adult midges resting in bushes or swarming in the air were carried out with insect net or sucking tubes by Dr. Akiko Shirasaka and Dr. Yoshitake Wada, during the period from 12 to 14 June 1986, almost at the same time as the collection at Shikotsu, Toya and Utonai carried out by

-
1. Visiting Fellow of the National Institute for Environmental Studies. Present address: Toyama Medical and Pharmaceutical University, Sugitani, Toyama-shi, 930-01, Japan
Assisted by Akiko Shirasaka; Department of Parasitology, Tokyo Women's Medical College, Kawabatacho 10, Shinjuku, Tokyo 162, Japan

Sasa, Yasuno and Sugaya, reported in the previous paper. The lakes studied in the present survey are located along the coast line, some containing brackish waters, and thus the environment is quite different from the lakes in Hokkaido surveyed by Sasa and Kamimura in June 1982 and by Sasa, Yasuno and Sugaya in June 1986, which are located in the inland regions and are mostly surrounded by high mountains. The methods of preservation and mounting of the specimens as well as the terminology used in the morphological accounts are the same as in the previous reports. Because the identification of the specimens was carried out jointly by the author and Dr. Shirasaka, her name is added as the joint author of new scientific names used in the present paper.

Acknowledgments

Thanks are especially due to Dr. Kiyoshi Sugahara and Dr. Masayuki Yasuno, National Institute for Environmental Studies, and to Dr. Yoshitake Wada, Tokyo Women's Medical College, for their assistance in planning and conducting this study. The author also wishes to thank to Mrs. Fumiko Kamimura who prepared the slide specimens.

Table 1. The number of adult chironomids (males:females) collected on the shore of 7 lakes in the Abasiri area.

Species	Beniya	Kutcharo	Komuke	Saroma	Notoro	Mokoto	Toufutsu	TOTAL
1. <i>Chironomus nipponensis</i>	1:0							1:0
2. <i>Chironomus salinarius</i>							24:9	24:9
3. <i>Dicrotendipes lobiger</i>		42:0	8:5					50:5
4. <i>Ainuyusurika tuberculata</i>			5:2	43:8	6:0		4:0	58:10
5. <i>Stictochironomus abasirisecondus</i>	2:0							2:0
6. <i>Limnophyes akanduodecimus</i>	0:1		0:1			46:1		46:3
7. <i>Pseudorthocladius akanseptimus</i>		1:0						1:0
8. <i>Smittia nudipennis</i>						16		16:0
9. <i>Ablabesmyia monilis</i>	3:0							3:0
Total	6:1	43:0	13:8	43:8	6:0	62:1	28:9	201:27

COLLECTION RECORDS AND TAXONOMICAL NOTES

1. *Chironomus nipponensis* Tokunaga, 1940

A male was collected at Beniya Genseikaen in 12 June 1986 (No.A 129:55).

2. *Chironomus salinarius* (Kieffer, 1921)

Altogether 24 males and 9 females were collected on the shore of Lake Toufutsu on 14 June 1986 (No. A 129:67-100).

Remarks. This is a species recorded by Kieffer (1921), Thienemann & Strenzke (1951), Strenzke (1959, p.22) and Pinder (1978, p.114) from Europe, and Sasa (1978, p.20) from Tokushima, Japan, as breeding in brackish water swamps. It is morphologically somewhat similar to *Ch. plumosus*, but body is almost entirely black or dark brown, including abdominal tergites, body size is smaller (in *plumosus*, WL larger than 5.0 mm), fLR is larger (1.16-1.23 in *plumosus*), fBR is smaller (more than 6.0 in *plumosus*), and dorsal appendage is more strongly hooked apically. Standard measurement data of 10 specimens among the present population: BL 7.86-9.08 (mean, 8.46) mm, WL 3.78-4.12 (3.94), AR 3.65-4.02 (3.85), AHR 0.56-0.66 (0.60), so 22-28 (25.3), cl 18-24 (19.6), pn 0, dm 21-33 (24.6), dl 25-42 (31.3), pa 5-8 (7.3), sc 26-34 (28.9), sq 18-40 (28.6), RR 0.18-0.29 (0.24), VR 1.04-1.08 (1.06), R/Cu 1.10-1.15 (1.12), fLR 1.30-1.36 (1.33), mLR 0.60-0.64 (0.62), hLR 0.71-0.75 (0.73), fTR 0.22-0.23 (0.22), fBR 3.7-4.2 (3.9), mBR 3.6-4.7 (4.1), hBR 3.5-5.7 (4.7). Anteprepronotum in Fig.17C1, hypopygium in Fig.17C2.

3. *Dicrotendipes lobiger* (Kieffer, 1921)

(Plate 17B)

42 males were collected on the shore of Lake Kutcharo on 13 June 1986 (129:01-42). 8 males and 5 females were collected also on the shore of Lake Komoko, on 13 June 1986 (No.A 130:81-88, 91-95).

Male. BL 4.38-5.42 (4.96 in average of 10) mm, WL 2.22-2.66 (2.40) mm. Body largely yellow, with brown or dark brown marks; ground color of scutum yellow, stripes reddish brown, scutellum yellow, postnotum dark brown, abdominal tergites yellow, hypopygium brown; front tibia and tarsi brown; middle and hind tarsi also brown, other proximal leg segments yellow; halteres yellow. Frontal tubercles small, roughly cylindrical, 10 μ long, 8 μ wide and 38 μ apart from each other (Fig.17B1). Antenna with 11 flagellar segments, AR 2.32-2.55 (2.40), AHR 0.50-0.60 (0.56). Eyes each with a prominent dorsomedial projection, ER 0.24-0.31 (0.27). so 18-.26 (20.9), cl 12-21 (17.1). Anteprepronotum (Fig.17B2) narrowly united in the middle, without lateral setae. dm 12-20 (15.0), sl 14-20 (16.3), pa 5-10 (7.1), sc 12-22 (17.4). Wing bare, sq 11-18 (15.0), RR 0.15-0.31 (0.21), VR 1.13-1.20 (1.15), R/Cu 1.10-1.12 (1.11). Terminal scale of front tibia broad and with rounded margin, bearing 3 long subterminal setae. Terminal combs of middle and hind tibiae both with a short spur (Fig.17B3). fLR 1.51-1.62 (1.58), mLR 0.50-0.53

(0.51), hLR 0.64-0.71 (0.68), fTR 0.25-0.28 (0.27), fBR 2.8-3.7 (3.2), mBR 3.8-4.9 (4.2), hBR 4.1-5.4 (4.6). All legs with a pair of large pulvilli.

Hypopygium as describe and illustrated by Sasa (1985, p.43, Fig.26) with specimens collected from Lake Yunoko (Nikko, Tochigi).

Female. BL 4.10-4.23 (4.18 in average of 5) mm, WL 2.40-2.88 (2.57) mm. Body coloration as in male. Antenna composed of a pedicel and 6 flagellar segments, AR 0.46-0.48 (0.47). Small frontal tubercles present, as in male. ER 0.23-0.33 (0.28), so 15-18 (16.0), cl 23-34 (28.2), pn 0, dm 16-23 (18.4), dl 19-25 (22.3), pa 6-9 (7.6), sc 18-29 (21.8). sq 17-23 (19.0), RR 0.13-0.20 (0.17), VR 1.15-1.30 (1.23), R/Cu 1.09-1.17 (1.14), fLR 1.68, mBR 0.53-0.58, hLR 0.62-0.67 (0.64), fTR 0.27, fBR 3.3, mBR 2.2-2.8 (2.4), hBR 2.4-3.0 (2.8). Other morphological characters as described and illustrated by Sasa (1985, p.44, Fig.25).

Remarks. The above characters of the present specimens are almost coincident with the descriptions of males and females of *D. lobiger* collected from Lake Yunoko by Sasa (1985). The male is characteristic especially in the structure of hypopygium. In the female, it can be differentiated clearly from those of *Ainuyusurika abasiriprima* by that antepnotum is united in the middle (narrowly separated in the latter), and terminal comb of middle and hind tibiae with two short spurs (with only one long spur in the latter).

Ainuyusurika Sasa et Shirasaka, gen. nov.

A genus of the tribe Chironomini, subfamily Chironominae, and a member of the *Polypedilum* complex in wider sense. In male, antenna composed of a pedicel and 13 flagellar segments, wing membrane bearing macrotrichiae towards the tip, squama fringed, one terminal comb of middle and hind tibiae with a long spur and the other comb without spur, pulvilli well developed, anterior margin of 8th tergite nearly straight and not angulate such as seen in genera *Pentapedium* and *Polypedilum*, gonocoxite longer than gonostylus, dorsal appendage roughly T-shaped and with a seta arising at posterolateral corner, ventral appendage well developed and with a conspicuous apical tubercle bearing several long and recurved setae. The above characters are somewhat related to genus *Phaenopsectra* Kieffer, but differs essentially in the structure of terminal comb of middle and hind tibiae (with two short spurs in *Phaenopsectra*), and in the structure of dorsal and ventral appendages. It is also somewhat allied to genus *Pentapedium* Kieffer, but also differs in the shape of anterior margin of 8th abdominal tergite (produced angularly towards middle in *Pentapedium*), in the absence of long setae on inner margin of gonostylus, and in the peculiar structure of dorsal and ventral appendages.

Genotype: *Ainuyusurika tuberculata*, (Tokunaga, 1940), monotypic

4. *Ainuyusurika tuberculata* (Tokunaga, 1940)

(Plate 16)

A total of 57 males (No. A 130:01-57) and 10 females (A 130:61-70) were collected on the shore of 4 lakes in the coastal area of Abasiri, i.e. 4 males

at Lake Toufutsu, 6 males at Lake Notoro, 43 males and 8 females at Lake Saroma, and 5 males and 2 females at Lake Komuke. Holotype: A 130:01. Paratypes, males, A 130:02-12; females, A 130:61-70.

Male. Body length 3.46-4.20 (3.69 in average of 12) mm, wing length 1.62-2.20 (1.85) mm. Ground color of scutum brown, stripes dark brown, scutellum brown, postnotum dark brown, legs almost uniformly yellowish brown, wing unmarked, abdominal tergites almost uniformly brown. Head in Fig. 16-1. Eyes bare, each with a long dorsomedial projection, ER 0.15-0.27 (0.22). Frontal tubercles absent (Fig.16-2). Antenna composed of a pedicel and 13 flagellar segments, AR 0.94-1.20 (1.05), AHR 0.44-0.52 (0.48). so 8-13, cl 12-20 (13.6). Anteprenotum (Fig.16-3) deeply separated in the middle, without lateral seta. Scutum and scutellum in Fig. 16-4. dm 13-27 (17.4), dl 8-16 (12.2), pa 5-8 (most frequently 6, mean 7.1), sc 9-14 (11.4). Wing in Fig. 16-5. Squama with 6-14 (9.3) fringe hairs. Wing membrane bluish in transmitted light, with macrotrichiae on veins R, R₁, R₄₊₅, M Cu₁, and apical portions of cells between R₄₊₅ and M, and M and Cu₁, proximal 3/4 of wing membrane free from macrotrichiae. R₂₊₃ almost in contact with R₁, RR very small, 0.11-0.21 (0.15). VR 1.29-1.42 (1.33), R/Cu 1.11-1.17 (1.13). Terminal scale of front tibia with rounded margin and with two long subapical setae (Fig.16-6). One terminal comb of middle and hind tibiae with a long spur, the other comb without spur, and both combs are narrowly separated (Fig.16-7, 8). All legs with a pair of large pulvilli (Fig.16-9). fLR 1.13-1.29 (1.19), relatively small as a species of Chironominae; mLR 0.52-0.57 (0.55), hLR 0.63-0.70 (0.67), fTR 0.22-0.26 (0.24). Tarsal beards relatively short, fBR 2.0-3.5 (2.8), mBR 2.6-3.8 (3.2), hBR 2.6-4.0 (3.4).

Eighth abdominal tergite with almost straight anterior margin, not angularly produced in the middle like in *Polypedilum* and *Pentapedilum* species (Fig.16-10). Hypopygium in Fig. 16-10. Bands of ninth tergite connected in the middle and forming a roughly circular mark in the center bearing several long setae. Ninth tergite with short setae on posterior margin. Anal point long, slender and apically rounded. The structure of dorsal appendage characteristic to this species, roughly T-shaped, composed of a narrow, parallel-sided basal shaft and apical portion which are expanded both medially and laterally, with several setae on inner margin near the base, and a lateral seta arising at the posterolateral corner (Fig.16-11). Ventral appendage also characteristic to this species, roughly thumb-like and with recurved setae on posterior portion, and with a conspicuous apical tubercle also bearing some 10 recurved setae (Fig.16-12). Gonostylus widest at about middle, inner margin almost straight, bearing numerous short setae on apical half of inner margin.

Female. BL 2.44-3.25 (2.74 in average of 10) mm, WL 1.58-2.11 (1.80) mm. Body coloration as in male, largely brown, scutal stripes and postnotum dark brown. Head in Fig. 16-13. Antenna composed of a pedicel and 6 flagellar segments (Fig.16-14). Eyes bare, each with a long dorsomedial projection, ER 0.23-0.40 (0.28). Frontal tubercles absent. AR 0.39-0.44 (0.41), so 8-13 (9.8), cl 13-24 (18.7), pn 0, dm 15-18 (16.2), dl 12-23 (16.7), pa 5-9 (most frequently 6, mean 6.5), sc 10-19 (15.0). Wing in Fig. 16-15. Macrotrichiae are distributed more extensively than in male. sq 6-15 (9.4), RR 0.07-0.22 (0.15), VR 1.22-1.35 (1.30), R/Cu 1.13-1.19 (1.16), fLR 1.15-1.24 (1.20), mLR

0.45-0.54 (0.51), hLR 0.64-0.71 (0.67), fTR 0.22-0.24 (0.23), fBR 2.0-2.8 (2.2), mBR 1.5-2.5 (2.2), hBR 1.8-3.0 (2.4). Pulvilli well developed. Spermathecae highly transparent and difficult for detection under the optical microscope (Fig.16-16). Cercus elongate, 60 μ high and 35 μ long (Fig.16-17).

Remarks. This species was described by Tokunaga (1940 p.290) by male collected at Lake Kita-Hakutyoko, Sakhalin, as showing characteristic structure of dorsal and ventral appendages. The female is a new record, and is also characteristic in that wing has macrotrichiae towards tip, and antenna is composed of a pedicel and 7 flagellar segments.

5. *Stictochironomus abasiriscundus* Sasa et Shirasaka, sp. nov.

(Plate 17A)

Two males were collected at Beniya Genseikaen, on 12 June 1986. Holotype. A 129:51. Paratype A 129:52.

Male. BL 7.80, 7.90 mm, WL 3.82, 3.90 mm. Body coloration peculiar to this species, scutum entirely black, scutellum yellow, postnotum black, abdominal tergites I to V largely yellow, VI-VIII and hypopygium dark brown. In the front legs, femur yellow, tibia and tarsi dark brown; in the middle and hind legs, femora, tibiae, tarsi I, II and III yellow, IV and V dark brown. Wing unmarked. Head in Fig. 17A1. Frontal tubercles lacking. Eyes each with a long and narrow dorsomedial projection, ER 0.21, 0.24. Antenna with 13 flagellar segments, AR 2.64, 2.82, AHR 0.58, 0.62, so 24:26, 24:26, cl 34, 40. Anteprepronotum (Fig.17A3) deeply and narrowly separated in the middle, lateral setae absent. Scutum and scutellum in Fig. 17A4. Scutum with a small hump on the mid-line. dm 15, 17, dl 24:26, 22:26, pa 8:9, 9:10, sc 20:24. Wing in Fig.17A2. Wing membrane bare and without dark marks. R₂₊₃ ending closer to end of R₁, RR 0.27, 0.33. VR 1.10, 1.14, R/Cu 1.16, 1.19. fLR 1.16, 1.19, mLR 0.60, hLR 0.71, 0.73, fTR 0.18, 0.19, fBR 3.0, 3.3, mBR 4.7, hBR 6.2, 9.0. Terminal scale of front tibia (Fig.17A5) long and with rounded margin, and bearing 3 long subterminal setae. Terminal combs of middle and hind tibiae (Fig.17A6) low, broad and contiguous, and with one rather short spur. All legs with a pair of large pulvilli (Fig.17A7).

Eighth abdominal tergite with almost straight anterior margin, not angularly produced as in *Polypedilum* species. Hypopygium in Fig. 17A8. Bands of ninth tergite H-type. Ninth tergite with 16 or 18 long setae arising in the middle portion. Anal point long, narrow and almost parallel-sided. Gonocoxite roughly conical, very long (340 μ), and longer than gonostylus (280 μ). Gonostylus (Fig.17A9) short and very stout, inner margin almost straight, and with rounded apex, bearing many short setae in the apical portion and on the ventral side. Dorsal appendage smoothly curved along entire length, basal portion only slightly expanded, and with 6-8 long inner setae, but without lateral seta (Fig.17A10). Ventral appendage long, narrow and finger-like, bearing 24-26 recurved and often forked setae on dorsal side and 2 long caudally directed apical setae.

Remarks. These specimens are tentatively diagnosed as a new species of the genus *Stictochironomus* Kieffer, since antenna has 13 flagellar segments, scutum with a small hump in the middle, terminal combs of middle and hind

tibiae contiguous and with only one spur, gonocoxite is longer than gonostylus, and ventral appendage bears long apical setae. However, they differ from all the previously known species of this genus in that wing has no dark marks even around r-m, legs are not ringed, and dorsal appendage has no lateral seta.

6. *Limnophyes akanundecimus* Sasa et Kamimura, 1987

A total of 46 males and one female were collected on the shore of Lake Mokoto on 14 June 1986 (No. A 131:01-47). One female was collected on the shore of Lake Komuke on 13 June (No. A 131:48), another female on the shore of Lake Toufutsu on 14 June (No. A 129:65), and two females at Beniya Genseikaen on 12 June (No. A 131:49, 50).

Male. Measurement were male on 12 mounted specimens. BL 2.00-2.32 (mean 2.16) mm, WL 1.12-1.28 (1.18) mm. Body largely dark brown, scutal stripes and postnotum black. Antenna with 13 flagellar segments, AR 0.79-0.95 (0.88), AHR 0.44-0.53 (0.48). Eyes bare, reniform and widely apart from each other, ER 1.50-1.74 (1.62). Supraorbital area with 1 or 2 median setae and 3 or 4 lateral setae on each side, cl 10-13 (11.3). Anteprenotum with 1 (in 11) or 2 (in 1 specimen) setae on the top, and 2 (in 2), 3 (in 9) or 4 (in 1 specimen) setae on lateral corners. dm 6-9 (most frequently 6, mean 6.7), dl 8-13 (10.1), pa 5-7 (5.7), sc 4 (in 10), 5 (in 1) or 6 (in 1). Wing membrane coarsely granular in appearance, sq 1-5 (2.8), RR 0.29-0.40 (0.32), VR 1.20-1.32 (1.28), R/Cu 1.02-1.07 (1.05). Costa extending much beyond end of R₄₊₅, Cuz strongly curved in the middle. fLR 0.49-0.52 (0.51), mLR 0.44-0.46 (0.45), hLR 0.54-0.57 (0.55), fTR 0.13-0.14 (0.13), fBR 2.1-2.8 (2.4), mBR 2.2-3.3 (2.7), hBR 2.6-4.5 (3.3). Pulvilli absent. Distribution of setae on abdominal tergites in Fig. 18A8, hypopygium in Fig.18A9.

Female. Three specimens (A:131:47-49) collected at the same time with the male of *L. akanundecimus* were measured. BL 1.86, 2.06, 2.10 mm, WL 1.14, 1.20, 1.29 mm. Body coloration largely dark brown as in the male. Head in Fig. 18A1. Antenna composed of a pedicel and 5 flagellar segments, last segment with a terminal seta. ER 1.33, 1.40, 1.43. Supraorbital setae composed of one inner and 3-4 lateral pairs. cl 14, 14, 15. Palp 4 segmented. Anteprenotum (Fig.18A2) very narrowly united in the middle, and with 8:9, 10:11 setae distributed along the lateral margin. dm 8, 8, 10, all minute and distributed only in the middle portion of the scutum, dl 15:16, 16:16, 16:17, pa composed of 4 anterior and 3 or 4 posterior pairs, sc 6 in all of 3 specimens (Fig.18A4). Wing in Fig. 18A3. sq 3-7 (5.5), RR 0.24, 0.28, 0.33, VR 1.35, 1.35, 1.37, R/Cu 1.02, 1.04, 1.05. Costa extending beyond end of R₄₊₅. Wing membrane coarsely granular, as in male. fLR 0.51, 0.52, mLR 0.43, 0.44, hLR 0.53, fTR 0.14, fBR 1.9, 2.5, mBR 1.9, hBR 2.3. Spermathecae two, both oval (Fig.18A6), cercus small, roughly semicircular (Fig.18A7). Distribution of setae on abdominal tergites in Fig. 18A5.

Remarks. This species was described by Sasa & Kamimura (1987) based on a single male collected on the shore of Lake Akan, Hokkaido, and a large numbers of males and females were collected this time from another lake in Hokkaido.

In male, it is somewhat related to *L. minimus* (Meigen, 1818) recorded from Europe in that it has no lanceolate setae on scutum, antenna with 13 flagellar segments as usual, and gonocoxite has only one inner lobe, but differs from the latter in that inner lobe of gonocoxite is much narrower, and has a distinct anal point bearing many strong setae. The female of this species is a new record.

7. *Pseudorthocladius akanseptimus* Sasa et Kamimura, 1987

A male was collected at the side of Lake Kutcharo on 13 June 1986 (No. A 131:71). BL 2.60 mm, WL 1.36 mm. Body largely dark brown, scutal stripes almost black. AR 1.07, AHR 0.48, ER 1.08, so 8:8, cl 8, pn 2:2, dm 12, dl 10:10, pa 7:7, sc 11, sq 4:5. Eyes bare, wing membrane without macrotrichiae, tarsi with long beards, mBR 4.2, hBR 6.4. Pulvilli well developed. Ninth tergite with a broad and rounded posterior margin, and bearing long setae. Inner lobe of gonocoxite broad, low and rounded. Gonostylus simple, broadest at about middle and with convex inner margin, bearing a strong and darkly pigmented terminal spur.

Remarks. The above morphological characters and measurement data are almost coincident with the type specimens of *P. akanseptimus* described by Sasa & Kamimura (1987, p.32) from Lake Kussharo (Hokkaido), and thus this is the second record of this species from another lake in Hokkaido.

8. *Smittia nudipennis* (Goetghebuer, 1913)

A total of 16 males were collected on the shore of Lake Mokoto on 14 June 1986 (No.A 51-66).

Male. BL 1.88-2.36 (2.09 in average of 10) mm, WL 1.04-1.30 (1.19) mm. Body almost uniformly black, excepting abdominal sternites which are brown. Eyes pubescent, reniform and widely apart from each other, ER 1.14-1.54 (1.26). Antenna with 13 flagellar segments, AR 1.13-1.37 (1.26), AHR 0.54-0.61 (0.57), last segment with a conspicuous apical seta. so 3-5 (4.5), cl 6-10 (7.1, most frequently 8). Anteprepronotum (Fig.18B2) united in the middle, with only 1 (in 8) or 2 (in 2 specimens) lateral setae, dm usually absent (one specimen had only 1 minute dorsomedian seta), dl 14-21 (17.3), pa 5-10 (7.5, most frequently 8), sc 8 excepting in a specimen with 7 (mean 7.9). Wing in Fig. 18B1. Squama bare, R/Cu 0.92-0.96 (tip of R₄₊₅ proximal to tip of Cu₁; mean 0.94), RR 0.52-0.61 (R₂₊₃ ending slightly beyond middle point between tips of R₁ and R₄₊₅, mean 0.56), VR 1.25-1.35 (fCu much beyond r-m, mean 1.32). Costa extending much beyond end of R₄₊₅. Anal lobe of wing obtuse. Tarsi I of all legs relatively short, fLR 0.46-0.49 (0.48), mLR 0.41-0.44 (0.43), hLR 0.54-0.58 (0.55), fTR 0.13-0.15 (0.14), fBR 3.0-4.8 (3.5), mBR 3.4-4.9 (4.3), hBR 4.2-6.7 (5.5). Pulvilli absent.

Hypopygium in Fig. 18B3. Ninth tergite without long setae in the middle portion. Anal point long (32 μ) and narrow (7 μ wide at base) and apically pointed, with microtrichiae in basal 1/3 and nude in apical 2/3. Inner lobe

of gonocoxite small and angulate. Gonostylus simple, with an apical spur, and a large, wide and rounded subapical swelling on inner margin.

Remarks. This is a typical member of genus *Smittia* Holmgren, since wing membrane is bare and smooth, Cu₂ is strongly curved in the middle, squama is bare, and antenna has a conspicuous apical seta. Among the species recorded within this genus, it is closest to *S. nudipennis* (Goetghebuer), as eyes are pubescent, inner margin of gonostylus is strongly expanded subapically, anal point is long and its apical half is bare, and R₄₊₅ is ending proximal to end of Cu₁ (ref. Pinder, 1978, p.96). Among two species of this group recorded in Europe, the present species is somewhat between *S. nudipennis* and *S. edwardsi*, as AR is varying from 1.13 to 1.37, and anal lobe of wing is slightly produced (AR is 1.0-1.2 and anal lobe is absent is *S. nudipennis*, while AR is 1.4-1.6 and anal lobe of wing is obtuse in *S. edwardsi*, according to Pinder, 1978, p.96). *S. nudipennis* was recorded also from Japan by Sasa (1985c, p.122) at Lake Motosu (Yamanashi), Sasa & Kamimura (1987) at Lake Pánke (Hokkaido), and by Sasa & Kawai (1987a, p.53) at Lake Biwa (Shiga). However, some morphological differences have been noticed among these specimens, and thus the identity among these populations needs to be further investigated.

9. *Ablabesmyia monilis* (Linnaeus, 1763)

Three males were collected at Beniya Genseikaen on 12 June 1986 (No. A 131:91-93). This is a species widely distributed in Europe, and was recorded also by Tokunaga (1937) from a number of localities in western Honshu, and by Sasa & Kawai (1987a) from Lake Biwa.

EXPLANATION OF PLATES

Plate 16.

Ainuyusurika tuberculata, gen. nov., . Male. 1: head. 2: frontal area, showing absence of frontal tubercles. 3: anteprenotum. 4: scutum and scutellum. 5: wing. 6: tip of front tibia. 7: tip of middle tibia. 8: tip of hind tibia. 9: hind tarsus V. 10: hypopygium. 11: dorsal appendage. 12: ventral appendage. Female. 13: head. 14: antenna. 15: wing. 16: spermathecae. 17: cercus.

Plate 17.

A. *Stictochironomus abasirisecondus*, sp. nov. Male. A1: head. A2: wing. A3: anteprenotum. A4: scutum and scutellum. A5: tip of front tibia. A6: tip of hind tibia. A7: hind tarsus V. A8: hypopygium. A9: gonostylus, ventral view. A10: dorsal appendage.

B. *Dicrotendipes lobiger* (Kieffer). Male. B1: frontal tubercles. B2: anteprenotum. B3: tip of hind tibia.

C. *Chironomus salinarius* (Kieffer). Male. C1: anteprenotum. C2: hypopygium.

Plate 18.

A. *Limnophyes akanundecimus* Sasa et Kamimura. Female. A1: head. A2: anteprenotum. A3: wing. A4: scutum and scutellum. A5: abdominal tergites. A6: spermathecae. A7: cercus. Male. A8: abdominal tergites. A9: hypopygium.

B. *Smittia nudipennis* (Goetghebuer). Male. B1: wing. B2: anteprenotum. B3: hypopygium.

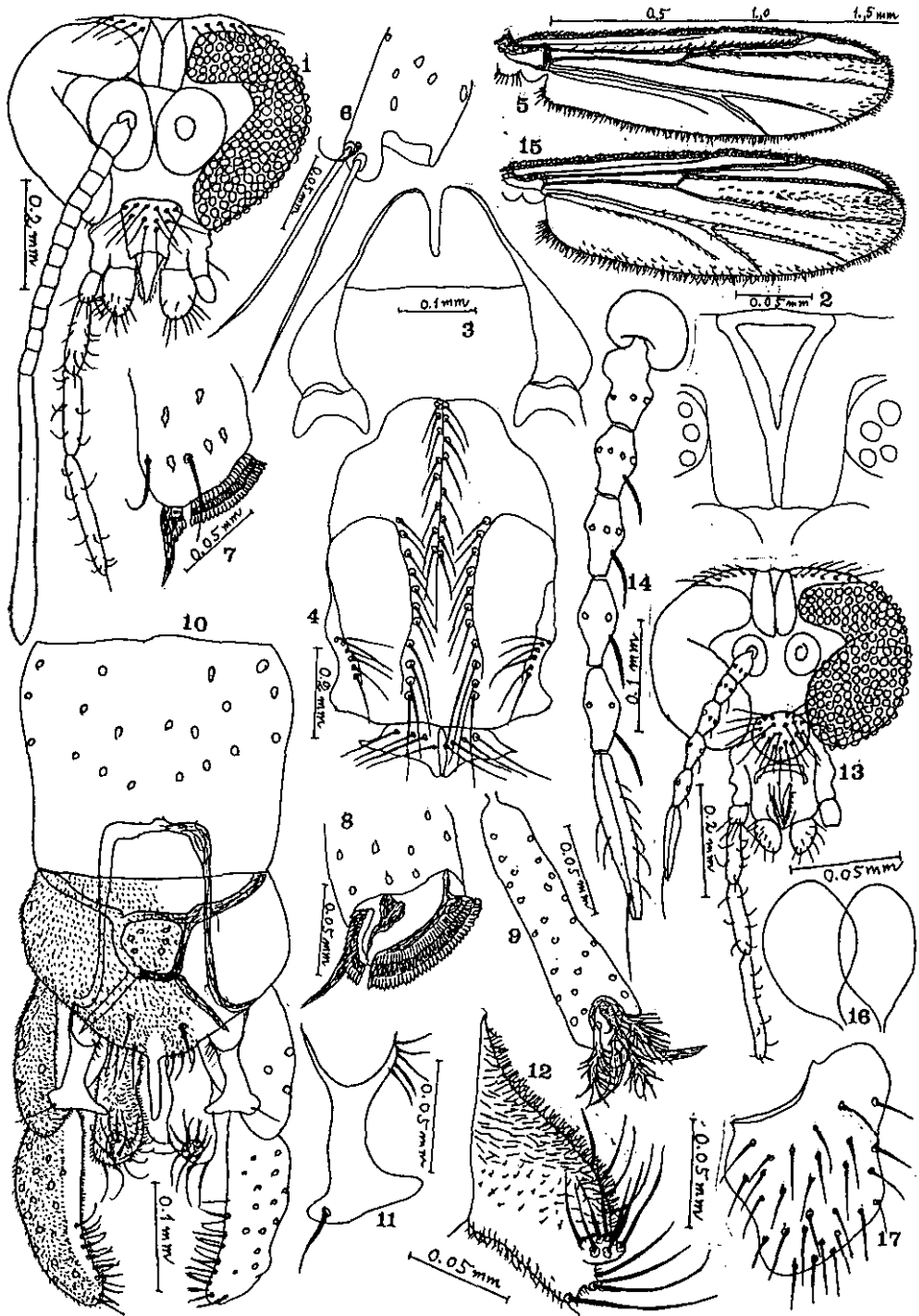


Plate 16. *Ainyusurika tuberculata* (Tokunaga, 1940), gen. nov.

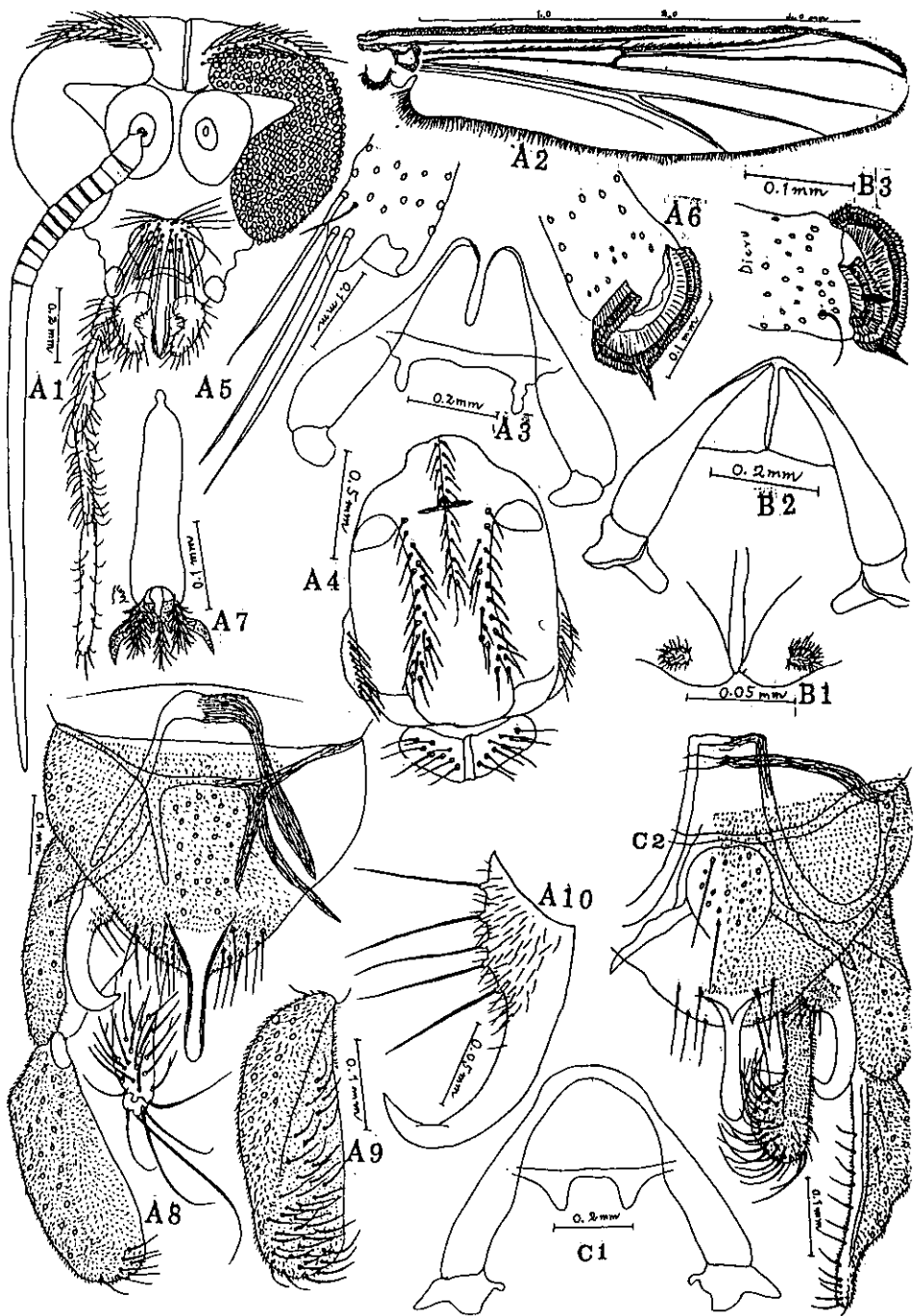


Plate 17. A. *Stictochironomus abasirisecondus*, sp. nov.
 B. *Dicrotendipes lobiger* (Kieffer)
 C. *Chironomus salnarius* (Kieffer)

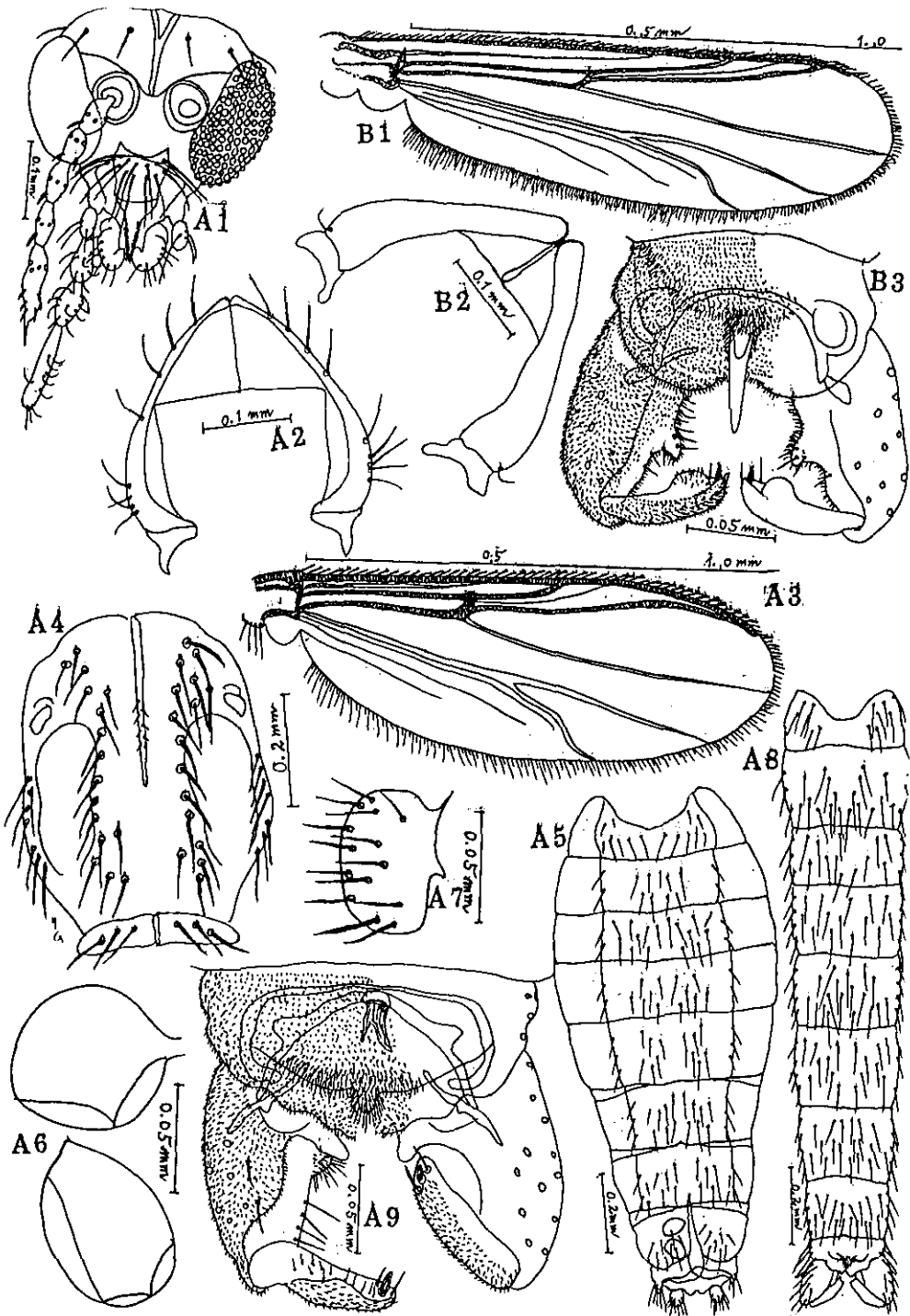


Plate 18. A. *Limnophyes akanundecimus* Sasa et Kamimura

B. *Smittia nudipennis* (Goetghebuer)

北海道の網走海岸の湖周辺で採集したユスリカの種類について

佐々 学¹

1986年6月12日より14日にかけて、北海道北部の網走海岸にあるクッチャロ湖、トウフツ湖、ノトロ湖、モコト湖、サロマ湖、コムケ湖などの岸で、主として捕虫網を用いユスリカ成虫を採集した。これらはいずれも浅い湖でその一部は塩気を含んでおり、冬期にはひどい低温にさらされて氷結する。これらの湖岸から合計して9種のユスリカが集められた。そのうちの4種は既にヨーロッパから報告されたものと同一種と判断したが、残り5種はこれまで日本ないしその近辺のみから見出されたものである。そのうちの1種はすでに徳永雅明(1940)が樺太で採集し、Pentapedilum tuberculatus と名付けられたものと同一種と推定されたが、既知の属にはこれを受け入れるものがなく Ainuyusurika という新属を設けた。そのほか Stictochironomus abasirisecundus が発見された。それらの分布は表1に示す通りである。トウフツ湖よりは塩分を含む水に特産する Chironomus salinarius が採集された。

1. 国立公害研究所客員研究員 富山医科薬科大学 〒930-01 富山市杉谷 2630

国立公害研究所特別研究成果報告

- 第1号 陸水域の富栄養化に関する総合研究—霞ヶ浦を対象域として—昭和51年度。(1977)
第2号 陸上植物による大気汚染環境の評価と改善に関する基礎的研究—昭和51/52年度 研究報告。(1978)

(改称)

国立公害研究所研究報告

- ※第3号 A comparative study of adults and immature stages of nine Japanese species of the genus *Chironomus* (Diptera, Chironomidae). (1978)
(日本産ユスリカ科 *Chironomus* 属9種の成虫、サナギ、幼虫の形態の比較)
- 第4号 スモッグチャンバーによる炭化水素-窒素酸化物系光化学反応の研究—昭和52年度 中間報告。(1978)
- 第5号 芳香族炭化水素-窒素酸化物系の光酸化反応機構と光酸化二次生成物の培養細胞に及ぼす影響に関する研究—昭和51、52年度 研究報告。(1978)
- 第6号 陸水域の富栄養化に関する総合研究(Ⅱ)—霞ヶ浦を中心として—昭和53年度。(1979)
- ※第7号 A morphological study of adults and immature stages of 20 Japanese species of the family Chironomidae(Diptera). (1979)
(日本産ユスリカ科20種の成虫、サナギ、幼虫の形態学的研究)
- ※第8号 大気汚染物質の単一および複合汚染の生体に対する影響に関する実験的研究—昭和52、53年度 研究報告。(1979)
- 第9号 スモッグチャンバーによる炭化水素-窒素酸化物系光化学反応の研究—昭和53年度 中間報告。(1979)
- 第10号 陸上植物による大気汚染環境の評価と改善に関する基礎的研究—昭和51~53年度 特別研究報告。(1979)
- ※第11号 Studies on the effects of air pollutants on plants and mechanisms of phytotoxicity. (1980)
(大気汚染物質の植物影響およびその植物毒性の機構に関する研究)
- 第12号 Multielement analysis studies by flame and inductively coupled plasma spectroscopy utilizing computer-controlled instrumentation. (1980)
(コンピュータ制御装置を利用したフレイムおよび誘導結合プラズマ分光法による多元素同時分析)
- 第13号 Studies on chironomid midges of the Tama River. (1980)
Part 1. The distribution of chironomid species in a tributary in relation to the degree of pollution with sewage water.
Part 2. Description of 20 species of Chironominae recovered from a tributary.
(多摩川に発生するユスリカの研究
—第1報 その一支流に見出されたユスリカ各種の分布と下水による汚染度との関係
—第2報 その一支流に見出された Chironominae 亜科の20種について)
- 第14号 有機廃棄物、合成有機化合物、重金属等の土壌生態系に及ぼす影響と浄化に関する研究—昭和53、54年度 特別研究報告。(1980)
- ※第15号 大気汚染物質の単一および複合汚染の生体に対する影響に関する実験的研究—昭和54年度 特別研究報告。(1980)
- 第16号 計測車レーザーレーダーによる大気汚染遠隔計測。(1980)
- ※第17号 流体の運動および輸送過程に及ぼす浮力効果—臨海地域の気象特性と大気拡散現象の研究—昭和53、54年度 特別研究報告。(1980)
- 第18号 Preparation, analysis and certification of PEPPERBUSH standard reference material. (1980)
(環境標準試料「リョウブ」の調整、分析および保証値)
- ※第19号 陸水域の富栄養化に関する総合研究(Ⅲ)—霞ヶ浦(西浦)の湖流—昭和53、54年度。(1981)
- 第20号 陸水域の富栄養化に関する総合研究(Ⅳ)—霞ヶ浦流域の地形、気象水文特性およびその湖水環境に及ぼす影響—昭和53、54年度。(1981)
- 第21号 陸水域の富栄養化に関する総合研究(Ⅴ)—霞ヶ浦流入河川の流出負荷量変化とその評価—昭和53、54年度。(1981)
- 第22号 陸水域の富栄養化に関する総合研究(Ⅵ)—霞ヶ浦の生態系の構造と生物現存量—昭和53、54年度。(1981)
- 第23号 陸水域の富栄養化に関する総合研究(Ⅶ)—湖沼の富栄養化状態指標に関する基礎的研究—昭和53、54年度。(1981)
- 第24号 陸水域の富栄養化に関する総合研究(Ⅷ)—富栄養化が湖利用に及ぼす影響の定量化に関する研究—昭和53、54年度。(1981)
- 第25号 陸水域の富栄養化に関する総合研究(Ⅸ)—*Microcystis* (藍藻類)の増殖特性—昭和53、54年度。(1981)

- 第26号 陸水域の富栄養化に関する総合研究(X) — 藻類培養試験法によるAGPの測定 — 昭和53、54年度。(1981)
- 第27号 陸水域の富栄養化に関する総合研究(XI) — 研究総括 — 昭和53、54年度。(1981)
- 第28号 複合大気汚染の植物影響に関する研究 — 昭和54、55年度 特別研究報告。(1981)
- 第29号 Studies on chironomid midges of the Tama River. (1981)
Part 3. Species of the subfamily Orthoclaadiinae recorded at the summer survey and their distribution in relation to the pollution with sewage waters.
Part 4. Chironomidae recorded at a winter survey.
(多摩川に発生するユスリカ類の研究
— 第3報 夏季の調査で見出されたエリユスリカ亜科Orthoclaadiinae 各種の記載と、その分布の下水汚染度との関係について
— 第4報 南浅川の冬期の調査で見出された各種の分布と記載)
- ※第30号 海域における富栄養化と赤潮の発生機構に関する基礎的研究 — 昭和54、55年度 特別研究報告。(1982)
- 第31号 大気汚染物質の単一および複合汚染の生体に対する影響に関する実験的研究 — 昭和55年度 特別研究報告。(1981)
- 第32号 スモッグチャンパーによる炭化水素-窒素酸化物系光化学反応の研究 — 環境大気中における光化学二次汚染物質生成機構の研究(フィールド研究1) — 昭和54年度 特別研究中間報告。(1982)
- 第33号 臨海地域の気象特性と大気拡散現象の研究 — 大気運動と大気拡散過程のシミュレーション — 昭和55年度 特別研究報告。(1982)
- ※第34号 環境汚染の遠隔計測・評価手法の開発に関する研究 — 昭和55年度 特別研究報告。(1982)
- 第35号 環境面よりみた地域交通体系の評価に関する総合解析研究。(1982)
- ※第36号 環境試料による汚染の長期モニタリング手法に関する研究 — 昭和55、56年度 特別研究報告。(1982)
- ※第37号 環境施策のシステム分析支援技術の開発に関する研究。(1982)
- 第38号 Preparation, analysis and certification of POND SEDIMENT certified reference material. (1982)
(環境標準試料「池底質」の調整、分析及び保証値)
- ※第39号 環境汚染の遠隔計測・評価手法の開発に関する研究 — 昭和56年度 特別研究報告。(1982)
- 第40号 大気汚染物質の単一及び複合汚染の生体に対する影響に関する実験的研究 — 昭和56年度 特別研究報告。(1983)
- 第41号 土壌環境の計測と評価に関する統計学的研究。(1983)
- ※第42号 底泥の物性及び流送特性に関する実験的研究。(1983)
- ※第43号 Studies on chironomid midges of the Tama River. (1983)
Part 5. An observation on the distribution of Chironominae along the main stream in June with description of 15 new species.
Part 6. Description of species of the subfamily Orthoclaadiinae recovered from the main stream in the June survey.
Part 7. Additional species collected in winter from the main stream.
(多摩川に発生するユスリカ類の研究
— 第5報 本流に発生するユスリカ類の分布に関する6月の調査成績とユスリカ亜科に属する15新種等の記録
— 第6報 多摩本流より6月に採集されたエリユスリカ亜科の各種について
— 第7報 多摩本流より3月に採集されたユスリカ科の各種について)
- 第44号 スモッグチャンパーによる炭化水素-窒素酸化物系光化学反応の研究 — 環境大気中における光化学二次汚染物質生成機構の研究(フィールド研究2) — 昭和54年度 特別研究中間報告。(1983)
- 第45号 有機廃棄物、合成有機化合物、重金属等の土壌生態系に及ぼす影響と浄化に関する研究 — 昭和53~55年度 特別研究総合報告。(1983)
- 第46号 有機廃棄物、合成有機化合物、重金属等の土壌生態系に及ぼす影響と浄化に関する研究 — 昭和54、55年度 特別研究報告 第1分冊。(1983)
- 第47号 有機廃棄物、合成有機化合物、重金属等の土壌生態系に及ぼす影響と浄化に関する研究 — 昭和54、55年度 特別研究報告 第2分冊。(1983)
- ※第48号 水質観測点の適正配置に関するシステム解析。(1983)
- 第49号 環境汚染の遠隔計測・評価手法の開発に関する研究 — 昭和57年度 特別研究報告。(1984)
- ※第50号 陸水域の富栄養化防止に関する総合研究(1) — 霞ヶ浦の流入負荷量の算定と評価 — 昭和55~57年度 特別研究報告。(1984)

- ※第51号 陸水域の富栄養化防止に関する総合研究(Ⅱ)―霞ヶ浦の物質循環とそれを支配する因子―昭和55～57年度 特別研究報告。(1984)
- ※第52号 陸水域の富栄養化防止に関する総合研究(Ⅲ)―霞ヶ浦高浜入における隔離水界を利用した富栄養化防止手法の研究―昭和55～57年度 特別研究報告。(1984)
- 第53号 陸水域の富栄養化防止に関する総合研究(Ⅳ)―霞ヶ浦の魚類及び甲かく類現存量の季節変化と富栄養化―昭和55～57年度 特別研究報告。(1984)
- 第54号 陸水域の富栄養化防止に関する総合研究(Ⅴ)―霞ヶ浦の富栄養化現象のモデル化―昭和55～57年度 特別研究報告。(1984)
- 第55号 陸水域の富栄養化防止に関する総合研究(Ⅵ)―富栄養化防止対策―昭和55～57年度 特別研究報告。(1984)
- 第56号 陸水域の富栄養化防止に関する総合研究(Ⅶ)―湯ノ湖における富栄養化とその防止対策―昭和55～57年度 特別研究報告。(1984)
- ※第57号 陸水域の富栄養化防止に関する総合研究(Ⅷ)―総括報告―昭和55～57年度 特別研究報告。(1984)
- 第58号 環境試料による汚染の長期的モニタリング手法に関する研究―昭和55～57年度 特別研究総合報告。(1984)
- 第59号 炭化水素-窒素酸化物-硫黄酸化物系光化学反応の研究―光化学スモッグチャンバーによるオゾン生成機構の研究―大気中における有機化合物の光酸化反応機構の研究―昭和55～57年度 特別研究報告(第1分冊)。(1984)
- 第60号 炭化水素-窒素酸化物-硫黄酸化物系光化学反応の研究―光化学エアロゾル生成機構の研究―昭和55～57年度 特別研究報告(第2分冊)。(1984)
- 第61号 炭化水素-窒素酸化物-硫黄酸化物系光化学反応の研究―環境大気中における光化学二次汚染物質生成機構の研究(フィールド研究1)―昭和55～57年度 特別研究報告(第3分冊)。(1984)
- 第62号 有害汚染物質による水界生態系のかく乱と回復過程に関する研究―昭和56～58年度 特別研究中間報告。(1984)
- 第63号 海域における富栄養化と赤潮の発生機構に関する基礎的研究―昭和56年度 特別研究報告。(1984)
- ※第64号 複合大気汚染の植物影響に関する研究―昭和54～56年度 特別研究総合報告。(1984)
- ※第65号 Studies on effects of air pollutant mixtures on plants―Part 1。(1984)
(複合大気汚染の植物に及ぼす影響―第1分冊)
- ※第66号 Studies on effects of air pollutant mixtures on plants―Part 2。(1984)
(複合大気汚染の植物に及ぼす影響―第2分冊)
- 第67号 環境中の有害物質による人の慢性影響に関する基礎的研究―昭和54～56年度 特別研究総合報告。(1984)
- ※第68号 汚泥の土壌還元とその環境影響に関する研究―昭和56～57年度 特別研究報告。(1984)
- ※第69号 中禅寺湖の富栄養化現象に関する基礎的研究。(1984)
- 第70号 Studies on chironomid midges in lakes of the Nikko National Park。(1984)
Part I. Ecological studies on chironomids in lakes of the Nikko National Park.
Part II. Taxonomical and morphological studies on the chironomid species collected from lakes in the Nikko National Park.
(日光国立公園の湖沼のユスリカに関する研究
―第1部 日光国立公園の湖のユスリカの生態学的研究
―第2部 日光国立公園の湖沼に生息するユスリカ類の分類学的、生態学的研究)
- ※第71号 リモートセンシングによる残雪及び雪田植生の分布解析。(1984)
- 第72号 炭化水素-窒素酸化物-硫黄酸化物系光化学反応の研究―環境大気中における光化学二次汚染物質生成機構の研究(フィールド研究2)―昭和55～57年度 特別研究報告(第4分冊)。(1985)
- ※第73号 炭化水素-窒素酸化物-硫黄酸化物系光化学反応の研究―昭和55～57年度 特別研究総合報告。(1985)
- ※第74号 都市域及びその周辺の自然環境に係る環境指標の開発に関する研究。環境指標―その考え方と作成方法―昭和59年度 特別研究報告。(1984)
- 第75号 Limnological and environmental studies of elements in the sediment of Lake Biwa。(1985)
(琵琶湖底泥中の元素に関する陸水学及び環境化学的研究)
- 第76号 A study on the behavior of monoterpenes in the atmosphere。(1985)
(大気中モノテルペンの挙動に関する研究)
- 第77号 環境汚染の遠隔計測・評価手法の開発に関する研究―昭和58年度 特別研究報告。(1985)
- 第78号 生活環境保全に果たす生活者の役割の解明。(1985)
- 第79号 Studies on the method for long term environmental monitoring―Research report in 1980-1982。(1985)
(環境試料による汚染の長期的モニタリング手法に関する研究)
- ※第80号 海域における赤潮発生モデル化に関する研究―昭和57/58年度 特別研究報告。(1985)

- 第81号 環境影響評価制度の政策効果に関する研究—地方公共団体の制度運用を中心として。(1985)
- 第82号 植物の大気環境浄化機能に関する研究—昭和57~58年度 特別研究報告。(1985)
- 第83号 Studies on chironomid midges of some lakes in Japan. (1985)
(日本の湖沼のユスリカの研究)
- 第84号 重金属環境汚染による健康影響評価手法の開発に関する研究—昭和57~59年度 特別研究総合報告。(1985)
- 第85号 Studies on the rate constants of free radical reactions and related spectroscopic and thermochemical parameters. (1985)
(フリーラジカルの反応速度と分光学的及び熱力学的パラメーターに関する研究)
- 第86号 GC/MSスペクトルの検索システムに関する研究。(1986)
- 第87号 光化学二次汚染物質の分析とその細胞毒性に関する研究—昭和53~58年度 総合報告。(1986)
- 第88号 都市域及びその周辺の自然環境等に係る環境指標の開発に関する研究Ⅱ。環境指標—応用例とシステム—昭和59年度 特別研究報告。(1986)
- 第89号 Measuring the water quality of Lake Kasumigaura by LANDSAT remote sensing. (1986)
(LANDSATリモートセンシングによる霞ヶ浦の水質計測)
- 第90号 ナショナルトラスト運動にみる自然保護にむけての住民意識と行動—知床国立公園内100平方メートル運動と天神崎市民地主運動への参加者の分析を中心として。(1986)
- 第91号 Economic analysis of man's utilization of environmental resources in aquatic environments and national park regions. (1986)
(人間による環境資源利用の経済分析—水環境と国立公園地域を対象にして)
- 第92号 アオコの増殖及び分解に関する研究。(1986)
- 第93号 汚泥の土壌還元とその環境影響に関する研究(I)—昭和58~59年度 特別研究総合報告第1分冊。(1986)
- 第94号 汚泥の土壌還元とその環境影響に関する研究(Ⅱ)—昭和58~59年度 特別研究総合報告第2分冊。(1986)
- 第95号 自然浄化機能による水質改善に関する総合研究(I)—汚濁負荷の発生と流出・流達—昭和58~59年度 特別研究報告。(1986)
- ※第96号 自然浄化機能による水質改善に関する総合研究(Ⅱ)—水草帯・河口域・池沼の生態系構造と機能—昭和58~59年度 特別研究報告。(1986)
- 第97号 自然浄化機能による水質改善に関する総合研究(Ⅲ)—水路及び土壌による水質の浄化—昭和58~59年度 特別研究報告。(1986)
- 第98号 自然浄化機能による水質改善に関する総合研究(Ⅳ)—自然浄化機能を活用した処理技術の開発と応用—昭和58~59年度 特別研究報告。(1986)
- 第99号 有害汚染物質による水界生態系のかく乱と回復過程に関する研究—昭和56~59年度 特別研究総合報告。(1986)
- 第100号 バックグラウンド地域における環境汚染物質の長期モニタリング手法の研究—特定汚染選択的検出法及び高感度分析技術の開発—昭和58~60年度 特別研究報告。(1986)
- 第101号 複合ガス状大気汚染物質の生体影響に関する実験的研究—昭和57~60年度 特別研究報告。(1986)
- 第102号 地球規模大気質変動に関する予備的研究。(1986)
- 第103号 環境調和型技術としての電気自動車の評価に関する基礎的研究。(1987)
- 第104号 Studies on chironomid midges in lakes of the Akan National Park. (1987)
(北海道阿寒国立公園の湖におけるユスリカ相の研究)
- 第105号 畑地土壌における水分と諸元素の動態。(1987)
- ※第106号 筑波研究学園都市における景観評価と景観体験に関する研究。(1987)
- 第107号 遠隔計測による環境動態の評価手法の開発に関する研究—昭和59~60年度 特別研究報告。(1987)
- 第108号 植物の大気環境浄化機能に関する研究—昭和57~60年度 特別研究総合報告。(1987)
- 第109号 地域環境評価のための環境情報システムに関する研究。(1987)
- 第110号 海域における赤潮発生モデル化に関する研究—昭和59~60年度 特別研究総合報告。(1987)
- 第111号 Application of X-Ray Photoelectron Spectroscopy to the Study of Silicate Minerals. (1987)
(ケイ酸塩鉱物研究へのX線光電子分光法の応用)
- 第112号 光化学汚染大気中における有機エアロゾルに関する研究—有機エアロゾルの生成と挙動に関する研究—昭和58~61年度 特別研究報告。(1988)
- 第113号 光化学汚染大気中における有機エアロゾルに関する研究—昭和58~61年度 特別研究総合報告。(1988)
- 第114号 水界生態系に及ぼす有害汚染物質の影響評価に関する研究—昭和60~61年度 特別研究

- 総合報告。(1988)
- 第115号 複合ガス状大気汚染物質の生体影響に関する実験的研究—昭和57～61年度 特別研究総合報告。(1988)
- 第116号 自然浄化機能による水質改善に関する総合研究(V)—汚濁負荷の発生と流出・流達—昭和58～61年度 特別研究報告。(1988)
- 第117号 自然浄化機能による水質改善に関する総合研究(VI)—湖沼の生態系構造と自然浄化—昭和60～61年度 特別研究報告。(1988)
- 第118号 自然浄化機能による水質改善に関する総合研究(VII)—自然浄化機能を活用した水路・土壌による浄化と処理技術の開発—昭和60～61年度 特別研究報告。(1988)
- 第119号 自然浄化機能による水質改善に関する総合研究(VIII)—自然浄化システムの評価方法—昭和60～61年度 特別研究報告。(1988)
- 第120号 自然浄化機能による水質改善に関する総合研究(IX) 昭和58～61年度 特別総合研究報告。(1988)
- 第121号 Studies on the Chironomid midges of Lakes in Southern Hokkaido. (1988)
(北海道南部の湖におけるユスリカ相の研究)

※ 残部なし

Report of Special Research Project the National Institute for Environmental Studies

- No. 1* Man activity and aquatic environment—with special references to Lake Kasumigaura—Progress report in 1976. (1977)
- No. 2* Studies on evaluation and amelioration of air pollution by plants—Progress report in 1976-1977. (1978)

[Starting with Report No. 3, the new title for NIES Reports was changed to:]
Research report from the National Institute for Environmental Studies

- ※No. 3 A comparative study of adults and immature stages of nine Japanese species of the genus *Chironomus*(Diptera, Chironomidae). (1978)
- No. 4* Smog chamber studies on photochemical reactions of hydrocarbon-nitrogen oxides system—Progress report in 1977. (1978)
- No. 5* Studies on the photooxidation products of the alkylbenzene-nitrogen oxides system, and on their effects on cultured cells—Research report in 1976-1977. (1978)
- No. 6* Man activity and aquatic environment—with special references to Lake Kasumigaura—Progress report in 1977-1978. (1979)
- ※No. 7 A morphological study of adults and immature stages of 20 Japanese species of the family *Chironomidae*(Diptera). (1979)
- ※No. 8* Studies on the biological effects of single and combined exposure of air pollutants—Research report in 1977-1978. (1979)
- No. 9* Smog chamber studies on photochemical reactions of hydrocarbon-nitrogen oxides system—Progress report in 1978. (1979)
- No. 10* Studies on evaluation and amelioration of air pollution by plants—Progress report in 1976-1978. (1979)
- ※No. 11 Studies on the effects of air pollutants on plants and mechanisms of phytotoxicity. (1980)
- No. 12 Multielement analysis studies by flame and inductively coupled plasma spectroscopy utilizing computer-controlled instrumentation. (1980)
- No. 13 Studies on chironomid midges of the Tama River. (1980)
Part 1. The distribution of chironomid species in a tributary in relation to the degree of pollution with sewage water.
Part 2. Description of 20 species of Chironominae recovered from a tributary.
- No. 14* Studies on the effects of organic wastes on the soil ecosystem—Progress report in 1978-1979. (1980)
- ※No. 15* Studies on the biological effects of single and combined exposure of air pollutants—Research report in 1979. (1980)
- No. 16* Remote measurement of air pollution by a mobile laser radar. (1980)
- ※No. 17* Influence of buoyancy on fluid motions and transport processes—Meteorological characteristics and atmospheric diffusion phenomena in the coastal region.—Progress report in 1978-1979. (1980)
- No. 18 Preparation, analysis and certification of PEPPERBUSH standard reference material. (1980)
- ※No. 19* Comprehensive studies on the eutrophication of fresh-water areas—Lake current of Kasumigaura(Nishiura)—1978-1979. (1981)
- No. 20* Comprehensive studies on the eutrophication of fresh-water areas—Geomorphological and hydrometeorological characteristics of Kasumigaura watershed as related to the lake environment—1978-1979. (1981)
- No. 21* Comprehensive studies on the eutrophication of fresh-water areas—Variation of pollutant load by influent rivers to Lake Kasumigaura—1978-1979. (1981)
- No. 22* Comprehensive studies on the eutrophication of fresh-water areas—Structure of ecosystem and standing crops in Lake Kasumigaura—1978-1979. (1981)
- No. 23* Comprehensive studies on the eutrophication of fresh-water areas—Applicability of trophic state indices for lakes—1978-1979. (1981)
- No. 24* Comprehensive studies on the eutrophication of fresh-water areas—Quantitative analysis of eutrophication effects on main utilization of lake water resources—1978-1979. (1981)
- No. 25* Comprehensive studies on the eutrophication of fresh-water areas—Growth characteristics of Blue-Green Algae, *Mycrocystis*—1978-1979. (1981)
- No. 26* Comprehensive studies on the eutrophication of fresh-water areas—Determination of argal growth potential by algal assay procedure—1978-1979. (1981)

- No. 27* Comprehensive studies on the eutrophication of fresh-water areas—Summary of researches—1978-1979. (1981)
- No. 28* Studies on effects of air pollutant mixtures on plants—Progress report in 1979-1980. (1981)
- No. 29 Studies on chironomid midges of the Tama River. (1981)
Part 3. Species of the subfamily Orthocladiinae recorded at the summer survey and their distribution in relation to the pollution with sewage waters.
Part 4. Chironomidae recorded at a winter survey.
- ※No. 30* Eutrophication and red tides in the coastal marine environment — Progress report in 1979-1980. (1982)
- No. 31* Studies on the biological effects of single and combined exposure of air pollutants—Research report in 1980. (1981)
- No. 32* Smog chamber studies on photochemical reactions of hydrocarbon-nitrogen oxides system—Progress report in 1979—Research on the photochemical secondary pollutants formation mechanism in the environmental atmosphere (Part 1). (1982)
- No. 33* Meteorological characteristics and atmospheric diffusion phenomena in the coastal region—Simulation of atmospheric motions and diffusion processes — Progress report in 1980. (1982)
- ※No. 34* The development and evaluation of remote measurement methods for environmental pollution—Research report in 1980. (1982)
- No. 35* Comprehensive evaluation of environmental impacts of road and traffic. (1982)
- ※No. 36* Studies on the method for long term environmental monitoring—Progress report in 1980-1981. (1982)
- ※No. 37* Study on supporting technology for systems analysis of environmental policy — The Evaluation Laboratory of Man-Environment Systems. (1982)
- No. 38 Preparation, analysis and certification of POND SEDIMENT certified reference material. (1982)
- ※No. 39* The development and evaluation of remote measurement methods for environmental pollution—Research report in 1981. (1983)
- No. 40* Studies on the biological effects of single and combined exposure of air pollutants—Research report in 1981. (1983)
- ※No. 41* Statistical studies on methods of measurement and evaluation of chemical condition of soil—with special reference to heavy metals—. (1983)
- ※No. 42* Experimental studies on the physical properties of mud and the characteristics of mud transportation. (1983)
- ※No. 43 Studies on chironomid midges of the Tama River. (1983)
Part 5. An observation on the distribution of Chironominae along the main stream in June, with description of 15 new species.
Part 6. Description of species of the subfamily Orthocladiinae recovered from the main stream in the June survey.
Part 7. Additional species collected in winter from the main stream.
- No. 44* Smog chamber studies on photochemical reactions of hydrocarbon-nitrogen oxides system—Progress report in 1979—Research on the photochemical secondary pollutants formation mechanism in the environmental atmosphere (Part 2). (1983)
- No. 45* Studies on the effect of organic wastes on the soil ecosystem—Outlines of special research project—1978-1980. (1983)
- No. 46* Studies on the effect of organic wastes on the soil ecosystem—Research report in 1979-1980, Part 1. (1983)
- No. 47* Studies on the effect of organic wastes on the soil ecosystem—Research report in 1979-1980, Part 2. (1983)
- No. 48* Study on optimal allocation of water quality monitoring points. (1983)
- No. 49* The development and evaluation of remote measurement method for environmental pollution—Research report in 1982. (1984)
- ※No. 50* Comprehensive studies on the eutrophication control of freshwaters—Estimation of input loading of Lake Kasumigaura—1980-1982. (1984)
- ※No. 51* Comprehensive studies on the eutrophication control of freshwaters—The function of the ecosystem and significance of sediment in nutrient cycle in Lake Kasumigaura—1980-1982. (1984)
- ※No. 52* Comprehensive studies on the eutrophication control of freshwaters—Enclosure experiments for restoration of highly eutrophic shallow Lake Kasumigaura—1980-1982. (1984)
- No. 53* Comprehensive studies on the eutrophication control of freshwaters—Seasonal

- changes of the biomass of fishes and crustacea in Lake Kasumigaura—1980-1982. (1984)
- No. 54* Comprehensive studies on the eutrophication control of freshwaters—Modeling the eutrophication of Lake Kasumigaura—1980-1982. (1984)
- No. 55* Comprehensive studies on the eutrophication control of freshwaters—Measures for eutrophication control—1980-1982. (1984)
- No. 56* Comprehensive studies on the eutrophication control of freshwaters—Eutrophication in Lake Yunoko—1980-1982. (1984)
- ※No. 57* Comprehensive studies on the eutrophication control of freshwaters—Summary of researches—1980-1982. (1984)
- No. 58* Studies on the method for long term environmental monitoring — Outlines of special research project in 1980-1982. (1984)
- No. 59* Studies on photochemical reactions of hydrocarbon-nitrogen oxides-sulfur oxides system — Photochemical ozone formation studied by the evacuable smog chamber—Atmospheric photooxidation mechanisms of selected organic compounds — Research report in 1980-1982, Part 1. (1984)
- No. 60* Studies on photochemical reactions of hydrocarbon-nitrogen oxides-sulfur oxides system—Formation mechanisms of photochemical aerosol—Research report in 1980-1982, Part 2. (1984)
- No. 61* Studies on photochemical reactions of hydrocarbon-nitrogen oxides-sulfur oxides system — Research on the photochemical secondary pollutants formation mechanism in the environmental atmosphere(Part 1) —Research report in 1980-1982, Part 3. (1984)
- No. 62* Effects of toxic substances on aquatic ecosystems —Progress report in 1980-1983. (1984)
- ※No. 63* Eutrophication and red tides in the coastal marine environment —Progress report in 1981. (1984)
- ※No. 64* Studies on effects of air pollutant mixtures on plants—Final report in 1979-1981. (1984)
- ※No. 65 Studies on effects of air pollutant mixtures on plants—Part 1. (1984)
- ※No. 66 Studies on effects of air pollutant mixtures on plants—Part 2. (1984)
- No. 67* Studies on unfavourable effects on human body regarding to several toxic materials in the environment, using epidemiological and analytical techniques—Project research report in 1979-1981. (1984)
- ※No. 68* Studies on the environmental effects of the application of sewage sludge to soil—Research report in 1981-1983. (1984)
- ※No. 69 Fundamental studies on the eutrophication of Lake Chuzenji — Basic research report. (1984)
- No. 70 Studies on chironomid midges in lakes of the Nikko National Park
Part I. Ecological studies on chironomids in lakes of the Nikko National Park.
Part II. Taxonomical and morphological studies on the chironomid species collected from lakes in the Nikko National Park. (1984)
- ※No. 71* Analysis on distributions of remnant snowpack and snow patch vegetation by remote sensing. (1984)
- No. 72* Studies on photochemical reactions of hydrocarbon-nitrogen oxides-sulfur oxides system—Research on the photochemical secondary pollutants formation mechanism in the environmental atmosphere — Research report in 1980-1982, Part 4. (1985)
- ※No. 73* Studies on photochemical reactions of hydrocarbon-nitrogen oxides-sulfur oxides system—Final report in 1980-1982. (1985)
- ※No. 74* A comprehensive study on the development of indices system for urban and suburban environmental quality—Environmental indices—Basic notion and formation. (1984)
- No. 75 Limnological and environmental studies of elements in the sediment of Lake Biwa. (1985)
- No. 76 A study on the behavior of monoterpenes in the atmosphere. (1985)
- No. 77* The development and evaluation of remote measurement methods for environmental pollution—Research report in 1983. (1985)
- No. 78* Study on residents' role in conserving the living environment. (1985)
- No. 79 Studies on the method for long term environmental monitoring—Research report in 1980-1982. (1985)
- No. 80* Modeling of red tide blooms in the coastal sea—Research report in 1982-1983. (1985)

- No. 81* A studies on effects of implementing environmental impact assessment procedure
—With particular reference to implementation by local governments. (1985)
- No. 82* Studies on the role of vegetation as a sink of air pollutants—Research report
in 1982-1983. (1985)
- No. 83 Studies on chironomid midges of some lakes in Japan. (1985)
- No. 84* A comprehensive study on the development of assessment techniques for health
effects due to environmental heavy metal exposure—Final report in 1982-1984.
(1985)
- No. 85 Studies on the rate constants of free radical reactions and related spectro-
scopic and thermochemical parameters. (1985)
- No. 86* A novel retrieval system for identifications of unknown mass spectra. (1986)
- No. 87* Analysis of the photochemical secondary pollutants and their toxicity on
cultured cells—Research report in 1978-1983. (1986)
- No. 88* A comprehensive study on the development of indices systems for urban and
suburban environmental quality II —Environmental indices—Applications and
systems. (1986)
- No. 89 Measuring the water quality of Lake Kasumigaura by LANDSAT remote sensing.
(1986)
- No. 90* National trust movement in Japanese nature conservation — Trustworthy or
illusion?(1986)
- No. 91 Economic analysis of man s utilization of environmental resources in aquatic
environments and national park regions. (1986)
- No. 92* Studies on the growth and decomposition of water-bloom of Microcystis. (1986)
- No. 93* Studies on the environmental effects of the application of sewage sludge to
soil(I)—Research report and papers(Part 1)in 1983-1984. (1986)
- No. 94* Studies on the environmental effects of the application of sewage sludge to
soil(II)—Research report and papers(Part 2)in 1983-1984. (1986)
- No. 95* Comprehensive studies on effective use of natural ecosystems for water quality
management(I)—Drainage and flowing down of pollutant load— Research report
in 1983-1984. (1986)
- ※No. 96* Comprehensive studies on effective use of natural ecosystems for water quality
management(II)—Structure and function of the ecosystems of littoral zone —
Research report in 1983-1984. (1986)
- No. 97* Comprehensive studies on effective use of natural ecosystems for water quality
management(III)—Self-purification in stream and soil—Research report in 1983-
1984. (1986)
- No. 98* Comprehensive studies on effective use of natural ecosystems for water quality
management(IV)—Development and application of wastewater treatment technolo-
gies utilizing self-purification ability—Research report in 1983-1984. (1986)
- No. 99* Effects of toxic substances on aquatic ecosystems—Final report in 1981-1984.
(1986)
- No. 100* Studies on the methods for long-term monitoring of environmental pollutants in
the background regions—Development of highly sensitive and selective analyt-
ical methods for measurement of pollutants in the background regions—Progress
report in 1983-1985. (1986)
- No. 101* Experimental studies on the effects of gaseous air pollutants in combination
on animals. (1986)
- No. 102* A review on studies of the global scale air quality perturbation. (1986)
- No. 103* Technological assessment of electric vehicle from the environmental protection
viewpoint. (1987)
- No. 104 Studies on chironomid midges in lakes of the Akan National Park. (1987)
Part I. Distribution of chironomid larvae in Lake Akan, Lake Panke and Lake
Kussyaro.
Part II. Chironomid midges collected on the shore of lakes in the Akan National
Park, Hokkaido(Diptera, Chironomidae)
- No. 105* Formulation of the dynamic behavior of water and solites leaching through the
field soil. (1987)
- ※No. 106* Appraised landscape and thier environmental value in Tsukuba Science City.
(1987)
- No. 107* Studies on remote sensing for spatial and temporal analysis of environment—
Research report in 1984-1985. (1987)
- No. 108* Studies on the role of vegetation as a sink of air pollutants—Final report in
1982-1985. (1987)

- No.109* Studies on environmental information system for regional environmental evaluation. (1987)
- No.110* Modeling of Red Tide Blooms in the Coastal Sea — Final report in 1984-1985. (1987)
- No.111 Application of X-Ray Photoelectron Spectroscopy to the Study of Silicate Minerals. (1987)
- No.112* Study on the Organic Aerosols in the Photochemically Polluted Air — Studies on Formation and Behavior of Organic Aerosols — Research report in 1983-1986. (1988)
- No.113* Study on the Organic Aerosols in the Photochemically Polluted Air — Final report in 1983-1986. (1988)
- No.114* Studies on the Assessment of the Hazard of Chemical Substances to Aquatic Ecosystems — Progress report in 1985-1986. (1988)
- No.115* Experimental Studies on the Effects of Gaseous Air Pollutants in Combination on Animals — Final report in 1982-1986. (1988)
- No.116* Comprehensive Studies on Effective Use of Natural Ecosystems for Water Quality Management(V)—Drainage and Flowing Down of Pollutant Load— Research report in 1983-1986. (1988)
- No.117* Comprehensive Studies on Effective Use of Natural Ecosystems for Water Quality Management(VI)—Lake Restoration and Ecosystems— Research report in 1983-1986. (1988)
- No.118* Comprehensive Studies on Effective Use of Natural Ecosystems for Water Quality Management(VII)—Use of Self-purification in Soil and Stream, and Development of Biological Waste Water Treatment Technology— Research report in 1985-1986 (1988)
- No.119* Comprehensive Studies on Effective Use of Natural Ecosystems for Water Quality Management(VIII)—Evaluation methods of Self-purification Water Treatment System — Research report in 1985-1986. (1988)
- No.120* Comprehensive Studies on Effective Use of Natural Ecosystems for Water Quality Management(IX)—Final report in 1983-1986. (1988)
- No.121 Studies on the Chronomid mides of Lakes in Southren Hokkaido. (1988)

* in Japanese

※ out of stock

編集委員会委員

委員長	村岡浩爾	委員	鷺田伸明
副委員長	溝口次夫	〃	相崎守弘
〃	近藤矩朗	〃	三浦 卓
委員	海野英明	〃	遠山千春
〃	松本幸雄	〃	古川昭雄
〃	清水 浩	〃	大政謙次
〃	安部喜也	〃(幹事)	古田早苗

〔昭和62年10月21日受領〕

〔昭和62年11月30日受理〕

RESEARCH REPORT FROM
THE NATIONAL INSTITUTE FOR ENVIRONMENTAL STUDIES, JAPAN

No. 121

国立公害研究所研究報告 第121号

(R-121-'88)

昭和63年3月31日発行

発行 環境庁 国立公害研究所

〒 305 茨城県つくば市小野川16番2

印刷 フクダ工芸株式会社

東京都中央区新川1-3-2

Published by the National Institute for Environmental Studies

16-2 Onogawa, Tsukuba, Ibaraki 305, Japan

March 1988