

Studies on the Chironomid Midges of Lakes in the Akan National Park, Hokkaido

北海道阿寒国立公園の湖におけるユスリカ相の研究

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Preface

The series of investigation on chironomid midges of Japan has been initiated from 1976 with relation to eutrophication of fresh water. Surveys on bottom fauna in about 30 Japanese lakes have been conducted. During taxonomical and morphological studies on chironomid midges, so many new species and newly recorded species in Japan were described. At the same time, ecological studies on benthos made clear that chironomid species were useful as biological indicators of aquatic environments.

The present report was for the first time dealing with the taxonomical study on *chironomids in lakes of Hokkaido, and a total of 28 species were described, among which 11 were new species and 6 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.

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March, 1987

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Distribution of Chironomid larvae in Lake Akan, Lake Panke and Lake Kussharo

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SUMMARY

Surveys on zoobenthos in three Lakes of the Akan National Park, Hokkaido, were carried out in June 1982. Number of chironomid species in the profundal zone in Lake Akan was rather limited but the standing crop was as high as the category of eutrophic lake, although this lake has been classified as a mesotrophic or even oligotrophic lake. No chironomid nor oligochaete inhabited in the central basin of the lake where dissolved oxygen seemed to deplete in the summer. While no chironomid could be obtained from the main basin of Lake Panke but this was due to the unsuitable sampler for lapilli which have covered the bottom. *Stictochironomus* sp. and *Cladopelma* sp. were characteristic species of Lake Panke and the latter was common to Lake Akan.

INTRODUCTION

There have been very limited studies on the benthos in lakes in Japan so far because of the difficulties of species identification. We have conducted surveys on bottom fauna in about 30 Japanese lakes and reported some results (Yasuno *et al.*, 1983). The lakes in the Akan National Park had been surveyed on 13th, 14th and 15th June 1982. Such single survey would not provide sufficient data on the ecology of chironomids, however the information obtained would be valuable and useful in the future study because only fragmental data on the bottom fauna in these lakes were available (Miyadi, 1932 ; Kitagawa 1975, 1976).

The Akan National Park is situated at the eastern Hokkaido (N 43° 27' and E 144° 06') and includes several lakes (Fig. 1). In the present study, we could survey chironomid fauna in the profundal zone in only two lakes, Lake Akan and Lake Panke and at littoral in Lake Kussharo. Lake Akan can be classified from the transparency as a mesotrophic lake now according to OECD's boundary values (1982) and is 12.7 km² in area and maximum 39 m in depth. Lake Panke, an oligotrophic lake, is 2.8 km² in extent and 39.4 m in the maximum depth. Lake Kussharo is the largest in this area (79.5 km² in area and 117 m in depth) and acidic

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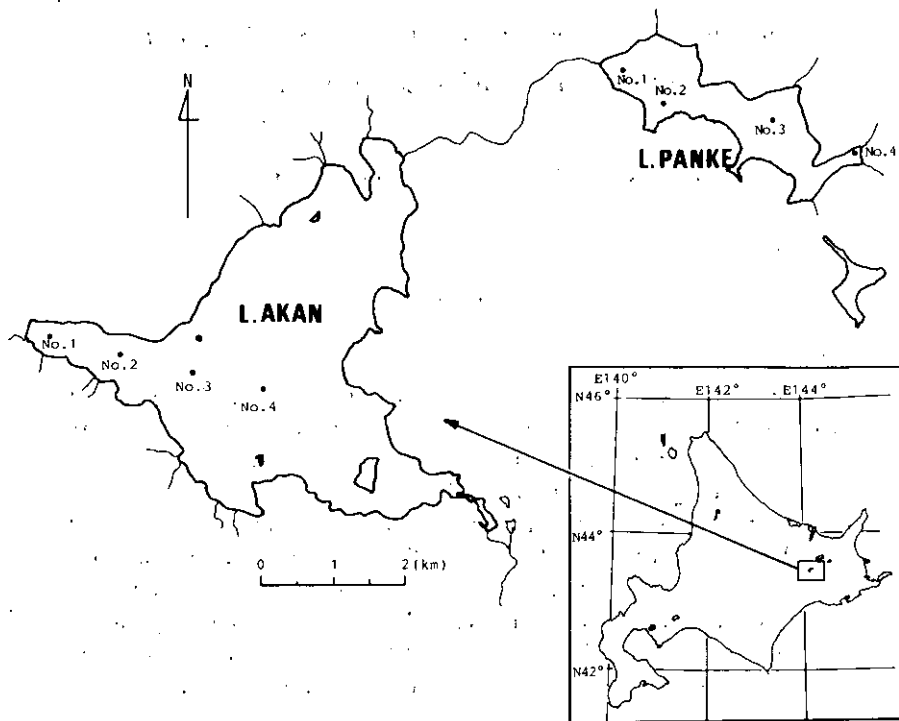


Fig. 1 Map showing the sampling sites in Lake Akan and Lake Panke in Hokkaido

(pH 4.68). Lake Akan and Lake Kussharo are caldera lake and Lake Panke is a natural dam lake made by volcanic eruption and therefore they are surrounded with mountains but the altitude of the lakes is not so high (from 120 m for Lake Kussharo to 450 m for Lake Akan), though all of them freeze from December to April.

METHODS

In Lake Akan, four sampling sites were selected as shown in Fig. 1. Eight samples of sediment were collected by an Ekman-Birge grab at each site, four of which served for identification and counting and another four were provided for the measurement of biomass after sorting. The samplings in Lake Panke were made at three sites. The sampled mud was washed using a mesh netting of 200 μm in aperture. The identification of larvae was conducted based on Wiederholm (1980). The water temperature, pH and dissolved oxygen were measured with Hydrolab 8000. The transparency was measured with a Secchi disc.

RESULTS

Limnological features

The water temperature, pH and dissolved oxygen at littoral zone near Wagoto in Lake Kussharo were 10.5, 4.7 and 14.0 mg l⁻¹, respectively. The same for Lake Akan and Lake Panke are shown in Fig. 2. The transparency was 4.8 m for the former and 13.2 m for the latter, indicating the contrast in the trophic state. The thermal stratification had developed at about 8 m in both lakes in June. The water temperature was almost the same at the surface in these lakes but differed under the stratification. The bottom temperature at the depth of 38 m in Lake Panke was 2.2°C, while that at 28 m in Lake Akan was 3.8°C in June. These values were much lower than those measured in August (Kitagawa, 1975, 1976). The

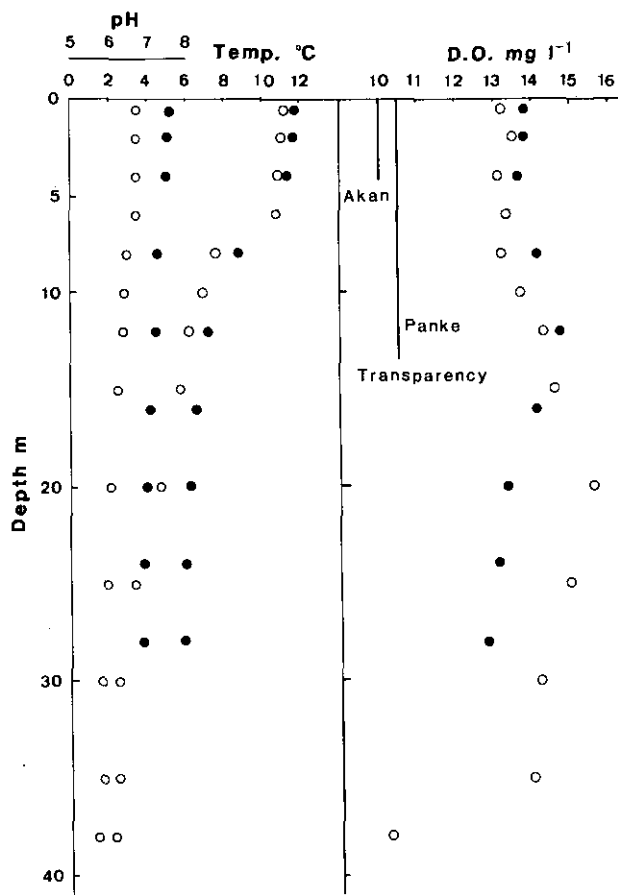


Fig. 2 Depth profiles of limnological data in Lake Akan and Lake Panke in June 1982 (solid ; Akan, open ; Panke)

Table 1. Benthos from the lakes in the Akan National Park

Species and numbers (Number of inds. m ⁻²)	L. AKAN					L. PANKE				L. KUSSHARO
	1 (2.3 m)	2 (11.2 m)	3 (18.0 m)	4 (28.8 m)	littoral (0.5 m)	1 (0.5 m)	2 (31.0 m)	3 (32.1 m)	4 (13.0 m)	littoral (0.3 m)
<i>Procladius</i> sp.	59	11	56	—	89	—	—	—	111	—
Tanypodinae gen.	—	—	—	—	—	—	—	—	—	44
<i>Chironomus</i> spp.	44	—	2,467	—	—	—	—	—	—	133
<i>Cladopelma</i> sp.	74	44	56	—	444	—	—	—	133	—
<i>Cryptochironomus</i> sp.	15	—	11	—	—	—	—	—	—	—
<i>Nilothauma</i> sp.	—	—	—	—	—	—	—	—	—	44
<i>Polypedilum</i> sp. A	—	11	—	—	—	—	—	—	—	—
<i>Polypedilum</i> sp. B	—	—	11	—	—	—	—	—	—	—
<i>Stictochironomus</i> sp. A	—	—	—	—	178	—	—	—	200	—
<i>Stictochironomus</i> sp. B	—	—	—	—	—	—	—	—	—	178
<i>Corynocera</i> sp.	—	—	—	—	44	—	—	—	67	—
<i>Tanytarsus</i> sp. A	—	—	22	—	—	—	—	—	22	—
<i>Tanytarsus</i> sp. B	—	—	—	—	—	—	—	—	—	44
<i>Piscidium</i> sp.	—	—	—	—	—	—	—	+	—	—
Biomass of chironomids (grams wet weight m ⁻²)	7.187	+	26.418	0	0.965	0	0	0	0.745	0.305
Biomass of oligochaetes (grams wet weight m ⁻²)	0.803	0.85	1.718	0	0.267	0.079	0	0	0.507	0

dissolved oxygen and pH did not show any marked stratification in June not as in August. The oxygen was more than 13 mg l^{-1} in both lakes excepting the bottom at Panke, even where it was 10.3 mg l^{-1} . One can notice a slight increase of dissolved oxygen at the middle depth in both lakes although the depth was not same.

Chironomid fauna in the profundal zone

Lake Akan

The distribution of chironomid larvae in this lake was very characteristic (Table 1); namely, a large number of chironomid larvae were found from the sampling site No. 3 where the depth was 18 m but no larvae inhabited at the site No. 4, 29 m in depth. Thus the profundal zone deeper than approximately 30 m in depth might be lifeless as reported by Kitagawa (1976) possibly because of the lack of oxygen. The dissolved oxygen at bottom of sampling site No. 4 was more than 12 mg l^{-1} in June but might be depleted during the summer since the colour of mud was very black. Sampling sites No. 1 and No. 2 selected in an inlet were not so productive. Five species were collected but none of them were abundant. They were *Chironomus plumosus*, *Cladopelma* sp., *Cryptochironomus* sp., *Procladius* sp. and *Polypedilum* sp. A. *Chironomus plumosus* were collected by adult collections on shores but the other were recovered only by this larval collection. The majority of the larvae collected from sampling site No. 3 were *Chironomus nipponensis* and/or *C. plumosus* but likely *C. nipponensis*. The larvae of *Tanytarsus* sp. were collected only from this site. *Cladopelma* sp. was common to the three sampling sites.

Lake Panke

This lake is being well kept from eutrophication because there is no human settlement near the lakeshore nor tourists are allowed to enter. *Cladopelma* sp. which was found in Lake Akan was also common in this lake. Other species were different from those in Lake Akan. *Stictochironomus* sp. was collected here commonly also. *Tanytarsus* found in this lake was different from the species of Lake Akan.

Lake Kussharo

Sampling was made only at the littoral zone of Wagoto, the southern side of the lake. The dominant species was *Chironomus* sp. and *Stictochironomus* sp.; the latter was apparently different from the species collected at Lake Panke in the morphology of mentum. A large swarm of *Stictochironomus histrio* was observed near shore, particularly the north-eastern side of the lake. However it has not been confirmed whether the larvae was the same species'.

DISCUSSION

The number of *Chironomus nipponensis/plumosus* at one sampling site in Lake Akan was much higher than in the other moderate eutrophic lakes in Japan. Although the seasonal differences should be considered, the number or biomass overwhelm those of Lake Yunoko, an alpine eutrophic lake (Yasuno *et al.*, 1984). The biomass of chironomid larvae recorded from Lake Akan was almost identical

to that of Lake Inbanuma, which is well known as an eutrophic lake in the Kanto plain. Thus the Lake Akan should be regarded as a rather progressed eutrophic lake as far as the productivity of chironomids. Oligochaeta were also abundant in this lake; the biomass at sampling site No. 3, 1.72 g m^{-2} might be in the normal range of the proportion to the biomass of chironomids (Yasuno *et al.*, 1983). In 1930, Miyadi (1932) collected a large number of *Corethra* and *Piscidium* but few chironomids. Accordingly, he had classified this lake as an oligotrophic lake. In fact, the transparency at that time was 8 m versus 4.3 m at present.

The Biomass of chironomids in Panke was less than 1 g m^{-2} and that of oligochaetes was still lower, suggesting a lower degree of trophic state.

Sasa and Kamimura (1987) described many species of chironomids from the adult collections on shore of both Lake Akan and Lake Panke, however still other genus and species of chironomids were recovered from the present survey. The identification of species from larval stage could be made based on Sasa and Kamimura (1987) in the future but further studies with frequent collections in different seasons are needed and may increase the number of species.

ACKNOWLEDGEMENT

We are indebted to Dr J. Hasegawa and Dr K. Kamimura for their assistance during the survey.

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阿寒湖、パンケ湖及び屈斜路湖 におけるユスリカ幼虫の分布

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阿寒国立公園の三つの湖のユスリカ幼虫の分布を調査した。阿寒湖では計8種類のユスリカ幼虫が捕獲された。ユスリカ幼虫の生息密度は水深17 mの地点で最も高く、水深26 m地点では何も生息していなかった。水深17 m地点に多かった種は *Chironomus* spp. (*C. nipponensis* と *C. plumosus* で両者は幼虫では区別できない) であり、*Procladius* sp. 及び *Cladopelma* sp. が水深17 m以浅の地点に共通して、しかも比較的多く見られた。

阿寒湖はかつて貧栄養湖であったが、透明度は夏期、約4 mになることから現在では中栄養湖と見なすことができる。しかし、今回の調査で判明したユスリカ及びイトミミズの現存量は、他の多くの富栄養湖を上まわっており、底生動物から判断すると富栄養湖に分類され、その富栄養化の進行が危ぶまれる。

パンケ湖では水深13 m地点で5種のユスリカ幼虫が見られた。水深約30 mの3地点では何も捕獲できなかった。*Procladius* sp., *Cladopelma* sp. *Tanytarsus* sp. Aは阿寒湖と共通種であったが、これらの他に *Stictochironomus* sp. A, *Corynocera* sp. が見られた。

屈斜路湖では沿岸地点でのみ採集した。計5種のユスリカ幼虫が見いだされた。その内 *Nilothauma* sp., *Stictochironomus* sp. B, *Tanytarsus* sp. B, は他二つの湖では捕獲できなかった種であった。

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**Chironomid midges collected on the shore of lakes
in the Akan National Park, Hokkaido (Diptera, Chironomidae)***

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SUMMARY

Collections of chironomid midges breeding in or around mountain lakes in the Akan National Park, Hokkaido, were carried out in June 1982. The present paper deals with the collection records of the adult chironomids caught with an insect net on the shore of these lakes, and the morphological or taxonomical notes on the species found in this area. A total of 172 males and 29 females belonging to 28 species, 14 genera of 2 subfamilies, Chironominae and Orthocladiinae, were identified. Eleven species among them are described as new species, and 6 additional species, *i. e.* *Chironomus riparius* (Meigen), *Microtendipes chloris* (Meigen), *Tanytarsus usmaensis* (Pagast), *Paratanytarsus inopertus* (Walker), *Orthocladus frigidus* (Zetterstedt), and *Heterotrissocladius subpilosus* (Kieffer), are new record for Japan. In addition to these 6 newly recorded species, another 6 species already recorded from Japan, *i. e.* *Chironomus plumosus* (Linnaeus), *Stictochironomus histrio* (Fabricius), *Polypedilum nubeculosum* (Meigen), *Orthocladus glabripennis* (Goetghebuer), *Smittia aterima* (Meigen), and *S. nudipennis* (Goetghebuer), are the midges more or less widely distributed in Europe and some also in North America, while the rest 16 species are tentatively judged as indigenous to Japan or the neighboring regions.

* This study was supported by Grant in Aid of Scientific Research, Ministry of Education, Culture and Science, No. 60030038

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Table 1. List of the chironomids species collected on the shore of the Lakes in Akan
Fig.

1. <i>Chironomus yoshimatsui</i> Martin et Sublette, 1972	
2. <i>Chironomus plumosus</i> (Linnaeus, 1758)	I - A
3. <i>Chironomus nipponensis</i> Tokunaga, "the light form"	I - B
4. <i>Chironomus nipponensis</i> Tokunaga, "the dark form"	I - C
5. <i>Chironomus fujitertius</i> Sasa, 1985	II - D
*6. <i>Chironomus riparius</i> (Meigen, 1803)	II - E
*7. <i>Microtendipes chloris</i> (Meigen, 1818)	II - F
8. <i>Stictochironomus histrio</i> (Fabricius, 1749)	III - G
9. <i>Polypedilum nubeculosum</i> (Meigen, 1818)	
**10. <i>Tanytarsus usmaensis</i> Pagast, 1931	III - H
**11. <i>Tanytarsus nipogregarius</i> , n. sp.	IV - I
**12. <i>Tanytarsus akantertius</i> , n. sp.	IV - J
*13. <i>Paratanytarsus inopertus</i> (Walker, 1856)	V - K
14. <i>Orthocladus glabripennis</i> (Goetghebuer, 1921)	V - L
**15. <i>Orthocladus</i> sp. "akanquartus"	V - M
16. <i>Orthocladus kanii</i> (Tokunaga, 1939)	VI - N
17. <i>Orthocladus</i> sp. near <i>saxosus</i> (Tokunaga, 1939)	VI - P
*18. <i>Orthocladus frigidus</i> (Zetterstedt, 1852)	VI - Q
**19. <i>Cricotopus montanus</i> Tokunaga, 1936	VII - R
**20. <i>Paracladius akansextus</i> , n. sp.	VII - S
**21. <i>Pseudorthocladus akanseptimus</i> , n. sp.	VIII - T
*22. <i>Heterotrissocladius subpilosus</i> (Kieffer, 1911)	VIII - U
**23. <i>Parachaetocladius akanoctavus</i> , n. sp.	IX - V
**24. <i>Limnophyes akannonus</i> , n. sp.	IX - W
**25. <i>Limnophyes akanangularius</i> , n. sp.	X - X
**26. <i>Limnophyes akanundecimus</i> , n. sp.	X - Y
27. <i>Smittia aterrima</i> (Meigen, 1818)	XI - ZA
28. <i>Smittia nudipennis</i> (Goetghebuer, 1913)	XI - ZB
**29. <i>Smittia akanduodecima</i> , n. sp.	XI - ZC

** : new species. * : new record for Japan

INTRODUCTION

The Akan National Park is located in the mountainous area of eastern Hokkaido, and has two main volcanos, Mount Oakan and Meakan, and several lakes, Akan, Kussharo, Panke, Penke, etc. Collections of chironomid midges of lakes in this area were conducted by Dr. M. Yasuno and Mr. Y. Sugaya, National Institute for Environmental Studies, and Dr. K. Kamimura, Toyama Medical and Pharmaceutical University, during the period from 12–16 June, 1982. The present report describes the adult chironomids collected by Kamimura with an insect net on the shore of Lakes Akan, Penke and Kussharo. Morphological and taxonomical studies with these specimens were mainly conducted by M. Sasa.

The Lakes and their environmental conditions are described in Yasuno & Sugaya in Part I of this report.

Hokkaido is the northern-most large island of Japan, and has been isolated from Honshu as well as from the Asian Continent from old times. Therefore, its fauna and flora have been known as more or less different from the mainland of Japan, being closer to those of Siberia and Europe than to those of Honshu, Kyushu and Shikoku, which are usually a mixture of Palaearctic and Oriental features.

The distribution of chironomid species in Hokkaido has been only poorly studied. Tokunaga (1938) described *Clunio aquilonius* from tide pools in Akkeshi. Tokunaga (1940) recorded *Smittia aterrima* (Meigen, 1818) from Kitami. Ito (1975) reported on the morphology of larvae of *Chironomus dorsalis* and *Chironomus yoshimatsui* collected from sewage ditches of Sapporo. Sasa (1985a), assisted by Dr. Tomiko Ito, collected bottom sediments of sewage ditches in Sapporo and those of Lake Utonai in December, 1981, reared the adults in the laboratory, and recorded *Chironomus yoshimatsui* Martin et Sublette, 1972 and *Polypedilum tamanigrum* Sasa, 1983 from the former, and *Chironomus nipponensis* Tokunaga, 1940, *Polypedilum nubeculosum* (Meigen, 1818), *Polypedilum arundineti* Goetghebuer, 1921, *Polypedilum scalaenum* (Schrank, 1803), *Tanytarsus* sp., *Phaenopsectra punctipes* (Wiedemann, 1817), and *Psectrocladius yunosecundus* Sasa, 1984 from the latter. The present paper is the first report on the chironomid fauna of the oligotrophic mountain lakes in Hokkaido, and is a part of series of papers by Sasa (1978, 1979a,b, 1980, 1981, 1983a,b, 1984, 1985), and his coworkers (Sasa & Hasegawa, 1983; Sasa & Ichimori, 1983; Sasa & Kikuchi, 1986) on the taxonomy and distribution of the Japanese chironomids.

MATERIALS AND METHODS

The specimens used in the present study were collected mainly by sweeping bushes and grasses on the bank of the lakes with insect nets. Large numbers of both males and females of chironomid midges resting in these shelters during the daytime were caught with this method together with other insects. They were collected from inside of the net with aspirator tubes, killed by chloroform vapor, transferred to small glass tubes and kept in the vapor of paradichlorobenzol until dissected and mounted on slides. The slide specimens were prepared by the method reported previously by Sasa (1979) and by Sasa & Hasegawa (1983). The wings were first removed with fine forceps and mounted dry under a cover glass (24 mm long and 8 mm wide), which was then fixed on the slide with manicure paste. The remaining body parts were soaked in hot 10% potassium hydroxide solution for a few minutes, washed in water, transferred on the same slide and dissected under a stereomicroscope; antennae were removed from head, which was then detached from thorax; scutum and scutellum were separated from the remainder of the thorax and legs, abdomen was also separated from thorax and mounted dorsal side up. Gumchloral solution was used as the mounting medium, which was prepared by dissolving 150 g of chloral hydrate and 40 g of arabic gum in the mixture of 50 ml of water, 15 ml of glycerin and 5 ml of glacial acetic acid in hot bath. Morphological terms and abbreviations follow Sasa (1984).

Abbreviations of terms in standard measurements. **BL**: body length as expressed by the combined length of thorax and abdomen in mounted specimen. **WL**: wing length measured as distance from tip of arcus to apex of wing. **ER**: eye ratio, or ratio of distance between inner margin of eyes to the height of an eye. **AR**: antennal ratio, or ratio of length of terminal segment to the combined length of the rest flagellar segments of antenna, not including pedicel. **AHR**: antennal hair ratio, or ratio of the length of antennal hair on the penultimate antennal segment to the length of flagellar segments of antenna. **so**: number of supraorbital setae. **cl**: number of clypeal setae. **pn**: number of setae on antepronotum. **dm**: number of dorsomedian setae (acrostichal setae) of scutum. **dl**: number of dorsolateral setae (dorsocentral setae) of scutum. **pa**: number of prealar setae on scutum. **sc**: number of setae on scutellum. **VR**: venarum ratio, or the ratio of length of Cu to length of R. **fLR**: front leg ratio, or ratio of length of front tarsus I to length of front tibia. **mLR**: ratio of middle tarsus I to length of middle tibia. **hLR**: ratio of hind tarsus I to length of hind tibia. **fTR**: ratio of front tarsus V to length of front tibia. **fBR**: ratio of the longest hair on front tarsus I to the diameter of the segment at the position of base of the hair. **mBR**: do, middle tarsus I. **hBR**: do, hind tarsus I.

Acknowledgements: Thanks are due to Drs. James and Mary Sublette, who visited us in Toyama by support of travel grant from Nissan Science Foundation, and gave us important advices, and to Dr. Masayuki Yasuno and his associates and collaborators at the National Institute for Environmental Studies, for their collaborations in completing this paper. We are also grateful to Mr. Koichiro Kawai and Mrs. Fumiko Kamimura for technical assistances.

COLLECTION RECORDS AND MORPHOLOGICAL ACCOUNTS

1. *Chironomus yoshimatsui* Martin et Sublette, 1972

Five males were collected on the shore of Lake Akan, 15 June 1982 (No. A 100: 61, 62A, B, 76A, 79A).

Remarks: This species was recorded by early Japanese workers under the name of *Chironomus dorsalis* Meigen, but Martin & Sublette (1972) described it as a new species with specimens collected from Yamaguchi, Japan. The present author collected it from sewage ditches and polluted streams at a number of localities in Honshu, Kyushu and Shikoku, but Sasa & Hasegawa (1983) did not find this species in the similar habitats in the Ryukyu Islands. The occurrence of this species in sewage ditches in Sapporo, Hokkaido, was reported by Sasa (1985a). The adults collected in the present survey are presumed to have emerged from sewage ditches running into Lake Akan.

2. *Chironomus plumosus* (Linnaeus, 1758) (Plate I -A)

Seven males and 3 females, the shore of Lake Akan, 14 June 1982 (No. A 100: 51-58). One male from Lake Panke, 15 June 1982 (No. A 100-59).

Male: Standard measurement data of males: BL 10.21-12.74 (11.36 in average of 8) mm, WL 5.62-6.37 (6.13) mm, AR 5.00-5.30 (5.15), AHR 0.55-0.66 (0.60), ER 0.23-0.33 (0.27), so 34-54 (43.8), cl 60-66 (63.3), pn 0, dm 18-22 (20.0), dl 36-56 (43.6), pa 7-10 (8.4), sc 46-96 (68.3), sq 20-30 (25.3), VR 1.04-1.09 (1.06), fLR 1.16-1.23 (1.20), mLR 0.58-0.62 (0.61), hLR 0.69-0.73 (0.71), fTR 0.18-0.20 (0.19), fBR 5.8-10.9 (7.8), mBR 5.9-10.8 (7.9), hBR 6.7-10.7 (8.7). Hypopygium in Figs. A-2,3. Frontal tubercles (Fig. A-1) nearly spindle-shaped, 70 microns long, and 27 microns in diameter, and 43 microns in the distance between the center of bases. Abdominal tergites largely dark brown, II to V each with a black longitudinal stripe in the middle.

Remarks: This is a large chironomid species known to be distributed in many lakes throughout the world, and was recorded from the mainland of Japan by Esaki (1932), Hashimoto (1977) and Sasa (1978, 1979a). The adults are characterised by the large size, low fLR and high BR values, and the peculiar shape of anal point and dorsal appendage of male hypopygium.

3. *Chironomus nipponensis* Tokunaga, 1940, "the light form" (Plate I -B)

Two males, shore of Lake Akan, 14 June 1982 (No. A 100: 67, 57B).

Male: BL 6.02, 7.91 mm, WL 3.57, 4.13 mm. Body largely dark brown with black marks, *i. e.* ground color of scutum brown, stripes black, scutellum brown, postnotum black, halteres yellow; all femora largely yellow and with an apical dark ring; front tibia dark for basal 1/3, yellow for distal 2/3, and with a narrow apical dark ring; middle and hind tibiae largely yellow and each with a narrow apical and a narrow basal dark ring; tarsi I and II of all legs largely yellow and each with

an apical dark ring, tarsi III largely dark but yellow for basal portion, tarsi IV and V dark brown; abdominal tergites II to V dark brown for oral 2/3 and paler for caudal 1/3, the former produced triangularly in the middle portion (Fig. B-2). ER 0.22, 0.23, AR 3.33, 3.45, AHR 0.53, 0.56, so 28:30, 34:36, cl 28, 32, pn 0, dm 23, 24, dl 28:28, 28:30, pa 6:6, 7:8, sq 26:28, 26:28, VR 1.02, 1.04, fLR 1.43, 1.45, mLR 0.63, 0.64, hLR 0.73, 0.74, fTR 0.24, 0.25, fBR 2.6, mBR 2.7, hBR 2.8. Frontal tubercles in Fig. B-1. Hypopygium in Fig. B-3. Anal point very broad and apically rounded. Dorsal appendage horn-like, smoothly curved, gradually tapering towards apex but with rounded apex, with 4 or 5 long inner setae at base (Fig. B-4). Ventral appendage widest at base and gradually tapering towards apex, with 24 stout and recurved setae arising on apical 2/3, a part of the setae bear one or two branches (Fig. B-5). Gonostylus abruptly narrowed at distal 2/5 and bears 6 or 7 long subapical setae on inner margin. (Fig. B-3).

4. *Chironomus nipponensis* Tokunaga, 1940, "the dark form" (Plate I -C)

Eight male, shore of Lake Akan, 14 June 1982 (No. A 100:71-77). One male, shore of Lake Panke, 15 June 1982 (No. A 100:60).

Male: BL 7.53-9.18 (8.21 in average of 8) mm, WL 3.70-4.86 (4.23) mm. Body largely black or dark brown, *i. e.* ground color of scutum brown, scutal stripes black, scutellum dark brown, postnotum black, abdominal tergites largely dark brown but I to VI each with a narrow longitudinal black band in the middle (Fig. C-2), leg segments almost uniformly dark brown. Eyes with a long dorsomedial projection, ER 0.22-0.32 (0.28). Frontal tubercles (Fig. C-1) long, narrow and nearly cylindrical, 65 microns long, 16 microns wide, and 50 microns in the distance between the centers of bases. Antenna with 11 flagellar segments, AR 3.90-4.47 (4.12 \pm 0.18 in measurements of 8), AHR 0.48-0.64 (0.58). Antepre-notum without lateral setae (an=0). Scutum and scutellum Fig. C-5, dm 12-18 (15.4), dl 13-31 (22.2), pa 5-10 (6.4), sc 31-48 (37.6). Wing bare, slightly bluish, venation as in other *Chironomus* species, VR 1.01-1.06. Squama with 26-43 (31.1) fringe hairs. Front tibia with a rounded terminal scale. Middle and hind tibiae with two terminal combs, both with a short terminal spur. fLR 1.32-1.45 (1.40), mLR 0.58-0.63 (0.61), hLR 0.69-0.77 (0.72), fTR 0.20-0.22 (0.21), fBR 2.5-3.8 (3.1), mBR 2.9-3.5 (3.3), hBR 4.1-6.3 (4.8). All legs with a pair of large pulvilli, claws, and an empodium.

Hypopygium in Fig. C-6. Anal tergite bands united in the middle and V-shaped, forming an oval area in the middle bearing 4-6 long setae. Anal point (Fig. C-8) long and stout, nearly parallel-sided but slightly tapering towards apex, and apically rounded, with a pair of lateral ridges. Dorsal appendage roughly horn-shaped (E-form of Strenzke, 1959), with a base bearing 4-6 inner setae, the terminal process smoothly curved and nearly parallel-sided but widest at about apical 1/3, with rounded apex (a structure characteristic to this species; Fig. C-7). Ventral appendage nearly cylindrical (Fig. C-9). Gonostylus widest at about basal 1/3 and abruptly constricted at apical 1/3, with 5 long subterminal setae (Fig. C-6).

Remarks: The above two groups of specimens are remarkably different in the coloration of legs and abdominal tergites, the range of pale areas being much wider in the light form, but the structure of hypopygium and the standard measurement data are within the same variation range, and thus are judged as two forms of

Ch. nipponensis Tokunaga. The specimens collected in large numbers in early spring from Lake Yunoko and measured by Sasa (1984, p. 101) were the dark form. This species was originally described by Tokunaga (1940, p. 293) with specimens collected at Shikuka, Karahuto, an island located north of Hokkaido, and seem to represent the dark form.

5. *Chironomus fujitertius* Sasa, 1985 (Plate II-D)

Two males, shore of Lake Kussharo, 13 June 1982 (No. A 100 : 64, 65).

Male: BL 7.51, 8.42 mm, WL 4.25, 4.59 mm. Body largely dark brown, *i. e.* ground color of scutum brown, stripes black, scutellum brown, postnotum black; all femora basally yellow and gradually darkened towards apex, front tibia largely dark brown but slightly paler in the middle portion, middle and hind tibiae largely yellowish brown and gradually darkened towards both ends, tarsi almost uniformly dark brown; abdominal tergites II to V dark brown for basal 2/3 and yellowish brown for distal 1/3, each with a triangular dark process in the middle (Fig. D-2), VI to VIII largely dark brown and each with a pale caudal zone, hypopygium entirely dark brown, anal point and dorsal appendages with darker stripes.

Frontal tubercles (Fig. D-1) prominent, almost cylindrical, 65 microns long, 15 microns in diameter, and 52 microns apart from each other (distance between the centers of base). AR 3.62, 3.68, AHR 0.63, 0.66, ER 0.29, 0.31, so 39 : 40, 30 : 32, cl 32, 38, pn 0, dm 24, 30, dl 36 : 39, 32 : 36, pa 8 : 9, 9 : 9, sc 36, 50, sq 34 : 35, 38 : 40, VR 1.09, 1.16. Front tarsi lost in both specimens, mLR 0.65, hLR 0.72, 0.74, mBR 4.1, 4.5, hLR 6.2, 7.5, pulvilli well developed, tarsi IV longer than tarsi V. Terminal scale of front tibia with rounded margin, and bears 3 subapical setae (Fig. D-3). Terminal combs of middle and hind tibiae both low, wide and bear a short spur (Fig. D-4).

Hypopygium in Fig. D-5. Anal point relatively wide, widest at base and rounded apically, with a pair of dark lateral ridges. Dorsal appendage (Figs. D-6, 7) composed of a wide base bearing 3 or 4 long inner setae, and a wide blade tapering towards pointed apex. Ventral appendage (Fig. D-8) almost cylindrical but basally broadened, with some 40 strong recurved setae mostly with one or two barbs. Gonostylus abruptly narrowed at apical 1/3, with long subapical setae along inner margin.

Remarks: The present specimens are somewhat similar in the shape of anal point and in the dark bands on abdominal tergites to *Ch. nipponensis*, but differ remarkably in the shape of dorsal appendage, and are almost coincident morphologically with that of *Ch. fujitertius* described by Sasa (1985c) from Lake Kawaguchi and Lake Motosu, though the body coloration is generally darker in the present specimens. In the type specimens, the values of fLR and fTR are 1.67—1.81 (1.79 in average of 5) and 0.30—0.32 (0.31), both significantly larger than in *Ch. nipponensis* (1.34—1.56, mean 1.41, and 0.21—0.23, mean 0.23).

6. *Chironomus riparius* (Meigen, 1803) (Plate II-E)

One male, shore of Lake Akan, 15 June 1982 (No. 100 : 79B).

Male: BL 6.85 mm, WL 3.90 mm. Body coloration yellow and brown, *i. e.* ground color of scutum yellow, scutal stripes brown, scutellum yellow, postnotum dark brown; femora, tibiae and tarsi I and II, as well as basal half of tarsi III yellow, apical half of III, and the distal segments brown; halteres yellow; abdominal tergites I to VI brown for oral 2/3 and yellow for caudal 1/3, the basal dark bands on II to V are triangularly produced in the middle (Fig. E-2), tergite or VIII, IX and hypopygium brown.

Frontal tubercles (Fig. E-1) rather small, 23 microns long, 10 microns in diameter, and 50 microns distant from each other (from center to center). AR 4.23, AHR 0.56, ER 0.23, so 32 : 34, cl 40. Anteprepronotum with 2 lateral setae on both sides (an unusual character as a *Chironomus*). dm 20, dl 22 : 24, pa 7 : 8, sc 39. fLR 1.65 (unusually high), mLR 0.64, hLR 0.77, fTR 0.26, fBR 2.5, mBR 3.4, hBR 3.6. Tarsus IV longer than tarsus V in all legs. VR 1.05. Tip of front tibia with a rounded terminal scale (Fig. E-3). Terminal combs of middle and hind tibiae both with a short spur (Fig. E-4). Hypopygium in Fig. E-5. Ninth tergite with 16 short setae in the middle. Anal point long, slender and constricted at base. Dorsal appendage (Fig. E-6) composed of a basal portion bearing 6 long inner setae, and a short and wide distal blade curved and expanded distally, and with a pointed apex. (S-form of Strenzke, 1959). Ventral appendage (Fig. E-7) almost cylindrical, with 20 stout and recurved setae arising on apical 1/3. Gonostylus widest at about middle and not abruptly constricted in basal portion, with 6 long subapical setae on inner margin (Fig. E-5).

Remarks: This specimen is identified tentatively as *C. riparius* (Meigen), since the above morphological characters mostly coincide with the description of this species from Europe by Edwards (1929, p. 384), Goetghebuer (1937, p. 28, described by a name of *Tendipes thummi* Kieffer, 1911), Strenzke (1959, p. 28, as *C. thummi thummi* Kieff.), and Pinder (1978, p. 115). In Japan, Tokunaga (1940, p. 291) recorded *C. thumini* (presumably a misprint of *thummi*) Kieffer from hot spring in Zigoku-onsen, Kumamoto, but it is probably a species different from the present one.

7. *Microtendipes chloris* (Meigen, 1818) (Plate II-F)

One male, shore of Lake Akan, 17 June 1982 (No. A 100 : 81).

Male: BL 5.89 mm, WL 3.95 mm. Ground color of scutum dark brown, stripes black, scutellum dark brown, postnotum black; front femur largely yellow and with a narrow and diffuse apical dark ring, front tibia and tarsus I entirely black, tarsi II to V brown; middle and hind legs almost uniformly brown, tarsi IV and V slightly darker. Abdominal tergites I to V largely pale yellow and II to V each with a faint brown longitudinal brown band (Fig. F-5), tergites VI to VIII brown, hypopygium dark brown.

Eyes bare, each with a long and narrow dorsomedial projection, ER 0.31. Frontal tubercles absent. Antenna with 13 flagellar segments, AR 2.58, AHR 0.53, so 22 : 22, cl 24. Anteprepronotum with 3 lateral setae. dm 0, dl 10 : 10, pa 4 : 5, sc 20. Wing membrane very finely granular, bluish by transmitted light. Squama with 20 fringe hairs. R_{2+3} fused with R_1 along its entire length (a characteristic of this genus). fCu slightly beyond r-m, VR 1.13. Anal lobe rather obtuse. Front tibia apically truncate, with 6 long subapical setae (Fig. F-6). Middle and hind tibiae

each with two terminal combs, one with a spur and the other without (Figs. F-7, 8). fLR 1.16 (unusually small as a Chironomini), mLR 0.64, hLR 0.79, fTR 0.19, fBR'2. 9, mBR 4.8, hBR 5.7. Pulvilli medium in size.

Hypopygium in Fig. F-1. Anal tergite bands united in the middle forming a pair of clear areas in the junction. Ninth tergite with 5 long setae in the center. Anal point long, narrow and nearly parallel-sided, with truncate apex. Dorsal appendage broad, sickle-like and curved inwards, with rather pointed apex, bearing a long basal seta arising from a large elevated base, and 7 dorsolateral setae (Fig. F-2). Ventral appendage nearly cylindrical but gradually tapering towards the apex, bearing nearly 30 recurved setae on the distal 2/3 of the dorsal side (Fig. F-3). Gonostylus widest at about middle, inner margin smoothly concave, bearing 3 stout apical setae and 10 recurved setae in two rows on inner margin (Fig. F-4).

Remarks: The above morphological characters of the present specimen are well in accordance with the description of *M. chloris* (Meigen) of Europe by Edwards (1929, p. 397), Goetghebuer (1937, p. 52) and Pinder (1978, p. 128).

8. *Stictochironomus histrio* (Fabricius, 1749) (Plate III-G)

Nine males and 3 females, shore of Lake Kussharo, 13 June 1982. Two males, shore of Lake Panke, 15 June 1982 (No. A 100: 91-98).

Male: BL 5.16-6.71 (5.71 in average of 11) mm, WL 2.94-3.71 (3.22) mm. Body coloration largely dark brown, or black, *i. e.* scutum, scutellum and postnotum black, halteres brown, abdominal tergites dark brown, tergites II to V each with a longitudinal black band in the middle; leg coloration in Fig. G-3, *i. e.* all coxae and trochanters brown, femora largely dark brown but with two narrow pale bands, one at base and the other in the subapical portion; all tibiae with three dark rings at base, middle and apex, with 2 pale rings between them; front tarsus I largely dark brown but with a basal and a subapical pale ring; these pale rings are fainter and more diffuse on middle and hind tarsi I; tarsi II of all legs each with a faint basal pale ring, tarsi III to V of all legs uniformly dark brown; these pale rings on tarsal segments are fainter and more diffuse than those on femora and tibiae. Wing with a dark area around cross vein r-m, otherwise evenly bluish.

Frontal tubercles absent. Antenna with 13 flagellar segments. AR 1.96-2.46 (2.27 in average of 11), AHR 0.54-0.67 (0.60), ER 0.30-0.42 (0.36), so 12-22 (15.2), cl 24-36 (28.5), pn 0, dm 11-18 (14.7), dl 11-20 (14.1), pa 5-8 (5.9), sc 24-42 (28.5). Scutum with a tubercle in the middle (Fig. G-2). Wing in Fig. G-1. Squama with 12-27 (19.1) fringe hairs. R_{2+3} separated from R_1 and R_{4+5} . fCu slightly proximal of r-m (a characteristic of this group), with VR (venarum ratio) of 0.93-0.99 (0.97). Anal vein extending to near wing margin. Front tibia with rounded terminal scale and 2 or 3 subterminal setae (Fig. G-4); terminal combs of middle and hind tibiae wide, and both with a short spur (Figs. G-5, 6). fLR relatively small, 1.05-1.19 (1.13); mLR 0.56-0.62 (0.60); hLR 0.70-0.78 (0.74); fTR 0.21-0.23 (0.22); fBR 2.9-3.9 (3.3); mLR 3.3-4.7 (4.0); hLR 3.5-6.5 (5.1). Pulvilli about half as long as the claws. Hypopygium, Fig. G-7. Bands of ninth tergite united in the middle forming a triangular area bearing 10-13 long bristles. Anal point long, slender, parallel-sided and with rounded apex. Dorsal appendage (Fig. G-8) composed of a rather narrow and long basal portion bearing 5-7 inner setae, and an apical

horn-shaped, strongly curved process bearing a long dorsal seta arising in the subapical portion. Ventral appendage (Fig. G-9) long, slender and tapering towards apex, bears some 25 recurved setae, and one long caudally directed apical seta. Gonocoxite much longer than gonostylus (a characteristic of this group), HR (hypopygium ratio, or the ratio of the length of gonostylus divided by length of gonostylus) 0.55. Gonostylus widest at about the middle, with a rather pointed apex, bearing some 16 inner setae in the apical portion.

Female: Body length 4.44, 5.20, 5.61 mm, wing length 3.11, 3.52, 4.03 mm. Body coloration largely black as in male, excepting abdominal tergites I to V with a narrow caudal pale band, and femora and tibiae of all legs with dark and pale rings, as in the male. Frontal tubercles absent, so 15–21 (mean 17.3), cl 28, 30, 48. Antenna with 5 flagellar segments, II, III and IV each with a pale distal neck, last segment 0.47 times as long as combined length of segments I to IV. ER 0.36, 0.38, 0.41. so 15 : 15, 16 : 16, 21 : 21 ; cl 28, 30, 48. Antepronotum without setae. dm 14, 16, 19 ; dl 14 : 14, 18 : 19, 23 : 26 ; pa 5 : 5, 5 : 5, 6 : 8 ; sc 22, 30, 48 ; sq 22–26 (24.0) ; VR 0.94, 0.96, 0.97 ; fLR 1.19, 1.24 ; mLR 0.54, 0.56, 0.58 ; hLR 0.71, 0.71, 0.73 ; fTR 0.21, 0.22 ; fBR 2.4, 2.6 ; mBR 2.3, 2.5, 2.7 ; hBR 3.2, 3.9. Spermathecae Fig. G-10, cercus long and ear-shaped (Fig. G-11).

Remarks: Males of the genus *Stictochironomus* is somewhat similar to those of genus *Polypedilum* and related genera in that one terminal comb of middle and hind tibiae has a spur and the other without spur, but are characteristic in that scutum has a tubercle in about the center, wing with one or more dark marks, legs are ringed, anal point is long and slender, and gonocoxite is much longer than gonostylus. Four species have been recorded with morphological accounts from Japan, *S. multannulatus* (Tokunaga, 1938), *S. histrio* (Fabricius, 1794), *S. akizukii* (Tokunaga, 1940), and *S. tamamontuki* Sasa et Ichimori, 1983. This species is tentatively identified as *S. histrio*, with special references to the coloration of leg segments and measurement data. However, these data are not exactly the same as those described from Europe by Edwards (1929, p. 401) and by Sasa (1985c) from the Fuji Lakes. For example, Edwards (1929) stated "four anterior tibiae whitish with the two ends black ; hind tibiae also with a dark ring in the middle." This was true with the Fuji specimens, but in the present colony tibiae of all the three legs with the middle dark ring (Fig. G-3). The values of AR (2.52–2.98, mean 2.79) and fBR (7.1–8.3, mean 7.6) observed with the Fuji specimens of *S. histrio* are both higher, and thus the present specimens are somewhat intermediate between the previously recorded *S. histrio* and *S. akizukii* of Japan.

9. *Polypedilum nubeculosum* (Meigen, 1818)

Five males, shore of Lake Akan, 15 June 1982 (No. A 101 : 86–89, 25A).

Male: Body almost uniformly dark brown, legs brown, wing with cloudy marks. BL 5.56–6.79 (6.05) mm, WL 3.31–4.44 (3.60) mm, antenna with 13 flagellar segments, AR 2.07–2.28 (2.15), AHR 0.56–0.61 (0.59), ER 0.25–0.34 (0.30), so 14 in 7, 16 in 3, cl 26–36 (31.2), pn 3–6 (3.8), dm 20–30 (24.0), dl 25–34 (29.9), pa 10–14 (11.4), sc 30–36 (32.8). Wing without dark spots but with cloudy marks, fCu only slightly beyond r-m, at 0.45–0.47 and 0.43–0.44 of wing length, respectively, VR 1.05–1.08 (1.07). Terminal scale of front tibia with rounded margin, one comb of

middle and hind tibiae each with a long spur, the other comb without a spur. fLR 1.42–1.44 (1.43), mLR 0.53–0.54 (0.54), hLR 0.69–0.74 (0.72), fTR 0.26–0.28 (0.27), fBR 4.1–4.3 (4.2), mBR 5.9–7.4 (6.8), hBR 7.4–7.9 (7.7). Pulvilli well developed. Hypopygium as described and illustrated by Sasa (1984, p. 58).

Remarks: This is a species widely distributed in Europe (Edwards, 1929, p. 402, Goetghebuer, 1937, p. 62, and Pinder, 1978, p. 138). It was recorded also by Tokunaga (1940, p. 297) from Tokyo and Karahuto, by Sasa (1984, p. 58) from Lakes Yunoko and Chuzenji, Nikko, by Sasa (1985a, p. 4) from Lake Utonai, Hokkaido, by Sasa (1985b, p. 42) from Lake Unagi, southern Kyushu, and by Sasa (1985c, p. 118) from Lakes Ashinoko, Kawaguchi, Motosu, Saiko and Yamanaka in the Mount Fuji area. Males of this species are characteristic in that the wing has cloudy marks, the body is almost uniformly dark brown and relatively large, the AR is higher than 2, the scutum and scutellum have large numbers of setae, lateral pronotal setae are present (an unusual character as a species of *Polypedilum*), the anal point is very long and slender, the lateral seta of the dorsal appendage arises at about the middle or distal to it, and the gonostylus is very stout, with a rounded apex.

10. *Tanytarsus usmaensis* Pagast, 1931 (Plate III-H)

Twenty four males, shore of Lake Akan, 14 June 1982 (No. A 100: 01–18).

Male: BL 3.16–4.03 (3.48 in average of 10) mm, WL 2.04–2.40 (mean 2.18) mm, relatively large midge as a member of genus *Tanytarsus*. Body largely brown, *i. e.* ground color of scutum yellow, scutal stripes dark brown, scutellum yellow, postnotum dark brown, abdominal tergites brown; halteres yellow, leg segments almost uniformly brown.

Frontal tubercles present but minute, about 9 microns high and 7 microns wide, 27 microns apart from each other (Fig. H-1). Antenna composed of 13 flagellar segments as usual, AR 1.13–1.24 (mean 1.19); antennal hairs well developed, AHR 0.51–0.63 (mean 0.55). Palp 4 segmented as usual. Eyes bare, ER 0.60–0.76 (mean 0.71). Supraorbital setae 10–14 (mean 12.2), clypeal setae 12–17 (mean 14.0).

Anteprepronotum without setae, scutum with 14–22 (mean 16.2) dorsomedian setae, 8–12 (mean 9.6) dorsolateral setae, and only one prealar seta on each side. Scutellum with 6–8 (most frequently 6, mean 6.6) setae in a transverse row. Wing with macrotrichiae on almost entire surface; R_{2+3} separated from R_1 and R_{4+5} , fCu much beyond r-m, VR 1.13–1.29 (1.21 in average of 10), tip of R_{4+5} much beyond tip of Cu_1 . Tip of front tibia with a narrow and sharply pointed terminal scale (Fig. H-2). Terminal combs of middle and hind tibiae widely separated, both with a spur (Fig. H-3). fLR 1.71–1.96 (mean 1.85), mLR 0.58–0.62 (mean 0.59), hLR 0.63–0.70 (mean 0.66). Front tarsus V 0.28–0.33 times as long as front tibia. Tarsal beards relatively long, fBR 3.5–4.8 (mean 4.2), mBR 4.7–8.1 (mean 6.3), hBR 5.7–8.2 (mean 6.9). Pulvilli absent.

Hypopygium, Fig. H-4. Ninth tergite without long setae and without lateral lobes. Anal tergite bands united in the middle, Y-shaped. Anal point showing a structure peculiar to this species, *i. e.* widest at base and tapering towards tip but apical portion parallel-sided and with rounded apex, anal point crests rather poorly developed, the dorsal side almost entirely covered by microtrichiae, with several

lateral setae, and 1—8 narrow and forked spinulae on the dorsal side near apex (Figs. H-7, 8). Appendage 1 roughly half-egg shaped and inner margin almost straight, with 3 setae on inner margin (including a seta on ventral side which has no basal tubercle), and 5—7 setae on dorsal side (Figs. H-5,6). Appendage 1-a finger-like, directed inwards and extending much beyond inner margin of appendage 1, with rounded apex (Figs. H-5, 6). Appendage 2 simple, without apical swelling, and with some 10 recurved setae (Fig. H-7), Appendage 2-a very short, directed inwards, bearing several simple setae. Gonostylus not abruptly narrowed near apex and widest at about middle.

Remarks: *T. usmaensis* is a species described first by Pagast (1931) from Usma Lake, and is distributed widely in oligotrophic, eutrophicated and brackish lakes in Europe (Reiss & Fittkau, 1971, p. 143). Its morphology was described also by Edwards (1929, p. 415) by the name of *T. junci* (Meigen), by Goetghebuer (1937, p. 116) and Brundin (1947, p. 73) as *T. heusdensis* Goetghebuer, and by Reiss & Fittkau (1971, p. 142) and Pinder (1978, p. 152) as *T. usmaensis* Pagast. The present specimens from mountain lakes in Hokkaido are morphologically almost coincident with these descriptions of the European materials, and especially characteristic in the above mentioned structure of anal point, appendages 1, 1-a and 2-a of hypopygium.

11. *Tanytarsus nippogregarius*, sp. nov. (Plate IV-1)

Nine males, shore of lake Akan, 14 June 1982 (holotype: A 100: 21; paratypes: A 100: 22—27). One male, shore of Lake Panke, 15 June 1982 (A 100: 30B).

Male: BL 4.03—4.44 (4.22 in average of 10) mm, WL 2.62—2.91 (2.74) mm. Body largely brown with dark brown marks, *i. e.* ground color of scutum and scutellum yellowish brown, scutal stripes dark brown, postnotum black, leg segments uniformly brown, halteres yellow; abdominal tergites largely brown with narrow basal pale bands, hypopygium dark brown. Antenna dark brown, with 13 flagellar segments, AR 1.31—1.48 (1.38 ± 0.07 in measurements of 6), AHR 0.56—0.64. ER 0.79—0.92 (0.85 in average of 10), so 10—16 (mean 12.8), cl 14—22 (mean 17.0), pn 0, dm 10—14 (mean 11.3), dl 7—10 (mean 8.8), pa 1 or 2 (mean 1.5), sc 6—10 (mean 8.2). Frontal tubercles prominent, roughly cylindrical, 35 microns long, 10 microns in diameter, and 84 microns apart from each other (Fig. I-4).

Wing membrane bluish in transmitted light, macrotrichiae rather sparsely distributed, squama bare. Wing venation in Fig. I-1. VR 1.11—1.16 (mean 1.13). Terminal scale of front tibia narrow, short and pointed apically (Fig. I-2). Terminal combs of middle and hind tibiae separated, and both with a spur (Fig. I-3). fLR 1.64—1.76 (mean 1.71), mLR 0.51—0.56 (0.54), hLR 0.66—0.68 (0.67), fTR 0.23—0.25 (0.24), fBR 3.8—5.0 (4.3), mBR 4.2—4.9 (4.6), hBR 5.3—8.4 (6.4). Tarsi IV much longer than tarsi V in all legs. Pulvilli well developed.

Hypopygium in Fig. I-5. Bands of ninth tergite widely separated in the middle. Ninth tergite without long bristles. Anal point wide, widest at base and with rounded apex, with 18—30 (22.6 in average of 10) spinulae, but without microtrichiae on dorsal surface between anal point crests (Fig. I-6). Appendage 1 (Fig. I-7) roughly egg-shaped, widest near distal end and with a small inner apical process, bears 3 lateral, 2 apicodorsal, 2 inner, and 1 basal seta arising from a small

base. Axis of appendage 1 is almost parallel to the body axis (a characteristic of this species group). appendage 1-a completely absent. Appendage 2 (Figs. 1-8,9) short, stout, bearing some 16 recurved dorsal setae and 4 caudally directed ventral setae in the apical portion. Appendage 2-a (Fig. 1-8) short, with several simple setae and a flat lamellar seta bearing 1-3 marginal spurs. Gonostylus widest at about basal 1/3 and tapering towards rather pointed apex.

Remarks: The present specimens seem to belong to the same species as that collected from Lakes Yunoko and Chuzenji of the Nikko National Park and described by Sasa (1984, p. 40) by male and pupa under the name of *Tanytarsus gregarius* Kieffer, 1909. These are closely related to *T. gregarius* described by various authors from Europe in that anal tergite bands are separated in the middle, anal point with spinulae between anal point crests, appendage 1 roughly elongate oval and parallel to body axis, appendage 1-a absent, and appendage 2-a being medium in size. However, the present specimens have large numbers of spinules in multiple rows on anal point (they are less than 8 in a single row in *T. gregarius*), and anal point without microtrichiae on dorsal surface (with numerous microtrichiae in *T. gregarius*). The present specimens are similar also to the *Tanytarsus lugens* group of Reiss & Fittkau (1971, p. 124) in that anal point with lateral ridges and spinules but without microtrichiae, bands of ninth tergite is widely separated in the middle and do not reach to the base of anal point, appendage 1 is roughly egg-shaped and 1-a is absent. However, the present species seems to differ from *T. lugens* (Kieffer, 1916) in that spinules on anal point is much more numerous (8-13, mean 10, in *lugens*: 18-30, mean 22.6, in the present species), setae on appendage 2-a are all simple (lamellar in *lugens*), and appendage 2 is much stouter in the present species. It is therefore closer to *T. bathophilus* (Kieffer, 1911) in the numbers of spine clusters on anal point (9-32, mean 19.7 in *bathophilus* according to Reiss & Fittkau, 1971, p. 125), but again differs from the allied species in the structure of setae on appendage 2-a (with wide and flat lamellar setae in *bathophilus*).

12. *Tanytarsus akantertius*, n. sp. (Plate IV-J)

Six males, shore of Lake Akan, 14 and 15 June 1982 (holotype: A 100-37B; paratypes: A 100: 35, 36A, 38A, 38B, 20B).

Male: BL 3.44-4.00 (3.68 in average of 6) mm, WL 2.09-2.31 (mean 2.23) mm. Body largely dark brown, *i. e.* ground color of scutum brown, stripes dark brown, scutellum yellowish brown, postnotum dark brown, abdominal tergites yellowish brown and paler than thorax, leg segments almost uniformly yellowish brown, halteres yellow. Small conical frontal tubercles present, 8 microns high, 7 microns wide at the base, and 40 microns apart from each other (Fig. J-1). Eyes largely bare but with microtrichiae along inner margin, ER 0.51-0.75 (0.62). Antenna with 13 flagellar segments as usual, AR 1.05-1.17 (1.12), AHR 0.47-0.56 (0.52), so 8-12 (mean 9.5, most frequently 10), cl 14-20 (16.4), pn 0, dm 4-10 (7.0, most frequently 6), dl 5-8 (9.5, usually 6 or 8), pa 1 or 2 (1.3), sc 2, 3 or 4 (3.5). Wing in Fig. J-10. Squama bare. Anal lobe obtuse. fCu much beyond r-m, VR 1.11-1.18 (mean 1.14). Wing membrane with macrotrichiae on distal half, between R_{4+5} and M, M and Cu_1 , Cu_1 and Cu_2 , and on veins R_1 , R_{4+5} , M, Cu_1 , Cu_2 and An. fLR 1.83-1.93 (1.89), mLR 0.54-0.58 (0.56), hLR 0.66-0.71 (0.68), fTR 0.29 or 0.30, fBR 4.

2—4.8 (4.5), mBR 4.4—5.6 (4.9), hBR 5.3—6.9 (5.9). Terminal scale of front tibia narrow and apically pointed (Fig. J-2). Terminal combs of middle and hind tibiae are clearly separated, and both with a short spur (Fig. J-3).

Hypopygium in Fig. J-4. Ninth tergite without long setae, bands widely separated from each other. Anal point peculiar to this species, wide at base and apically narrowed, with rounded apex, and with 5—7 spine clusters between lateral ridges and 4 pairs of short lateral setae. Appendage 1 (Figs. J-6, 7) with ovoid base and a hook-like apical process, with 4 setae on lateral margin, 3 setae on dorsal surface, two setae on inner margin both arising from a small conical base, and a basal seta on ventral side arising from a large cylindrical base. Appendage 2 slightly expanded apically, with 12 recurved setae on dorsal side, and 4 caudally directed setae on ventral side (Figs. J-8, 9). Appendage 2-a very short, with 5 or 6 simple setae directed inwards. Gonostylus long, slender and nearly parallel-sided, with concave inner margin and rounded apex, and two rows of short setae along inner margin (Fig. J-4).

Remarks: This species seems to belong to the *chinyensis* group of Reiss & Fittkau (1971), since anal point has both lateral ridges and spine clusters but without microtrichiae, bands of anal tergite separated in the middle, appendage 2-a being short, and 1-a extends much beyond inner margin of appendage 1. It is closest to *T. chinyensis* Goetghebuer, 1934, which was also redescribed by Goetghebuer (1937, p. 112), Brundin (1947, p. 70), and Reiss & Fittkau (1971, p. 99) from Europe, but the present specimens differ from their descriptions and illustrations in the shape of appendage 1 (posterior process is narrow and sharply pointed in *chinyensis*, stout and with rounded apex in the present specimens), in the characters of setae on appendage 2-a (with lamellar setae in *chinyensis*, all simple in the present specimens), in body coloration (green in *chinyensis*, dark brown in the present ones). They also resemble somewhat to *T. sinuatus* Goetghebuer, 1936, of the *norvegicus*-group of Reiss & Fittkau (1971, p. 134), but differs in the more strongly hooked dorsal appendage, in the shape and structure of anal point, and in having a large tubercle bearing a long seta at the base of appendage 1-a. Among the previously described Japanese *Tanytarsus* species, they most closely resemble to *T. tamagotoi* Sasa, 1983, which was collected and reared from bottom sediments of upstream parts of River Tama, but again differ from it in having a large tubercle at the base of appendage 1-a (this is small and inconspicuous in *T. tamagotoi*), longer than wide and almost cylindrical in the present specimens), in the numbers of dorsal setae on appendage 1 (2 inner and 4 or 5 outer setae in *T. tamagotoi*, 2 inner, 3 dorsal and 4 outer setae in the present species), in the values of AR (0.83—0.87 versus 1.05—1.17), fLR (2.44—2.68 versus 1.83—1.93), WL (1.42—1.50 mm versus 2.09—2.31 mm), and in body coloration (pale yellow versus dark brown).

13. *Paratanytarsus inopertus* (Walker, 1856) (Plate V-K)

Four males, shore of Lake Akan, 14 June 1982 (No. A 100 : 28, 29A, B, 30A).

Male: BL 3.10—3.62 (3.53 in average of 4) mm, WL 2.17—2.38 (mean 2.27) mm. Body largely dark brown, *i. e.* ground color of scutum brown, scutal stripes dark brown, scutellum dark brown, postnotum nearly black, leg segments uniformly brown, abdominal tergites dark brown. Frontal tubercles (Fig. K-1) rather promi-

ment, almost cylindrical, 22 microns high, 13 microns wide at the base, and 68 microns apart from each other (center to center). Eyes with microtrichiae along inner margin, ER 0.58—0.79 (0.67). Antenna with 13 flagellar segments, AR 1.39—1.57 (1.47), AHR 0.52—0.61 (0.57), so 13—17 (15.4, most frequently 17), cl 12—18 (15.0), dm 20—28 (22.5), dl 13—18 (16.1), pa 2 or 3 (2.25), sc 9—12 (9.75).

Wing in Fig. K-2. Squama bare, membrane with denser macrotrichiae on distal half. R_{2+3} present but faint, anal vein not reaching beyond fCu. VR 1.13—1.18 (1.15). Terminal scale of front tibia (Fig. K-3) low, flat and with a short small spur. Terminal combs of middle and hind tibiae narrowly separated and both with a short spur (Fig. K-4). fLR 1.20—1.26 (1.23), mLR 0.59, hLR 0.68, fTR 0.21, fBR 5.2—6.2 (5.7), mBR 8.8, hBR 9.4. Pulvilli vestigial.

Hypopygium in Figs. K-5, 6. Ninth tergite with 7—11 short setae in the middle and 4—6 short setae on posterior margin flanking anal point. Bands of ninth tergite separated in the middle and continuous to the bases of of the anal point crests. Anal point (Figs. K-7, 8) short and wide, apically rounded, and crests with a pair of strong lateral crests which are not united posteriorly such as in *P. tenuis* (Meigen), and swollen like an onion bulb in lateral view (Fig. K-5). Appendage 1 roughly half-egg shaped, wider than long, with slightly concave inner margin, with 7 simple setae on dorsal side and a basal seta on ventral side arising on a small tubercle at the base of appendage 1-a (Figs. K-9, 10). Appendage 1-a large, roughly triangular but with a conspicuous incision near base, extending distinctly beyond inner margin of appendage 1, apically pointed, and with microtrichiae in the basal portion (Fig. K-10). Appendage 2 digitiform and curved inwards, not swollen apically, with 12 recurved setae on dorsal side and 4 caudally directed setae on ventral side of the apical portion (Figs. K-11, 12). Appendage 2-a medium in length, bearing numerous simple setae reaching to about 2/3 of appendage 2 (Fig. K-12). Gonostylus widest at about basal 1/3, inner margin slightly concave, pointed apically, and with 12 short setae in two rows along inner margin (Fig. K-6).

Remarks: This species is a typical member of genus *Paratanytarsus* Bause (= *Lundstroemia* Kieffer) in that tibial combs are narrowly separated and both with a short spur, anal point without spine clusters and with a pair of lateral ridges, appendage 2-a with simple setae only, and gonostylus is smoothly tapering towards apex. It is tentatively diagnosed as *P. inopertus* (Walker) described by various authors as being common in Europe, by Edwards (1929, p. 410), Goetghebuer (1937, p. 119), Brundin (1947, p. 77), Pinder (1978, p. 148, Fig. 197D), since its basic structure is almost coincident, especially in that appendage 2-a being relatively long, slender and bearing simple setae only, appendage 2 only slightly expanded distally, and lateral ridges of anal point is not united in the middle. However, the present specimens differ from the descriptions of the European *inopertus* in several points, such as in body coloration (olive green with black stripes in *inopertus* according to Edwards, 1929), in the value of fLR (1.4—1.5 in *inopertus* according to Edwards, 1929 1.20—1.26 in the present specimens), in the shape of appendage 1 (inner margin convex in *inopertus* according to Fig. 179D of Pinder, 1978, it is concave in the present specimens, Fig. K-9), and setae on inner margin of gonostylus being shorter and more restricted to distal portion in *inopertus*.

A key for identification of males of the Japanese species of genus *Paratanytarsus* is as follows, in which *Micropsectra miikeseconda* Sasa, 1985, and *Tanytarsus stagnarius* Tokunaga, 1938, are transferred to this genus as a new combination.

Key to Japanese species of genus *Paratanytarsus* Bause

- 1 — Antenna with 12 flagellar segments, AR 0.32—0.35; (appendage 2-a long, reaching to almost tip of appendage 2, with numerous spoon-like setae in the apical portion; fLR 1.6, tarsi without long beard; appendage 1 hemispherical, inner margin convex, appendage 1-a long and with pointed apex *tredecemarticulus* (Tokunaga, 1938)
- Antenna with 13 flagellar segments as usual, AR larger than 1.0 2
- 2 — Ninth tergite with a pair of processes on posterior margin; appendage 2-a long, reaching to near tip of appendage 2 3
- Ninth tergite without processes on posterior margin; appendage 2-a not reaching to tip of appendage 2 4
- 3 — Processes on ninth tergite long and narrow, much longer than wide; appendage 2-a long and slender, with spatulate setae on distal half; AR about 1.3, fLR about 2 (according to Tokunaga, 1938, p. 341) *stagnarius* (Tokunaga, 1938)
- Processes on ninth tergite roughly rectangular, wider than long; appendage 2-a long and stouter, also with spatulate setae on distal half; AR 1.11—1.26 (1.14), fLR 1.76—1.96 (1.86), fBR 3.5—4.4 (4.0) *miikesecondus* (Sasa, 1985)
- 4 — Appendage 2 swollen apically; anal point with short setae on dorsal surface; appendage 1-a parallel-sided and rounded apically; AR 1.08—1.38 (1.23), fLR 1.59—1.73 (1.68), fBR 3.1—4.7 (4.2); body greenish yellow *tamanegi* Sasa, 1983
- Appendage 2-a not swollen apically; anal point without setae on dorsal surface; appendage 1-a tapering towards sharply pointed apex; body largely dark brown 5
- 5 — Appendage 2-a short, with blade-like terminal setae which are almost as long as the shaft; appendage 1-a simple claw-like, without basal tubercles; terminal combs of middle and hind tibiae completely confluent and with two short spurs; AR about 1.3, fLR 1.5, tarsal beard absent (according to Tokunaga, 1938, p. 367) *telmatophilus* (Tokunaga, 1938)
- Appendage 2-a long, slender, with simple setae only, terminal setae much shorter than the shaft; appendage 1-a with a basal tubercle; terminal combs of middle and hind tibiae clearly separated, both with a short spur; AR 1.39—1.57 (1.47), fLR 1.20—1.29 (1.25), tarsi with long beards, fBR 5.2—6.2, mBR 8.8, hBR 9.4 *inopertus* (Walker, 1856)

**14. *Orthocladius (Orthocladius) glabripennis* (Goetghebuer, 1921)
(Plate V-L)**

Three males, shore of Lake Akan, 14 June 1982 (No. A 101: 51, 52A, 52B).
Male: BL 3.78, 3.98, 4.08 mm, WL 2.55, 2.55, 2.86 mm. Body almost entirely

black to dark brown; scutum, scutellum and postnotum black, scutal stripes shining black, abdomen dark brown, leg segments dark brown, halteres brown. Eyes bare, inner margin concave and with a dorsomedial projection, ER 1.19, 1.21, 1.22. Antenna with 13 flagellar segments, AR 2.00, 2.08, AHR 0.50, 0.53, last antennal segment only slightly expanded apically. so 14—16, cl 12, 14, 16. Anteprepronotum well developed, without dorsal seta and with 6—9 lateral setae. Dorsomedian setae of scutum 12—14, all minute and arising from small pits. Dorsolateral setae well developed, 8—11 (mean 9.0), all arising from large pale pits. Prealar setae 5 or 6 on each side. Scutellum with 12, 14 or 18 setae on an uniserial row.

Wing membrane bare, slightly brown by transmitted light. Wing structure in Fig. L-1. Anal lobe strongly produced. Costa not extending beyond end of R_{4+5} . R_{2+3} ending slightly closer to end of R_1 than to end of R_{4+5} . fCu nearly under r-m, VR 1.03, 1.04, 1.05. Cu_2 almost straight. Anal vein extending much beyond fCu. Front tibia with a long terminal spur (88 microns long; Fig. L-4). Middle tibia with two short terminal spurs (32 and 35 microns). Hind tibia with a long terminal spur (90 microns), a short terminal spur (22 microns), and a terminal comb composed of 12 free spurs (32—65 microns) arising on a line oblique against apical margin of tibia (Fig. L-5); in addition, hind tibia bears numerous short spurs densely distributed in the distal portion. Middle tarsi I and II as well as hind tarsus I bearing two short terminal spurs, other tarsal segments without apical spurs. Tarsal beards relatively long (fBR 2.5—2.8, mBR 3.0—3.2, hBR 3.9—5.4). Tarsus IV of all legs longer than tarsus V. Pulvilli absent.

Hypopygium in Fig. L-2. Ninth tergite without long setae in the middle, several short setae on posterior margin near base of anal point. Anal point acutely conical, with pointed apex, bearing 3—6 lateral setae on both sides. Inner lobes of gonocoxite are double layered (Fig. L-2,3), the dorsal lobe narrow and finger-like, almost free from microtrichiae and with 9 short curved setae on dorsal side and some 10 longer setae along lateral margin. The ventral lobe is broader and thickly covered with microtrichiae, but without long setae. Gonostylus tapering from middle towards base, distal half nearly parallel-sided, apically truncate, with a stout apical spine but without subapical flange (Fig. L-2). Virga present (Fig. L-3).

Remarks: This species was described by Goetghebuer (1921, p. 84) as *Dactylocladius glabripennis*. It was redescribed from Europe by Edwards (1929, p. 345) as *Spaniotoma (Orthocladius) glabripennis*, and by Goetghebuer (1937, p. 45) as *Orthocladius glabripennis*. However, Brundin (1956, p. 99) regarded it as a synonym of *Orthocladius (Pogonocladius) consobrinus* (Holmgren). Tokunaga (1965, p. 40) recorded *O. glabripennis* on the bank of a river in Kyoto in winter. More recently, Pinder & Cranston (1976), conducted comparative studies on *O. consobrinus* and *O. glabripennis* collected from various localities in Europe, and concluded that both were the valid species. The present specimens are almost identical with the description and figures of the latter species. However, the identification of the species of genus *Orthocladius* is sometimes difficult by examination of the adult forms only, as was discussed by Sasa (1985b, p. 53—57), and the information on the immature stages is required in order to give definitive identification of the present specimens. A review of this group of *Orthocladius* was made more recently by Soponis (1977).

15. *Orthocladius (Orthocladius) sp. "akanquartus"* (Plate V-M)

One male, shore of Lake Kussharo, 15 June 1982 (No. A 101 : 58A).

Male: BL 3.03 mm, WL 1.93 mm. Body coloration almost entirely dark brown, *i. e.* ground color of scutum brown, stripes dark brown, scutellum brown, postnotum nearly black, abdominal tergites almost uniformly dark brown, leg segments brown, middle portion of tibiae paler. Eyes bare, both with a conspicuous dorsomedial projection, ER 1.07. Antenna with 13 flagellar segments, AR 1.57, AHR 0.53. so 12 : 12, cl 12. Scutum and scutellum Fig. M-2. dm 14, all minute; dl 7 : 7, all arising from large pale pits; pa 4 : 4. Scutellar setae 8, in a transverse row. Wing in Fig. M-1, sq 22—20. Anal lobe nearly rectangular. R_{2+3} separated from R_1 and R_{4+5} , ending closer to end of the former (at 38% level of the distance between ends of R_1 and R_{4+5}). Costa extending slightly beyond end of R_{4+5} . fCu slightly beyond r-m, at 41% and 44% level of wing length, VR 1.08. Anal vein extending much beyond fCu. Cu_2 almost straight. Front tibia with a long terminal spur (62 microns). Middle tibia with two short spurs (27 and 30 microns). Hind tibia with a long terminal spur (63 microns), a short terminal spur (22 microns), and a terminal comb composed of 11 free spurs 26—44 microns long arising on a curved line. Middle and hind tarsi I with two short terminal spurs, middle tarsus II with one short terminal spur, other tarsal segments without terminal spur. Tarsus V with a pair of large and apically forked claws, a small empodium, but without pulvilli (Fig. M-5).

Hypopygium in Fig. M-3. Ninth tergite wide and short, nearly quadrangular, without long setae in the middle. Anal point (Fig. M-4) nearly conical, with a wide base, and a narrow and pointed apical process, bearing nearly 10 lateral setae on both sides. Inner lobes of gonocoxite double layered, situated near base of gonocoxite, the dorsal process conical and bearing numerous macro- and microtrichiae, the ventral process with rounded margin and bearing short setae. Gonostylus nearly parallel-sided and apically tapering to a pointed apex, with a small, colorless apical spine. Virga present, composed of 5 median and several lateral blades on each side.

Remarks: This is another species representing subgenus *Orthocladius*, since anal point is widest at base and with pointed apex, and scutellum bears only 8 setae situated on a transverse line. It appears to be related to the preceding species, *O. glabripennis*, but differs in that the anal point is much wider at base and with a narrow and pointed apical process, the AR is smaller, the gonocoxite is much shorter, and gonostylus is also much less massive than in the preceding species.

16. *Orthocladius (Euorthocladius) kanii* (Tokunaga, 1939)(Plate VI-N)

Two males, shore of Lake Akan, 13 June 1982 (No. A 101 : 54, 55B).

Male: BL 3.16, 3.32 mm, WL 1.89, 2.04 mm, much smaller than in the preceding species. Body coloration largely brown, *i. e.* ground color of scutum brown, scutal stripes dark brown, scutellum brownish yellow, postnotum dark brown, abdominal tergites largely brown, hypopygium dark, brown, leg segments

uniformly brown, halteres brown. Head in Fig. N-8(Plate VII). Eyes bare, reniform, without dorsomedial projection, ER 1.23, 1.48. Antenna with 13 flagellar segments, AR 1.23, 1.30, AHR 0.53 in both specimens. so 16: 16, 18: 18, cl 12, 14. Anteprenotum with 6: 6, 10: 10 lateral setae. Scutum and scutellum in Fig. N-2. Dorsomedian setae 0, 0, dorsolaterals 8: 10, 12: 12, all arising from large pale pits, pa 4: 5, 5: 5. Scutellar setae 20, 24, irregularly distributed.

Wing membrane bare, dusty in appearance and conspicuously brown. Venation in Fig. N-1. Squama with 18—24 (mean 20.8) fringe hairs. Anal lobe conspicuously produced. Costa not extending beyond end of R_{4+5} . R_{2+3} ending closer to end of R_1 than to end of R_{4+5} . fCu nearly under r-m. VR 1.05, 1.06. Cu_1 and Cu_2 forming narrow angle. Cu_2 only slightly curved near apex. Anal vein extending much beyond fCu and reaching near wing margin. fLR 0.76, 0.76, mLR 0.49, 0.51, hLR 0.57, 0.58. Front tibia with a long terminal spur (70 microns), middle tibia with two short terminal spurs (29 and 31 microns), hind tibia with a long terminal spur (75 microns), a short terminal spur (26 microns), and a terminal comb composed of 12 free spurs forming an oblique line (28—42 microns long, Fig. N-7). Front tarsus V 0.17 times as long as front tibia (relatively long as a member of Orthocladiinae). fBR 2.4—2.8, mBR 3.0—3.2, hBR 3.9—4.0. Tarsus IV longer than tarsus V in all legs. Tarsi I and II of middle and hind legs with two short terminal spurs, other tarsal segments without terminal spur. Pulvilli absent (Fig. N-9, Plate VII).

Hypopygium in Fig. N-3. Ninth tergite with 2 or 3 short setae on both sides near base of anal point. Anal point robust, widest at base and tapering towards rather bluntly pointed apex, with short lateral setae. Inner lobe of gonocoxite composed of two lobes, a conical dorsal lobe about 40 microns high and 40 microns wide at the base and with rounded margin, and a ventral lobe which is much wider and bearing several long setae and numerous microtrichiae (Figs. N-4,5,6). Gonostylus widest near apex and with a conspicuous subapical tooth. Virga present, composed of four fimbriate scales (Fig. N-4).

Remarks: This species belongs to the subgenus *Euorthocladius* Thienemann in the sense of Brundin (1956, p.101), since scutellar setae are numerous and distributed irregularly, but the shape of anal point is not parallelsided but widest at base and tapering towards apex, such as seen in species of the subgenus *Orthocladius*. The present specimens are tentatively identified as *O. kanii* (Tokunaga, 1939) because of the similarity of the structure of hypopygium but examination of pupa is required for definitive identification of this group of midges. Among the species known from Europe, it appears to be most closely related to *O. thienemanni* Kieffer, 1906, which was redescribed and illustrated by Goetghebuer (1940, p. 55) and Pinder (1978, p. 70, Fig. 111C).

17. *Orthocladius* (*Euorthocladius*) sp. near *saxosus* (Plate VI-P)

One male, shore of Lake Akan, 13 June 1982 (No. A 101: 56A).

Male: BL 3.21 mm, WL 1.94 mm. Body largely yellowish brown with brown marks; ground color of scutum yellow, stripes dark brown, scutellum brown, postnotum dark brown, abdominal tergites brown; leg segments almost uniformly yellowish brown. Head in Fig. P-9. Eyes bare, reniform, and with concave inner margin, ER 1.43. Antenna with 13 flagellar segments, AR 1.09, AHR 0.50. so 16:

16, cl 13. Anteprepronotum without dorsal setae and with 10 : 12 lateral setae. dm 0, dl 8 : 8, pa 5 : 5 (Fig. P-2). Scutellum partly lost, with multiple rows of setae. Wing in Fig. P-1. sq 16 : 18, VR 1.10. fLR 0.77, mLR 0.51, hLR 0.58, fTR 0.16, fBR 2.3, mBR 2.6, hBR 3.0. Pulvilli absent, tarsus IV longer than tarsus V in all legs. Tip of front tibia with a long spur (Fig. P-3), middle tibia with two short terminal spurs (Fig. P-4), hind tibia with a long spur, a short spur, and a terminal comb (Figs. P-5, 6). Tarsi I and II of middle and hind legs each with two short terminal spurs.

Hypopygium in Fig. P-7. Anal point very short, broad and with rounded apex, and with lateral setae. Inner lobe of gonocoxite double, the dorsal lobe nearly semicircular and bare, the ventral lobe situated more distally, very broad and flat, bearing both macro- and microtrichiae (Figs. P-7, 8). Gonostylus widest at apex and tapering towards base, with a broad apical spine, and a large, rectangular subapical tooth (Fig. P-7)

Remarks : Tokunaga (1939, p. 326) described a species under the name of *Spaniotoma (Orthocladius) saxosa* by male, female, pupa and larva collected and reared from a rapid stream in Kyoto in winter. The morphological structure of pupa and larva described and illustrated in details in the original paper seems to be quite characteristic to this species, but that of the male was only poorly described ; as for the structure of male genitalia, it is stated only that "hypopygium with setigerous anal point, coxite with a small mesal lobe, style (Plate 2, Fig. 39) with a prominent triangular preapical ridge." No figure was given to the entire hypopygium. Since the *Spaniotoma (Orthocladius)* species described by Tokunaga (1939) were differentiated mainly by the morphology of pupa and larva, it is unfortunately unable to identify by the male whether the present specimen belongs to *O. saxosus* or to some other species. The present specimen is unique in having a short, parallel-sided anal point which is truncate at the tip and in having the dorsal lobe of gonocoxite much smaller than the ventral lobe and lying proximal to it.

18. *Orthocladius (Euorthocladius) frigidus* (Zetterstedt, 1852)
(Plate VI-Q)

One male, shore of Lake Akan, 15 June 1982 (No. A 101 : 58B).

Male : BL 3.47 mm, WL 2.35 mm. Body coloration brown with dark brown marks, *i. e.* ground color of scutum brown, stripes dark brown, scutellum yellowish brown, postnotum dark brown, abdominal tergites brown ; wing unmarked, femora brown, tibiae brown at both ends and yellowish brown in the middle, tarsi yellowish brown.

Head in Fig. Q-11, Plate VII. Eyes bare, each with a conspicuous dorsomedial projection, ER 0.87 (unusually small as a species of Orthocladiinae). Antenna with 13 flagellar segments as usual, AR 1.63, AHR 0.52. so 12 : 12 ; cl 10. Anteprepronotum with 8 : 10 lateral setae. Scutum with 10 dorsomedian setae, all very small (some 12 microns long), dorsolateral setae 12 : 12, all arising from large pale pits, prealar setae 5 : 5. Scutellum with 23 setae in multiple rows (Fig. Q-2). Wing in Fig. Q-1. Squama with 20—22 fringe hairs. Anal lobe nearly rectangular, not strongly produced as in some other *Orthocladius* species (cf. Figs. N-1, P-1). Wing membrane brownish and dusty (in the preceding *Orthocladius* species, wing membrane is paler and plain). R_{2+3} ending at 0.34 of the distance between ends of R_1 and R_{4+5} .

Costa slightly extending beyond end of R_{4+5} . fCu a little beyond r-m, at 43%, 41% of wing length, VR 1.05. Anal vein extending much beyond fCu. Front tibia with a long terminal spur (80 microns, Fig. Q-3), middle tibia with two short spurs (26 and 28 microns, Fig. Q-4), hind tibia with a long terminal spur (75 microns), a short terminal spur (38 microns), and a terminal comb composed of 10 free spurs 28–60 microns long (Fig. Q-5). Tarsi I and II of middle and hind legs with two short terminal spurs (Figs. Q-6, 7), other tarsal segments without terminal spurs. Pulvilli lacking. fLR 0.72, mLR 0.50, hLR 0.60, fTR 0.16, fBR 2.0, mBR 2.3, hBR 2.8.

Hypopygium in Fig. Q-8. Anal point robust, about 60 microns long and 15 microns wide, nearly parallel-sided and with rounded apex, without microtrichiae on dorsal side, and with 6 lateral setae on each side. Inner lobes of gonocoxite double in structure (Fig. Q-9), the dorsal lobe much longer than wide and apically pointed, dorsally bare and with marginal setae. The ventral lobe situated on the same level, wider and covered thickly with microtrichiae. Gonostylus (Figs. Q-8, 10) long, narrow and nearly parallel-sided, with a long apical spine, and a large subapical tooth.

Remarks: *Orthocladus frigidus* (Zetterstedt, 1852) has been recorded as being common in Europe by Edwards (1929, p. 346), Brundin (1947, p. 21), Goetghebuer (1940, p. 43), and Pinder (1978, p. 70). The morphology of the present specimen is almost coincident with these descriptions. It is a typical member of subgenus *Euorthocladus* Thienemann in the sense of Brundin (1956), since the anal point is long, stout, parallel-sided and with rounded apex, and the scutellum bears numerous setae irregularly distributed on entire surface. Most characteristic to this species is the long and stout anal point bearing lateral setae, narrow and conical lobes of gonocoxite, and the characteristic shape of gonostylus. The AR of the present specimen is nearly the same as 1.7 of *O. frigidus* reported by Edwards (1929).

19. *Cricotopus montanus* Tokunaga, 1936 (Plate VII-R)

One male, shore of Lake Panke, 15 June 1982 (No. 101 : 46).

Male. BL 3.01 mm, WL 2.24 mm. Ground color of scutum dark brown, median stripes only slightly darker and reaching only to the middle of scutum, lateral stripes black; scutellum dark brown, postnotum black, halteres brown; coxae and trochanters of all legs yellowish brown, femora of all legs dark brown, front tibia with a narrow basal dark ring, a wide apical dark ring occupying about half of the segment, and a wide pale ring between the two dark rings; middle and hind tibiae as well as all tarsal segments dark brown; abdominal segments I and II white, other abdominal tergites entirely black, distal part of gonocoxite and gonostylus pale brown.

Head in Fig. R-1. Eyes pubescent, with a conspicuous dorsomedial projection, ER 0.77. Antenna with 13 flagellar segments, AR 1.18. Antennal hairs long, AHR 0.51. Palp with 4 flagellar segments, 72, 135, 145, 210 microns. so 12 : 12, cl 16. Dorsal view of thorax in Fig. R-2. Anteprepronotum with 7 lateral setae on each side. Scutum with 20 dorsomedian setae and 21 : 24 dorsolateral setae, all minute and arising from extremely small pits. Prealar setae well developed, 3 on each side. Scutellum with 30 irregularly distributed setae. Squama with 9 fringe hairs. Wing membrane bluish, anal lobe rather obtuse. R_{2+3} ending at 0.47 between ends

of R_1 and R_{4+5} . Costa extending beyond end of R_{4+5} . fCu much beyond $r-m$, at 0.45 and 0.39 of wing length, VR 1.16. Anal vein only slightly extending beyond fCu . fLR 0.56, mLR 0.48, hLR 0.55. fTR 0.12. fBR 2.7, mBR 3.0, hBR 3.6. Front tibia with a long terminal spur (63 microns), middle tibia with two short terminal spurs (34 and 36 microns), hind tibia with a long terminal spur (76 microns), a short terminal spur (29 microns), and a terminal comb composed of 18 free spurs (32–60 microns long). Front tarsus V 0.12 times as long as front tibia. Pulvilli absent (Fig. R-6). Chaetotaxy of abdominal tergites II to IV, Fig. R-9.

Hypopygium in Fig. R-8. Ninth tergite with 14 short setae in the middle. A small, bare, conical and transparent anal point (a) is present. Gonocoxite with a quadrangulate inner lobe (b) bearing simple and stout setae, and its inner and apical margin is also produced like a rectangular process (c). The gonostylus is directed backward parallel to the body axis, and bears a long, finger-like basal process (d) with 2 or 4 short, spatulate blade on apex, and 3 stout setae (one of which is broad and sword-like). In addition, the gonostylus bears a long blade (e) arising from a large conical base, and a long seta at its base. The apical portion of gonostylus is narrow and extending like a beak to the pointed apex, but has neither apical spur nor long setae such as seen in *C. tamadigitatus*.

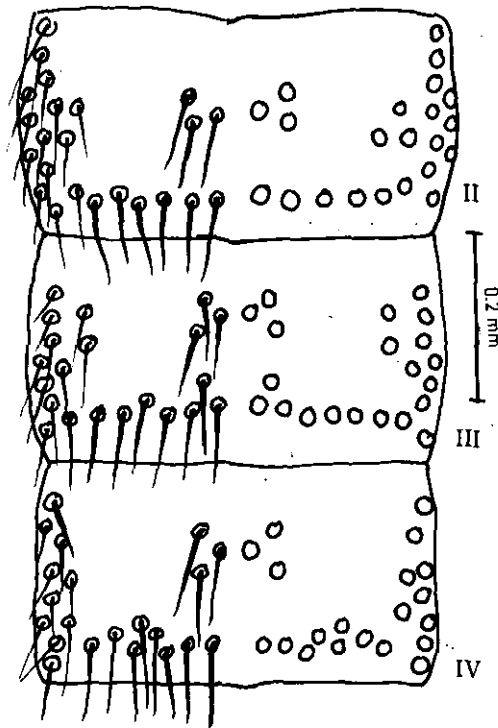


Fig. R-9 Chaetotaxy of abdominal tergites II to IV.
Cricotopus montanus Tokunaga

Remarks : This is a species recorded by Tokunaga (1936, p. 29) by male and female collected at Kamikochi, about 1500 m in altitude in Japan Alps, Nagano Prefecture. It is interesting that a specimen of apparently the same species were collected this time from Hokkaido. This species is a member of genus *Cricotopus* in wider sense, since eyes are pubescent, dorsolateral setae of scutum are all minute and arise from small pits, squama with fringe hairs, legs and abdomen with pale marks, hypopygium is paler than the preceding abdominal segments, and wing membrane is bare. However, the structure of hypopygium is highly complicated and characteristic to this species especially in that it has a small anal point, and gonostylus as well as gonocoxite bears various appendages, as stated previously. This species is closely related to *C. tamadigitatus* Sasa, 1981 in that abdominal tergites I and II are pale and the other tergites are black, and in having highly complicated appendages in gonostylus and gonocoxite, but the structure of these appendages are clearly different between the two species. According to James and Marry Sublette, there exist another species related to these in North America (personal communication), and a new subgenus will be erected for these species in a separate paper.

Two additional male specimens each belonging to different species of genus *Cricotopus* were collected on the shore of Lake Akan but their species identification will be reserved until additional specimens are collected in this area.

20. *Paracladius akansextus*, n. sp. (Plate VII-S)

Two males, shore of Lake Kussharo, 13 June 1982 (holotype: A 101: 56B; paratype: 57A).

Male: BL 3.57, 3.72 mm, WL 2.30, 2.40 mm. Ground color of scutum yellow, scutal stripes dark brown, scutellum brown, postnotum dark brown, halteres yellow, wing unmarked, legs almost uniformly dark brown (trochanter, coxa and basal portion of femur as well as middle portion of tibia slightly paler); abdominal tergites and hypopygium uniformly brown.

Head in Fig. S-1. Eyes highly pubescent, each with a conspicuous dorsomedial projection, ER 0.73, 0.78. Antenna with 13 flagellar segment, AR 1.26, 1.31. Antennal hairs long, AHR 0.46, 0.47; so 14: 14, 11: 12; cl 10, 14. Palp 4 segmented, 62, 109, 130, 185 microns long. Anteprepronotum with 8: 8, 8: 10 lateral setae. Scutum and scutellum in Fig. S-7. Dorsomedian setae 24, 26, all minute (22–30 microns long) and arising from near anterior margin of scutum. Dorsolateral setae 24: 26, 28: 30, all relatively short (62–69 microns long) and narrow, arising from small pits without pale holes. Prealar setae 4: 4, 4: 6, much longer and stouter than the dorsolaterals. Scutellar setae 10 in both, also long and stout, arising on a single line.

Wing membrane bare, slightly brown by transmitted light. Wing venation in Fig. S-2. Squama with 22–22, 26–27 fringe hairs. Anal lobe conspicuously produced. Costa extending beyond end of R_{4+5} . R_{2+3} ending closer to end of R_1 than to end of R_{4+5} . fCu slightly beyond r-m, 42% and 44%, VR 1.05. Cu_2 nearly straight. Anal vein extending beyond fCu . Front tibia with a long and slender terminal spur (72 microns; Fig. S-3). Middle tibia with two short terminal spurs (35 and 36 microns; Fig. S-4). Hind tibia with a long terminal spur (73 microns), a short

tetraminal spur (32 microns), and a terminal comb composed of 12 free spurs 27–56 microns long (Fig. S-6). fLR 0.71, 0.74, mLR 0.53, 0.54, hLR 0.59, 0.60, fTR 0.13, fBR 2.3, 2.7, mBR 3.0, 3.2, hBR 3.3, 4.8. Pulvilli absent. All tarsi without terminal spurs, and without sensory spines. Tarsus IV longer than tarsus V in all legs.

Hypopygium in Fig. S-8. Ninth tergite with 10 short setae in the middle, and with a narrow, conical anal point (35 microns long and 15 microns wide at the base) with pointed apex, bearing numerous microtrichiae on dorsal surface and 3 or 4 lateral setae on both sides. Inner lobe of gonocoxite shoe-shaped, constricted at base and produced posteriorly, bearing some 15 setae on the margin. Gonostylus with a conspicuous subapical flange, and a terminal spur.

Remarks: This species belongs to the *Cricotopus* group of subfamily Orthocladiinae, since wings are bare, squama fringed, eyes highly pubescent, and dorsal setae of scutum all weak and arising from small pits. However, it differs from species of genus *Cricotopus* in the strict sense in that body is almost uniformly dark and devoid of pale markings on abdomen and legs, and with a large anal point. It can therefore be classified into genus *Paracladius* Hirvenoja, 1973. Three species have been recorded within this genus by Hirvenoja (1973, p. 90), among which the present species is most closely related to *P. quadrinodosus* Hirvenoja, 1973, in that it has a large anal point (anal point of the other two species is minute), but the AR is much larger (1.83–2.03), the number of setae on ninth tergite also much larger (more than 20), and the inner lobe of gonocoxite is narrower and with a more pointed apex in the allied species than in the present new species.

21. *Pseudorthocladius akanseptimus*, n. sp. (Plate VIII-T)

Three males, shore of Lake Kussharo, 13 June 1982 (holotype: No. A 101: 61; paratypes: A 101: 62A, 62B).

Male: BL 2.48, 2.59, 2.66 mm in the 3 specimens, WL 1.83, 1.83, 1.86 mm. Body largely dark brown, *i. e.* ground color of scutum yellowish brown, scutal stripes dark brown, scutellum dark brown, postnotum nearly black, leg segments and abdominal tergites almost uniformly dark brown, halteres yellow. Head in Fig. T-1. Eyes bare and reniform, ER 1.21, 1.50, 1.52. Antenna with 13 flagellar segments as usual, AR 1.11, 1.11, 1.13. Antennal hairs long, AHR 0.53, 0.58, 0.59. so 10–12 (mean 10.7), cl 4, 4, 5. Palp with 4 flagellar segments as usual, 62, 105, 92, 130 microns long. Anteprepronotum without dorsal setae, and with 8–12 (10.0) lateral setae. Scutum with 12, 15, 16 dorsomedian setae which are all minute and arising from small pits, 10–12 (10.8) dorsolateral setae which are long, stout and arising in large pale pits, and 6 or 7 prealar setae on each side; scutellar setae 8, 10, 10 (Fig. T-2). Wing in Fig. T-3. Squama with 5–8 (6.0) fringe hairs. Anal lobe obtuse. Wing membrane bare and very finely granular, slightly bluish under transmitted light. Costa slightly produced beyond end of R_{4+5} . R_{2+3} clearly separated from both R_1 and R_{4+5} , ending at 0.52 of the distance between ends of R_1 and R_{4+5} . Vein R with 14–18 setae, R_{4+5} without setae. fCu slightly beyond r-m, at 0.42 and 0.45 of the wing length, respectively. Cu_2 moderately sinuate.

Front tibia with a long terminal spur (55 microns, Fig. T-4). Middle tibia with two rather short terminal spurs (40 and 42 microns, Fig. T-5), hind tibia with a long terminal spur (68 microns), a short terminal spur (30 microns), and a terminal

comb composed of some 18 free spurs 28—50 microns long (Figs. T-6, 7). fLR 0.51—0.54, mLR 0.42—0.44, hLR 0.55—0.56. fTR 0.11—0.12. fBR 2.9—3.2, mBR 3.0—3.3, hBR 4.3—5.2. Pulvilli well developed, claws with forked apex, empodium also well developed (Fig. T-8).

Hypopygium in Fig. T-9. Ninth tergite rather short and wide, posterior margin only slightly convex. Anal point robust, almost conical but with rounded apex, densely covered with microtrichiae, and bears some 15 rigid setae on dorsal and lateral side. Gonocoxite nearly conical, inner lobe low and very broad, extending from 0.55 to 0.80 the length of gonocoxite, bearing numerous micro and macrotrichiae, posterior corner nearly rectangular. Virga absent. Gonostylus densely covered by coarse microtrichiae, widest at about middle, lateral margin smoothly convex and inner margin strongly angulate, without apical projection and without subapical flange, and with a dark and strong apical spur (Figs. T-10, 11).

Remarks: This species belongs to the genus *Pseudorthocladius* Goetghebuer, 1943, as redefined by Goetghebuer (1944), Brundin (1956), Pinder (1978), and Saether & Sublette (1983), since wings are bare, eyes bare, squama with fringe hairs, vein Cu_2 sinuate, costa produced beyond end of R_{4+5} , legs with distinct pulvilli, and anal point roughly conical and with strong setae. Saether and Sublette (1983) published a comprehensive review of this genus, divided it into two subgenera, *Lordella* and *Pseudorthocladius*, and described more than 20 species from the Holarctic region. The present species belongs to the subgenus *Pseudorthocladius*, and is apparently closest to *P. dumicaudus* Saether, 1969, in that inner lobe of gonocoxite is broad and roughly rectangular, virga absent, AR slightly larger than 1.0, anal point robust and with strong setae. However, the present species differ remarkably in the shape of gonostylus and of inner lobe of gonocoxite from the allied one, as well as in the absence of setae on R_{4+5} .

Two species of genus *Pseudorthocladius* were recorded from Japan, *P. fujiocavus* Sasa, 1985 and *P. fujinonus* Sasa, 1985, both collected on the shore of lakes in the Mount Fuji area. Both species have long and narrow inner lobe on gonocoxite, and thus seem to be closer to subgenus *Lordella* than to subgenus *Pseudorthocladius*, but they differ from both of the two species of this subgenus described from North America by Saether & Sublette (1983), *P. wingoi* and *P. comans*, in the structure of gonostylus, inner lobe of gonocoxite and the virga.

22. *Heterotrissocladius subpilosus* (Kieffer, 1911) (Plate VIII-U)

33 males and 12 females, shore of Lake Kussharo, 13 June 1982 (No. A101: 01—41).

Male: BL 4.08—4.59 (4.39 in average of 10) mm, WL 2.30—2.76 (2.60) mm. Body coloration almost uniformly black (or slightly brownish), halteres brown, leg segments uniformly dark brown. Head in Fig. U-1. Eyes bare, with a conspicuous dorsomedial projection, ER 0.72—0.96 (0.81). Antenna with 13 flagellar segments, AR 1.66—2.02 (1.77), AHR 0.46—0.62 (0.54). so 12—16 (13.8), cl 10—14 (12.5). Clypeus wider than long, and wider than the diameter of pedicel. Palp with 4 flagellar segments, 75, 180, 152, 196 microns. Anteprepronotum without dorsal setae, and with 3—5 (3.3) lateral setae. Thorax in Fig. U-5. Scutum without dorsomedian setae in all the specimens examined, with 8—16 (12.8) well developed dorsolateral setae

arising from large pale pits, and 6—8 (7.2) prealar setae. Scutellar setae 14—18 (16.4).

Wing membrane slightly bluish, and with macrotrichiae on distal portion and between veins R and M, M and Cu₁, Cu₁ and Cu₂, and also on veins M, Cu and its branches, and An. Squama with 21—32 (26.7) fringe hairs. Anal lobe moderately produced. Venation in Fig. U-3. R₂₊₃ separated from R₁ and R₄₊₅, ending about midway between ends of the two veins. fCu slightly beyond r-m, at 0.40 and 0.45 of wing length, VR 1.12. Cu₂ only slightly sinuate. Anal vein extending beyond fCu. Costa ending at the end of R₄₊₅ and not extending beyond it. Leg segments long and slender, fLR high as a member of Orthoclaadiinae, 0.80—0.89 (0.87); mLR 0.52—0.57 (0.55), hLR 0.59—0.65 (0.62). Front tarsus V 0.14—0.16 (0.15) times as long as front tibia. fBR 2.1—3.1 (2.7), mBR 3.3—6.0 (4.5), hBR 5.9—6.6 (6.2). Front tibia with a long terminal spur (72 microns; Fig. U-6), middle tibia with two short terminal spurs (28 and 40 microns; Fig. U-7), hind tibia with a long terminal spur (72 microns), a short terminal spur (15 microns), and a terminal comb composed of 12 or 13 free spurs 35—75 microns long (Figs. U-8, 9). Tarsus V without pulvilli (Fig. U-10).

Hypopygium in Fig. U-11. Ninth tergite with rounded posterior margin, without long setae in the middle. Anal point robust, widest at base and tapering towards rounded apex, thickly covered with microtrichiae, and with short setae on lateral and ventral sides. Inner lobe of gonocoxite wide and with rounded margin, bearing numerous rigid setae. Gonostylus widest at apex and tapering towards base, apically truncate, and with a small subapical tooth (Crista dorsalis of Saether, 1975, p. 13).

Female: BL 3.31—4.08 (3.65 in average of 10) mm, WL 2.30—2.65 (2.55) mm. Body coloration paler in general than in male, *i. e.* ground color of scutum brown, scutal stripes dark brown, scutellum brown, postnotum black, abdominal tergites dark brown, leg segments brown, halteres brown. Head in Fig. U-2. Eyes bare, reniform, ER 0.59—0.82 (0.65). Antenna with 5 flagellar segments, segments II to IV fusiform, last segment 0.42—0.47 (0.45) times as long as the combined length of I to IV, bearing one or two subterminal setae. Palp with 4 flagellar segments. so 12—18 (14.7), cl 14—20 (15.8). Lateral pronotal setae 3—6 (3.9). Scutum without dorsomedian setae as in male, dl 18—28 (21.8), pa 7—10 (8.35), sc 18—24 (19.9). Wing in Fig. U-4. Squama with 23—36 (29.7) fringe hairs. Anal lobe prominent. Costa not extending beyond end of R₄₊₅. Cu₂ slightly sinuate. Wing membrane almost entirely covered with macrotrichiae (more hairy than in male), vein R₁, R₂₊₃, M, Cu, Cu₁, Cu₂ and An also bearing numerous macrotrichiae. fLR 0.82—0.86 (mean 0.84, relatively high as a member of Orthoclaadiinae), mLR 0.52—0.54 (0.53), hLR 0.59—0.63 (0.61). Tarsus V of front leg 0.14—0.16 (0.15) times as long as front tibia. fBR 2.3—4.4 (2.7), mBR 2.3—3.7 (2.8), hBR 2.8—5.0 (3.5), some specimen bearing long tarsal beards. Pulvilli absent. Spermathecae two, 50×62 microns and 65×52 microns, both dark brown in color (Fig. U-12). Cercus ear-shaped, with a long and narrow ventral process, 126 microns long and 76 microns high (Fig. U-13).

Remarks: This species belongs to genus *Heterotrissocladius* Sparck 1922, since the wing membrane has numerous macrotrichiae, gonostylus simple, eyes bare, Cu₂ only slightly curved, anal tergite normally developed and with a large anal point, and costa ending at tip of R₄₊₅ (Brundin 1956, p. 80; Pinder, 1972, p. 46). Among the Palaearctic and Nearctic species of this genus described in details by

Saether (1975a), the present species is morphologically almost coincident with *H. subpilosus* (Kieffer) in that male has macrotrichiae restricted to distal portion of wing, clypeus is wider than pedicel, and AR being about 1.8 (1.66–2.02). The structure of male hypopygium and other measurement data, including relatively high fLR ratio, also coincide with the description of *H. subpilosus* of Saether (1975a, p. 11). This author and also Brundin (1949) reported that this species represents an important bottom fauna of mountain lakes in northern Europe. It is ecologically interesting that a large number of specimens of apparently the same species were collected on the shore of a mountain lake in Hokkaido, northern Japan.

23. *Parachaetocladius akanoctavus*. n. sp. (Plate IX-V)

23 males and 11 females, shore of Lake Kussharo, 13 June 1982 (holotype: A 101: 21A; paratypes: other males and females, A 101: 03–40),

Male: BL 3.64–4.60 (4.07 in average of 10) mm, WL 2.22–2.73 (2.48) mm. Body almost entirely black, *i. e.* antennal shaft dark brown, hairs dark grey, ground color of scutum black, stripes shining black, scutellum dark brown, halteres dark brown, abdominal tergites dark, hypopygium dark brown, leg segments uniformly dark brown. Eyes bare, reniform, inner margin concave, ER 1.38–1.52 (1.48). Head in Fig. V-2. Antenna with 13 flagellar segments, AR 1.50–1.72 (1.63), last segment with a strong terminal seta. Antennal hairs long, AHR 0.59–0.69 (0.63), so 12–20 (14.8), cl 10–18 (13.9). Anteprepronotum bare dorsally, and with 8–14 (11.0) lateral setae. Scutum and scutellum in Fig. V-3. Scutum with no dorsomedian setae, 20–33 (26.9) dorsolateral setae all simple and arising from large pale pits, and 10–12 (11.2) pre-alar setae. Scutellar setae 18–36 (24.6). Wing membrane granular like in species of *Limnophyes*, slightly bluish by transmitted light. Squama with 17–32 (25.8) fringe hairs. Wing venation in Fig. V-1. R_{2+3} separated from R_1 and R_{4+5} , ending about midway between ends of the last two veins. Costa not extending beyond end of R_{4+5} . fCu slightly beyond r-m, 0.45 and 0.43 Cu_2 slightly sinuate. Anal vein extending beyond fCu. Anal lobe strongly produced. Terminal structure of tibiae usual as a member of Orthocladiinae, *i. e.* front tibia with a long terminal spur (95 microns long; Fig. V-4), middle tibia with two short terminal spurs (37 and 48 microns long; Fig. V-5), hind tibia with a long terminal spur (72 microns), a short terminal spur (41 microns), and a terminal comb composed of 14 free spurs 30–45 microns long in the type specimen (Fig. V-6). Tarsal segments without terminal spurs. Tarsal beards rather short, fBR 2.3–3.3 (2.7), mBR 2.6–4.8 (3.4), hBR 3.4–5.3 (4.3). Front tarsus V 0.10–0.12 (0.11) times as long as front tibia. All legs with a pair of large pulvilli (Fig. V-7).

Hypopygium in Figs. V-8–10. Anal point wide, low and crescent-shaped, bearing more than 10 short and stout bristles on posterior margin. Posterior margin of ninth tergite concave in the middle. Gonocoxite with a finger-like dorsal lobe bearing several simple setae (Fig. V-10), and a small accessory lobe on ventral side (Fig. V-9). Structure of gonostylus characteristic to this species, widest at near apex, with a beak-like apical process and a wide subterminal swelling on inner side, and a strong terminal spine accompanied by two stout subterminal setae (Figs. V-8, 9, 10). Virga small, peg-like.

Female: BL 2.95–3.57 (3.22 in average of 10) mm, WL 2.19–2.55 (2.38) mm.

Body coloration as in male but generally paler, *i. e.* ground color of scutum yellow, scutal stripes dark brown, median stripes separated in the middle, and prescutellar area yellow; halteres brown, leg segments almost uniformly dark brown, abdominal tergites dark brown

Head in Fig. V-11. Eyes bare, reniform and inner margin slightly concave, ER 0.90—1.23 (mean 1.06). Antenna with 5 flagellar segments, segment I with double rows of antennal hairs, segments II, III and IV fusiform, last segment 0.31—0.35 (0.32) times as long as the combined length of flagellar segments I to IV, widest at about basal 1/3 and tapering towards apex, with one or two long subapical setae. Palp 5 segmented, first segment without long seta, 44, 68, 125, 140, 195 microns long in a paratype. Supraorbital setae 14—24 (most frequently 16, mean 17.1), clypeal setae also 14—24 (mean 19.7). Anteprenotum without dorsal setae, and with 10—15 (12.7) lateral setae. Scutum without dorsomedian setae in all the specimens examined as in the male, with 26—38 (31.4) dorsolateral setae all arising from small pale pits, and 12—18 (14.8) pre-alar setae. Scutellar setae 26—38 (29.7). Wing venation as in male but relatively wider. Squama with 24—37 (29.9) fringe hairs. Distribution of terminal spurs of tibiae as in male, tarsi without terminal spurs. fLR 0.58—0.62 (0.60), mLR 0.37—0.41 (0.39 unusually small), hLR 0.52—0.55 (0.53), fTR 0.11—0.13 (0.12), fBR 1.7—2.3 (2.0), mBR 1.9—2.3 (2.1), hBR 2.0—3.0 (2.6). All legs with a pair of large pulvilli. Spermathecae two, both egg-shaped, 110×60 and 75×65 microns (Fig. V-12). Cercus almost as long as wide and with rounded posterior margin, 98 microns long and 92 microns wide, nearly circular and not ear-shaped as in most other females of Orthoclaadiinae (Fig. V-13).

Remarks: This species seems to belong to the group within the subfamily Orthoclaadiinae discussed by Saether & Sublette (1983), since eyes are bare, squama fully fringed by hairs, Cu_2 curved, and pulvilli are well developed. Among 4 genera included in this group, the present species is most closely allied to the genus *Parachaetocladius* Wülker, because gonostylus has a conspicuous apical projection, acrostichals (dorsomedian setae of scutum) are absent, and anal point is low and rounded. Of 4 species described within this genus, the present species is apparently closest to *P. imberbus* Saether et Sublette, 1983, in that inner lobe of gonocoxite being well developed and digitiform, and AR is 1.5 or larger. However, the present species has much more pronounced apicodorsal projection on gonostylus, inner lobe of gonocoxite is narrower and longer, higher AR (1.50—1.72 in the present species, 1.09—1.12 in *imberbus*), and more numerous setae on scutum and scutellum (dorsomedian setae are absent in both species, but dorsolaterals are 20—33 versus 15—16, prealars 10—12 versus 4, scutellars 18—36 versus 13—14).

The present species is also somewhat related to the genus *Limnophyes* Eaton in that wing membrane is coarsely granular, anal point is low and bearing strong setae, and gonostylus is highly modified in structure, but previously known species of this genus are all very small, squama with only a few fringe hairs, mostly bear lanceolate setae on scutum, anal lobe of wing is obtuse and not strongly produced as in the present species, costa produced beyond of R_{4+5} , and pulvilli are absent. It is also somewhat related to genus *Psectrocladius* Kieffer in that it has large pulvilli and many fringe hairs on squama, but differs from species of this genus in that wing membrane is granular, anal point is low and rounded, and inner lobe of gonocoxite being digitiform. The present species is thus tentatively placed in genus *Parachaetocladius*, but its taxonomic status should be revised by future studies.

24. *Limnophyes akannonus*, n. sp. (Plate IX-W)

Three males, shore of Lake Kussharo, 15 June 1982 (holotype: No. A 101: 71; paratypes: 101: 72A, 72B).

Male: BL 2.07, 2.24, 2.41 mm, WL 1.45, 1.52, 1.55 mm. Scutum, scutellum and postnotum black, abdominal tergites I—VIII brown, hypopygium dark brown, legs dark brown, halteres brown. Head in Fig. W-1. Eyes bare, reniform and without dorsomedial projection, ER 1.28, 1.44, 1.50. Antenna with 13 flagellar segments as usual, AR 0.85, 0.86, 0.90, last segment without terminal seta and not expanded apically. Antennal hairs well developed, AHR 0.45, 0.50, 0.51. Palp with 4 flagellar segments, 40, 87, 84, 120 microns in the type specimen. Supraorbital setae 4: 4 in one and 6: 6 in two specimens, clypeal setae 12, 14, 16. Anteprenotum (Fig. W-2) well developed, with 2 or 3 dorsal setae and 3, 4 or 5 lateral setae. Scutum (Fig. W-3) without dorsomedian setae but with numerous dorsolateral setae, among which about 10 on the lateral and anterior portion as well as about 8 on the prescutellar area are short and lanceolate (some 30 microns long and 4 microns wide), the remainder of the more median setae are long and simple (some 100 microns long and 4 microns wide), with the total number of dorsolateral setae on each side being 58—75 (mean 64.2). Prealar setae 7: 7 in one and 10: 10 in two specimens. Scutellar setae 5 or 6.

Wing membrane coarsely granular (a characteristic of this genus). Venation in Fig. W-4. Squama with 4 fringe hairs in all the specimens. Anal lobe rather obtuse. R_{2+3} ending about midway between ends of R_1 and R_{4+5} . fCu much beyond r-m, 52% and 39% of wing axis, VR 1.31. Cu_2 bent in the middle. Anal vein ending at the level of fCu. Costa extending beyond end of R_{4+5} . Front tibia with a long terminal spur (63 microns, Fig. W-5). Middle tibia with two short terminal spurs (22 and 23 microns, Fig. W-6). Hind tibia with a long terminal spur (60 microns), a short terminal spur (38 microns) and a terminal comb composed of 10 free spurs 22-52 microns long (Fig. W-7). fLR 0.55, 0.55, 0.56; mLR 0.49 in all; hLR 0.56, 0.57, 0.57. fBR 2.3, 2.7, 2.8; mBR 2.2, 2.5, 2.7; hBR 3.2, 3.2, 3.8. fTR 0.11, 0.12, 0.12. Pulvilli present but very small, empodium well developed, claws with barbs at base and forked apically (Fig. W-8).

Hypopygium in Fig. W-9. Posterior margin of ninth tergite rounded but slightly concave in the middle. Anal point absent, ninth tergite without long setae in the middle and with some 12 short setae along posterior margin. Inner lobe of gonocoxite double, the dorsal lobe small and fingerlike, the ventral lobe low, wide and with rounded margin. Gonostylus peculiarly shaped, widest at about middle and tapering towards apex, outer margin slightly concave and inner margin strongly convex, with a beak-like apical process, a small rectangular subapical tooth and a long subapical spine (length of gonostylus 110 microns, subapical spine 30 microns; Figs. W-9, 10).

Remarks: This species is a typical member of genus *Limnophyes* Eaton, since wing membrane is coarsely granular, vein Cu_2 strongly sinuate, costa extending much beyond end of R_{4+5} , squama with a few fringe hairs, anal lobe of wing obtuse, eyes bare, and scutum with lanceolate setae in both humeral and prescutellar areas. Among species of this genus known from Europe (Edwards, 1929, Goetgh-

ebuer, 1940, Pinder, 1978), it is somewhat related to *L. truncorum* Goetghebuer, 1921, especially in the peculiar structure of gonostylus, but the present species is different from the allied in that outer margin of gonostylus is concave and its inner margin strongly convex (both slightly convex in the latter), and in having lanceolate setae both in the humeral and prescutellar areas of scutum (only in the prescutellar area and not in humeral area in *truncorum* according to Goetghebuer, 1940, p.143. Among the Nearctic *Limnophyes* reviewed by Saether (1975b), the present species is most allied to *L. eltoni* (Edwards) in that lanceolate setae are present both on humeral and prescutellar areas of scutum, and gonocoxite has two inner lobes, but the present species has no anal point (this is present in *L. eltoni*) and the shape of gonostylus is quite different.

25. *Limnophyes akanangularius*, n. sp. (Plate X-X)

Four males, shore of Lake Panke, and one male, shore of Lake Akan, 15 June 1982 (holotype: A 101: 74A; paratypes: A 101: 74B, 75A, 75B, 76B).

Male: BL 1.59–1.93 (mean 1.75) mm, WL 1.17–1.28 (1.21) mm, both smaller than in the previous species. Body coloration almost uniformly dark brown, *i.e.* scutum dark brown and stripes hardly distinguishable, scutellum and postnotum nearly black, halteres and leg segments dark brown, abdominal tergites dark brown and sternites yellowish brown.

Head in Fig. X-1. Eyes bare, without dorsomedial projection and widely apart from each other, ER 1.23–1.81 (1.50). Antenna with only 12 (4 specimens) or 11 (one specimen) flagellar segments, AR 0.50–0.63 (0.56), last segment slightly expanded apically and without apical spur. AHR 0.43–0.47 (0.45), supraorbitals composed of a median seta and 3–5 (usually 4) lateral setae. Clypeals 12–16 (13.7). Anteprepronotum well developed, with one dorsal seta and 1–3 lateral setae (Fig. X-2). Scutum with 4 or 5 minute dorsomedial setae, 3–5 short lanceolate setae on the shoulder, and 4–6 short lanceolate setae in the prescutellar area (all about 30 microns long and 4 microns wide; Fig. X-4), and with 13–22 long simple dorsolateral setae (about 100 microns long; Fig. X-3).

Wing membrane coarsely granular. Venation in Fig. X-5. Anal lobe almost flat. Costa extending much beyond end of R_{4+5} . fCu much beyond $r-m$, 52% and 38% of wing axis, respectively, VR 1.38. Cu_2 strongly sinuate. Squama with 1–3 (mean 2.0) fringe hairs. Tips of tibiae in Figs. X-6, 7, 9, 10. fLR 0.49–0.53 (0.51), mLR 0.47–0.48 (0.47), hLR 0.53–0.56 (0.55), fTR 0.12–0.14 (0.13), fBR 2.0–2.7 (2.4), mBR 2.5–3.5 (2.9), hBR 2.6–4.7 (3.6). Pulvilli absent (Fig. X-8).

Hypopygium in Figs. X-11, 12. Ninth tergite with a smoothly rounded posterior margin, anal point absent, no long setae in the middle, and some 12 short setae on the posterior margin. Inner lobe of gonocoxite broad and almost rectangular or acutely angulate. Gonostylus relatively slender and almost parallel-sided, apically truncate and with a triangular subapical tooth and a strong apical spine (Figs. X-11, 12, 13).

Remarks: This species is also a typical member of genus *Limnophyes* Eaton in the characteristic structure of wing membrane, wing venation, and hypopygium, and is again somewhat related to *L. truncorum* (Goetghebuer, 1921) in that scutum has lanceolate setae (in both shoulder and prescutellar areas), and gonostylus bears

a long apical spine, but the lanceolate setae are much longer in the present species (only about 22 microns long in *truncorum* according to Pinder, 1978), and the shape of inner lobe of gonocoxite is quite different between the two species (narrow and finger-like in *truncorum*, cf. Pinder, 1978, Fig. 128C). Among the Nearctic *Limnophyes* described by Saether (1975b), it is closest to *L. ninae* Saether 1975 in that lanceolate setae are present on both prescutellar and humeral areas of scutum and antenna is composed of only 11 or 12 flagellar segments, but again differs from it in the absence of anal point and much wider inner lobe of gonocoxite in the present species. As for differentiation from other Japanese *Limnophyes*, see the attached key.

26. *Limnophyes akanundecimus*, n. sp. (Plate X-Y)

One male, shore of Lake Panke, 15 June 1982 (No. A 101 : 77B).

Male: BL 1.97 mm, WL 1.28 mm. Ground color of scutum dark brown, scutal stripes, scutellum and postnotum black, leg segments almost uniformly dark brown, abdominal tergites I to VIII brown, hypopygium dark brown. Head in Fig. Y-1. Eyes bare, reniform, inner margin slightly concave and without dorsomedial projection, ER 1.50. Antenna with 13 flagellar segments, AR 0.87, AHR 0.45. Supraorbital area with a pair of median seta, and 4 or 5 lateral setae. Palp with 4 flagellar segments (36, 90, 72, 110 microns). Clypeal setae 14. Anteprepronotum (Fig. Y-2) with 2 : 2 dorsal setae, and 3 : 3 lateral setae. Scutum with 8 minute dorsomedian setae arising in the middle portion, dorsolateral setae 12 : 13, all long and simple, none of them lanceolate, prealar setae 6 : 7 (Fig. Y-3). Scutellar setae 6, in a transverse row.

Wing membrane coarsely granular. Venation in Fig. Y-4. Squama with 5 fringe hairs. Costa extending beyond end of R_{4+5} . fCu much beyond r-m, VR 1.26. Cu_2 short and strongly bent. Anal vein ending at the level of fCu. Anal lobe of wing rather obtuse. fLR 0.53, mLR 0.44, hLR 0.58, fBR 2.0, mBR 2.3, hBR 3.1. Front tibia with a long terminal spur (50 microns long; Fig. Y-5), middle tibia with two short terminal spurs (20 and 25 microns; Fig. Y-6), hind tibia with a long terminal spur (50 microns), a short terminal spur (21 microns), and a terminal comb composed of 12 free spurs 22—45 microns long (Fig. Y-7). Tarsi V shorter than tarsi IV in all legs, pulvilli absent (Fig. Y-8).

Hypopygium in Figs. Y-9, 10. Ninth tergite with a dark brown, conical anal point bearing numerous setae. Inner lobe of gonocoxite longer than wide and with rounded margin. Gonostylus nearly parallel-sided, apically truncate, without subapical flange, and with a stout subapical spur.

Remarks: Among the previously recorded species of this genus, the present specimen is closest to *L. minimus* (Meigen, 1818) as it has no lanceolate setae on scutum, antenna with 13 flagellar segments, and gonocoxite with only one inner lobe, but differs from *minimus* in the shape of inner lobe (much broader in *minimus* according to Pinder, 1978, Fig. 130A), and in the presence of distinct anal point (anal point is absent in *minimus*).

Key to males of genus *Linnophyes* recorded from Japan

- 1 — Gonostylus without apical spine, angularly produced dorsally and tapering towards pointed apex2
 - Gonostylus with apical spine3

- 2 — Anal point present; antenna with 13 flagellar segments, AR 0.56—0.60; prescutellar area with numerous lamellar setae*prolongatus* Kieffer sensu Tokunaga, 1965
 - Anal point absent; antenna with only 12 flagellar segments, AR 0.22—0.30; no lamellar setae in prescutellar area*tamakireides* Sasa, 1983

- 3 — Dorsolateral setae of scutum usually 8—12, all simple4
 - Dorsolateral setae of scutum usually 18 or more (sometimes more than 50), and with lamellar setae in humeral or prescutellar area7

- 4 — Antenna with 13 flagellar segments, AR about 0.9; anal point present*akanundecimus* n. sp.
 - Antenna with 12 or less flagellar segments5

- 5 — Anal point present; inner lobe of gonocoxite broad and with angulate margin; gonostylus truncate apically, and with an angulate subapical tooth*fujinonus* Sasa, 1985
 - Anal point absent; inner lobe of gonocoxite with rounded margin; gonostylus without angulate subapical tooth6

- 6 — Antenna with 10 flagellar segments, AR 0.37; inner lobe of gonocoxite single, broad and with rounded margin*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*hudsoni* Saether, 1975 sensu Sasa et Kikuchi, 1986

- 7 — Gonostylus with convex inner margin, widest at about basal 1/3 and tapering towards pointed apex, with a long (about 30 microns long) 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*akannonus*, n. sp.
 - Gonostylus apically rounded or truncate, apical spine much shorter8

- 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 sete; 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 seta, 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*, n. sp.

27. *Smittia aterrima* (Meigen, 1818) (Plate XI-ZA)

One male, shore of Lake Akan, 13 June 1982 (No. 101 : 81B).

Male : BL 2.26 mm, WL 1.71 mm. Body coloration almost uniformly dark brown, including scutum, scutellum, postnotum, abdominal tergites and leg segments. AR 1.49, AHR 0.52, ER 1.23, so 10 : 11, cl 8, dm 10, dl 12 : 12, pa 4 : 4, sc 8, fLR 0.53, fLR 0.59, mLR 0.46, hLR 0.57 ; fTR 0.11 ; fBR 4.7, mBR 7.5, hBR 7.6, tarsi with long beards. Head in Fig. ZA-1. Antenna with 13 flagellar segments, last segment with a conspicuous terminal spur (Fig. ZA-2). Eyes highly pubescent, inner margin concave. Scutum and scutellum in Fig. ZA-8. Dorsomedian setae of scutum all minute, lateral setae all simple, arising from large pale pits. Front tibia with a long terminal spur 75 microns long (Fig. ZA-4), middle tibia with two short terminal spurs (Fig. ZA-5), hind tibia with a long terminal spur (63 microns), a short terminal spur (23 microns), and a terminal comb composed of 13 free spurs 30—50 microns long (Fig. ZA-6). Other leg segments without terminal spurs. Claws well developed, apically forked and with basal setae, pulvilli absent (Fig. ZA-7). Wing membrane smooth, slightly brownish. Venation in Fig. ZA-3. Squama bare, anal lobe rather obtuse. Costa extending much beyond end of R_{4+5} . R_{2+3} separated from R_1 and ending closer to end of R_{4+5} than to end of R_1 . Cu_2 strongly sinuate. fCu much beyond r-m, at 51% and 38% levels of wing length respectively, VR 1.33. Anal veins not forked.

Hypopygium in Figs. ZA-9, 10. Ninth tergite without long setae in the middle. Small anal point is present. Virga present, a small crown composed of 6 short spines located between bases of gonocoxites. Inner lobes of gonocoxite double, a small semicircular dorsal lobe without setae, and a lower ventral lobe bearing both macro and microtrichiae. Gonostylus with a low and rounded subapical flange occupying about 1/3 of the inner margin, and a stout apical spur.

Remarks : *S. aterrima* is a species widely distributed in Europe (Edwards, 1929, p.360 ; Goetghebuer, 1940, p.86 ; Brundin, 1947, p.42 ; 1956, p.147 ; Pinder, 1978, p.96), and was recorded also from Japan by Tokunaga (1940, p.298) from Hokkaido, and by Sasa (1985c, p.121) from lakes in Fuji area.

28. *Smittia nudipennis* (Goetghebuer, 1913) (Plate XI-ZB)

Six males, shore of Lake Panke, 15 June 1982 (No. A 101 : 81A, 82, 83A, B, 84A, B).

Male: BL 1.74–1.94 (1.87 in average of 6) mm, WL 1.19–1.36 (1.27)mm. AR 1.05–1.33 (1.15), AHR 0.51–0.59 (0.57), ER 1.19–1.46 (1.28), so 4 in all, cl 6 or 8 (6.7), pn 0 or 2 (in 1), dm 0, dl 9–15 (11.1), pa 3–8 (mean 4.8, most frequently 4), sc 6 (in 4) or 8 (in 2), sq 0, fLR 0.51, mLR 0.41–0.43, hLR 0.52–0.54, fTR 0.12, fBR 4.0–4.3, mBR 3.8–4.3, hBR 5.0–6.6. Other morphological characters as described by Sasa (1985c, p.122) with specimens collected in the Fuji area. Scutum and scutellum in Fig. ZB-1, dorsomedian setae absent in all the specimens. Hypopygium in Figs. ZB-2, 3. Anal point long, slender and without microtrichiae. Inner lobe of gonocoxite small and hyaline. Gonostylus with a wide and conspicuous subapical swelling. Virga absent.

Remarks: This is also a species widely distributed in Europe (Edwards, 1929, p.362; Goetghebuer, 1940, p.97; Brundin, 1947, p.44; Pinder, 1978, p.96), and was recorded also by Tokunaga (1939, p.312) from Taiwan, and by Sasa (1985, p.122) from lakes in Fuji area.

29. *Smittia akanduodecima*, n. sp. (Plate XI-ZC)

One male, shore of Lake Panke, 15 June 1982 (No. A 101 : 77A)

Male: BL 2.05 mm, WL 1.44 mm. Body almost uniformly dark brown, halteres yellowish brown. Antenna with 13 flagellar segments, AR 1.14, AHR 0.52. Supraorbitals 4 : 4, clypeals 8. Eyes pubescent, inner margin only slightly concave, eyes widely separated from each other, ER 1.31. No seta was visible on antepnotum. Scutum without dorsomedian setae, with 6 : 8 dorsolateral setae, and 3 : 3 prealar setae (Fig ZC-1). Scutellar setae 6. Wing in Fig. ZC-2. Squama bare, anal lobe obtuse. Wing membrane smooth, slightly brown (granular and bluish in *Limnophyes* spp.). R_1 and R_{4+5} only narrowly separated, but R_{2+3} separated from both veins. Costa extending much beyond end of R_{4+5} . fCu much beyond r-m, 0.49 and 0.40 of wing length, VR 1.20. Cu_2 strongly sinuate, anal vein extending beyond fCu. Front tibia with a long terminal spur (35 microns), middle tibia with two short terminal spurs (22 and 24 microns), hind tibia with a long terminal spur (46 microns), a short terminal spur (22 microns), and a terminal comb composed of 12 free spurs (20–50 microns); other leg segments without terminal spur. fLR 0.51, mLR 0.42, hLR 0.55, fTR 0.12, fBR 3.4, mBR 4.6, hBR 5.1. Pulvilli absent.

Hypopygium Figs. ZC-3, 4. Ninth tergite with 8 short setae in the middle near base of anal point. Anal point 27 microns long and 4 microns wide, needle-like. Gonocoxite with a small, rounded inner lobe. Gonostylus widest near apex and tapering towards base, with a strong apical spur, and a conspicuous, angulate and wide subapical tooth. Virga absent.

Remarks: This species is similar in morphological characters to *S. aterrima* (Meigen), which was collected also in this area, but after detailed comparative study judged as a different new species, since body size is much smaller, AR also much smaller, dorsomedian setae of scutum absent, anal lobe of wing more reduced, R_1 and R_{4+5} running closer and costa more extending beyond end of R_{4+5} in the present species than in *S. aterrima*. In comparison of the hypopygium, the present species has strong setae on 9th tergite near base of anal point, but without virga, while the former is absent and the latter is present in *S. aterrima* collected in Akan and in Fuji.

Key to males of genus *Smittia* recorded from Japan

- 1 — Eyes bare (anal point present, somewhat conical and pubescent ; marine or seashore species2
- Eyes pubescent (anal point present or absent)3
- 2 — Gonocoxite with two inner lobes, the distal one long, slender and finger-like, the proximal one flat and rounded ; anal vein of wing forked ; AR about 0.7*bifurcata* Tokunaga, 1936
- Gonocoxite with a short inner lobe (rarely with another flat lobe on the ventral side) ; anal vein not forked*littoralis* Tokunaga, 1936
- 3 — Antenna with 12 or less flagellar segments, AR smaller than 0.5 ; marine or seashore species4
- Antenna with 13 flagellar segments as usual, and with a strong terminal seta, AR larger than 1.0 ; terrestrial species5
- 4 — Antenna with 8 flagellar segments only, antennal hairs poorly developed ; with a large, somewhat conical and pubescent anal point ; gonostylus long and tapering towards pointed apex*nemalionè* Tokunaga, 1936
- Antenna with 12 flagellar segments, antennal hairs well developed ; anal point absent ; gonostylus widest at about middle *endocladiae* Tokunaga, 1936
- 5 — Gonostylus with rounded or truncate apex, and with a large, wide and rounded subapical swelling on inner margin ; dorsomedians 6—10, dorsolaterals 6—17, prealars 3—56
- Gonostylus tapering towards pointed apex, without such subapical swelling, and with a long and stout subapical spine ; scutellars 16—26, dorsolaterals 17—30, prealars 6—12*sainokoensis* Sasa, 1984
- 6 — Anal point long (38—56 microns), largely extending beyond posterior margin of ninth tergite, and almost entirely bare ; WL 1.07—1.41 (1.13) mm, AR 1.03—1.30*nudipennis* Goetghebuer, 1913
- Anal point shorter (30 microns or less), only slightly extending beyond posterior margin of ninth tergite, and covered almost entirely by microtrichiae7
- 7 — Dorsomedians present (7—12, mean 9.4), dorsolaterals 8—17 (11.9), AR 1.64—1.97 (1.68), WL 1.59—1.83 (1.66) mm ; anal lobe of wing more conspicuously produced, R_1 and R_{4+5} more separated, costa less extending beyond end of R_{4+5} ; virga present*aterrima* (Meigen, 1818)
- Dorsomedians absent, dorsolaterals 6—8, AR 1.16, WL 1.44 mm ; anal lobe of wing almost flat, R_1 and R_{4+5} running closer, costa more extending beyond end of R_{4+5} ; virga absent :*akanduodecima* n. sp.

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EXPLANATION OF PLATES

Plate I. A. *Chironomus plumosus* (Linnaeus), male.

A-1. frontal tubercles. A-2. hypopygium. A-3. dorsal appendage.

B. *Chironomus nipponensis* Tokunaga, the light form, male.

B-1. frontal tubercles. B-2. abdominal tergites II and III. B-3. hypopygium, with lateral view of twisted anal point. B-4. dorsal appendage. B-5. ventral appendage.

C. *Chironomus nipponensis* Tokunaga, the dark form, male.

C-1 frontal tubercles. C-2. abdominal tergites II and III. C-3. tip of front tibia. C-4. tip of hind tibia. C-5. scutum and scutellum. C-6. hypopygium. C-7. dorsal appendage. C-8. anal point. C-9. ventral appendage.

Plate II. D. *Chironomus fujitertius* Sasa, male.

D-1. frontal tubercles. D-2. abdominal tergite II. D-3. tip of front tibia. D-4. tip of hind tibia. D-5. hypopygium. D-6. left dorsal appendage. D-7. right dorsal appendage. D-8. ventral appendage.

E. *Chironomus riparius* (Meigen), male.

E-1. frontal tubercles. E-2. abdominal tergites II and III. E-3. tip of front tibia. E-4. tip of hind tibia. E-5. hypopygium. E-6. dorsal appendage. E-7. ventral appendage.

F. *Microtendipes chloris* (Meigen), male.

F-1. hypopygium. F-2. dorsal appendage. F-3. ventral appendage. F-4. gonostylus. F-5. abdominal tergites I to IV. F-6. tip of front tibia. F-7. tip of middle tibia. F-8. tip of hind tibia.

Plate III. G. *Stictochironomus histrio* (Fabricius). Male.

G-1. wing. G-2. scutum and scutellum. G-3. coloration of leg segments. G-4. tip of front tibia. G-5. tip of middle tibia. G-6. tip of hind tibia. G-7. hypopygium. G-8. dorsal appendage. G-9. ventral appendage. Female. G-10. spermathecae. G-11. cercus.

H. *Tanytarsus usmaensis* Pagast. Male.

H-1. frontal tubercles. H-2. tip of front tibia. H-3. tip of hind tibia. H-4. hypopygium. H-5. appendages 1 and 1-a, dorsal view. H-6. do, ventral view. H-7. anal point, lateral view. H-8. anal point, ventral view. H-9. appendages 2 and 2-a, dorsal view.

Plate IV. I. *Tanytarsus nippogregarius*, n. sp. Male.

I-1. wing. I-2. tip of front tibia. I-3. tip of hind tibia. I-4. frontal tubercles. I-5. hypopygium. I-6. anal point, dorsal view. I-7. appendage 1, dorsal view. I-8. appendages 2 and 2-a, dorsal view. I-9. appendage 2, ventral view. I-10. scutum and scutellum.

J. *Tanytarsus akantertius*, n. sp. Male.

J-1. frontal tubercles. J-2. tip of front tibia. J-3. tip of hind tibia. J-4. hypopygium, dorsal view. J-5. anal point, lateral view. J-6. appendages 1 and 1-a, dorsal view. J-7. appendages 1 and 1-a, ventral view. J-8. appendages 2 and 2-a, dorsal view. J-9. inner margin of gonocoxite, and appendage 2, ventral view. J-10. wing.

Plate V. K. *Paratanytarsus inopertus* (Walker) Male.

K-1. frontal tubercles. K-2. wing. K-3. tip of front tibia. K-4. tip of hind tibia. K-5. ninth abdominal segment and hypopygium, lateral view. K-6. ninth tergite and hypopygium, dorsal view. K-7. anal point, dorsal view. K-8. anal point, ventral view. K-9. appendages 1 and 1-a, dorsal view. K-10. appendages 1-a and 1, ventral view. K-11. appendages 2 and 2-a, inner margin of gonocoxite, dorsal view. K-12. do, ventral view.

L. *Orthocladius glabripennis* (Goetghebuer). Male.

L-1. wing. L-2. hypopygium, dorsal view. L-3. inner margin of gonocoxite, and inner lobes. L-4. tip of front tibia. L-5. tip of hind tibia.

M. *Orthocladius akanquartus*, n. sp. Male.

M-1. wing. M-2. scutum and scutellum. M-3. hypopygium. M-4. anal point, dorsal view. M-5. front tarsus V.

Plate VI. N. *Orthocladius kanii* (Tokunaga) Male.

N-1. wing. N-2. scutum and scutellum. N-3. hypopygium. N-4. inner margin of gonocoxite, ventral view. N-5. inner lobes of gonocoxite, dorsal view. N-6. do, ventral view. N-7. tip of hind tibia.

P. *Orthocladius* sp. near *saxosus*. Male.

P-1. wing. P-2. antepnotum and scutum. P-3. tip of front tibia. P-4. tip of middle tibia. P-5. tip of hind tibia, inside view. P-6. do, outside view. P-7. hypopygium. P-8. inner margins of gonocoxite.

Q. *Orthocladius frigidus* (Zetterstedt).

Q-1. wing. Q-2. scutum and scutellum. Q-3. tip of front tibia. Q-4. tip of middle tibia. Q-5. tip of hind tibia. Q-6. tip of hind tarsus I. Q-7. tip of hind tarsus II. Q-8. hypopygium. Q-9. inner margins of gonocoxites. Q-10. left gonostylus.

Plate VII. N-8. head, *Orthocladius kanii*. N-9. hind tarsus V, do. P-9. head, *Orthocladius* sp. near *saxosus* P-10. hind tarsus V, do. Q-11. head, *Orthocladius frigidus*. Q-12. front tarsus V, do.

R. *Cricotopus montanus* Tokunaga, Male.

R-1. head. R-2. dorsal view of thorax. R-3. tip of front tibia. R-4. tip of middle tibia. R-5. tip of hind tibia. R-6. hind tarsus V. R-7. wing. R-8. hypopygium, dorsal view.

S. *Paracladius akansextus*, n. sp. Male.

S-1. head. S-2. wing. S-3. tip of front tibia. S-4. front tarsus V. S-5. tip of middle tibia. S-6. tip of hind tibia. S-7. dorsal view of thorax. S-8. hypopygium.

Plate VIII. T. *Pseudorthocladius akanseptimus*, n. sp. Male.

T-1. head. T-2. scutum and scutellum. T-3. wing. T-4. tip of front tibia. T-5. tip of middle tibia. T-6, 7. tip of hind tibia. T-8. middle tarsus V, showing well developed pulvilli. T-9. hypopygium. T-10. gonostylus, ventral view. T-11. gonostylus, and inner margin of gonocoxite, ventral view.

U. *Heterotrissocladius subpilosus* (Kieffer).

U-1. head, male. U-2. head, female. U-3. wing, male. U-4. wing, female. U-5. scutum and scutellum, male, left half. U-6. tip of front tibia, U-7. tip of middle tibia, U-8, 9. tip of hind tibia, U-10. front tarsus V, all male. U-11. male hypopygium. U-12. spermathecae, female. U-13. cercus, female.

Plate IX. V. *Parachaetocladus akanoctavus*, n. sp. Male.

V-1. wing. V-2. head. V-3. scutum and scutellum, left half. V-4. tip of front tibia. V-5. tip of middle tibia. V-6. tip of hind tibia. V-7. hind tarsus V, showing large pulvilli. V-8. hypopygium. V-9. ventral view of left gonocoxite and gonostylus. V-10. dorsal view of left gonostylus. Female. V-11. head. V-12. spermatheca. V-13. cercus.

W. *Limnophyes akannonus*, n. sp. Male.

W-1. head. W-2. anteprenotum. W-3. scutum and scutellum, left half. W-4. wing. W-5. tip of front tibia. W-6. tip of middle tibia. W-7. tip of hind tibia. W-8. middle tarsus V, showing absence of pulvilli. W-9. hypopygium, dorsal view of left half. W-10. left gonostylus.

Plate X. X. *Limnophyes akanangularis*, n. sp. Male.

X-1. head. X-2. anteprenotum. X-3. scutum and scutellum. X-4. enlarged view of prescutellar setae (4 short lamellar, and one long simple). X-5. wing. X-6. tip of front tibia. X-7. tip of middle tibia. X-8. middle tarsus V, showing empodium and claws, pulvilli absent. X-9, 10. tip of hind tibia. X-11. hypopygium, dorsal view. X-12. do, ventral view, left half. X-13. gonostylus.

Y. *Limnophyes akanundecimus*, n. sp. Male.

Y-1. head. Y-2. anteprenotum. Y-3. scutum and scutellum. Y-4. wing. Y-5. tip of front tibia. Y-6. tip of middle tibia. Y-7. tip of hind tibia. Y-8. middle tarsi IV and V, showing the former shorter than the latter, and the latter without pulvilli. Y-9. hypopygium, dorsal view. Y-10. do, ventral view.

Plate XI. ZA. *Smittia aterrima* (Meigen), Male.

ZA-1. head. ZA-2. tip of antenna. ZA-3. wing. ZA-4. tip of front tibia. ZA-5. tip of middle tibia. ZA-6. tip of hind tibia. ZA-7. front tarsus V. ZA-8. scutum and scutellum. ZA-9. hypopygium, dorsal view. ZA-10. hypopygium, ventral view.

ZB. *Smittia nudipennis* (Goetghebuer). Male.

ZB-1. scutum and scutellum. ZB-2. hypopygium, dorsal view. ZB-3. hypopygium, ventral view.

ZC. *Smittia akanduodecima*, n. sp. Male.

ZC-1. scutum and scutellum. ZC-2. wing. ZC-3. hypopygium, dorsal view. ZC-4. hypopygium, ventral view.

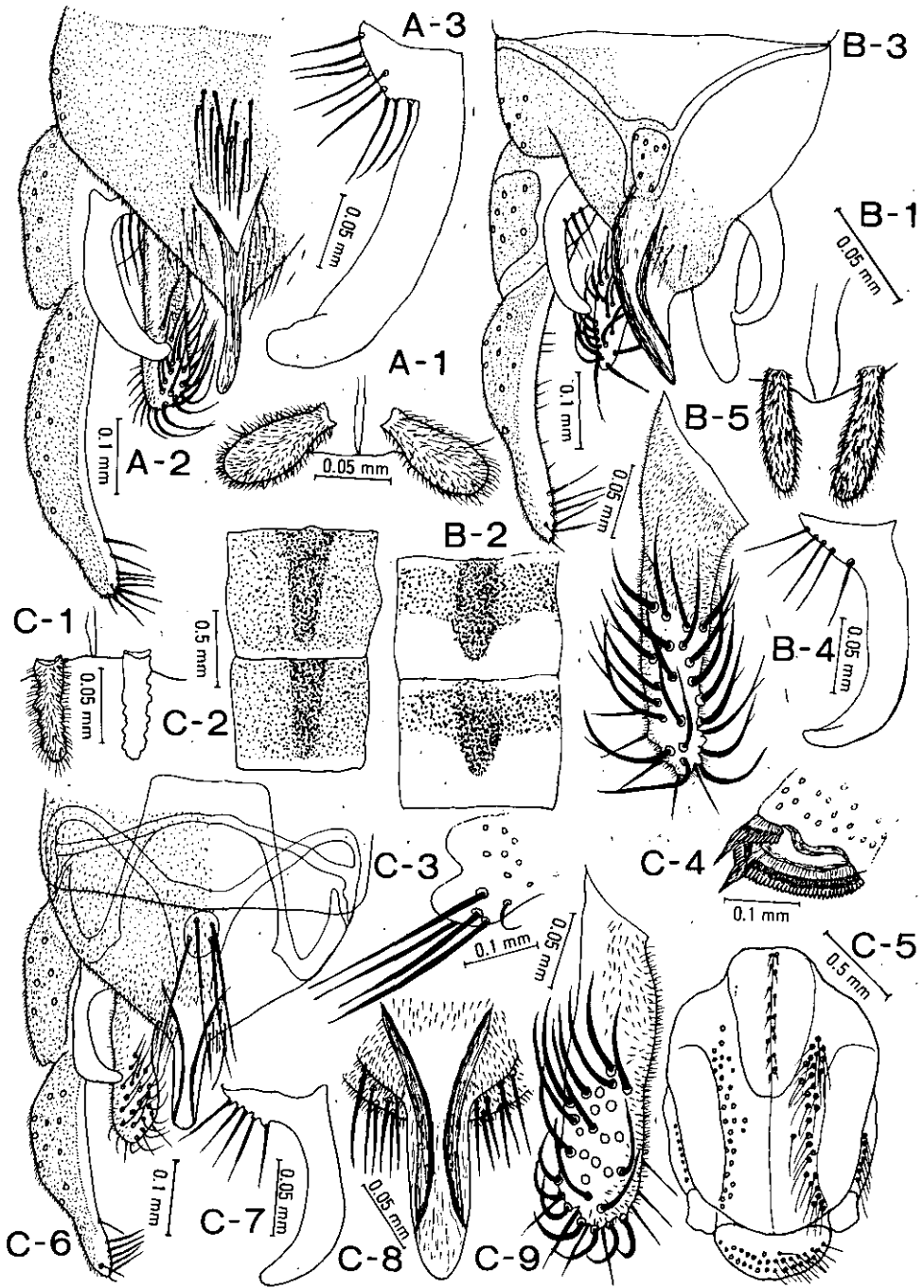


Plate I. A. *Chironomus plumosus* (Linnaeus)
 B. *Chironomus nipponensis* Tokunaga, the light form
 C. *Chironomus nipponensis* Tokunaga, the dark form

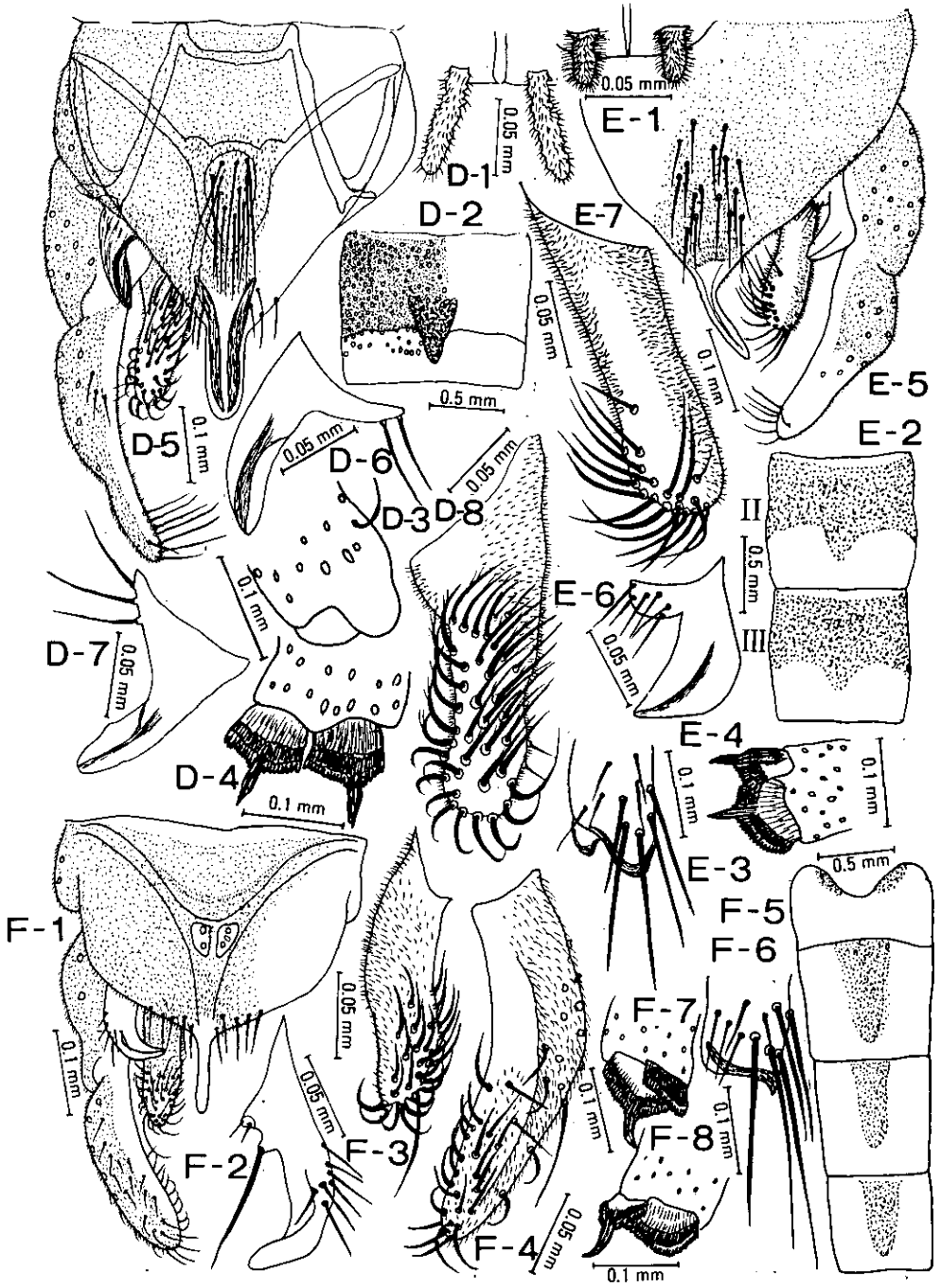


Plate II. D. *Chironomus fujitertius* Sasa
 E. *Chironomus riparius* (Meigen)
 F. *Microtendipes chloris* (Meigen)

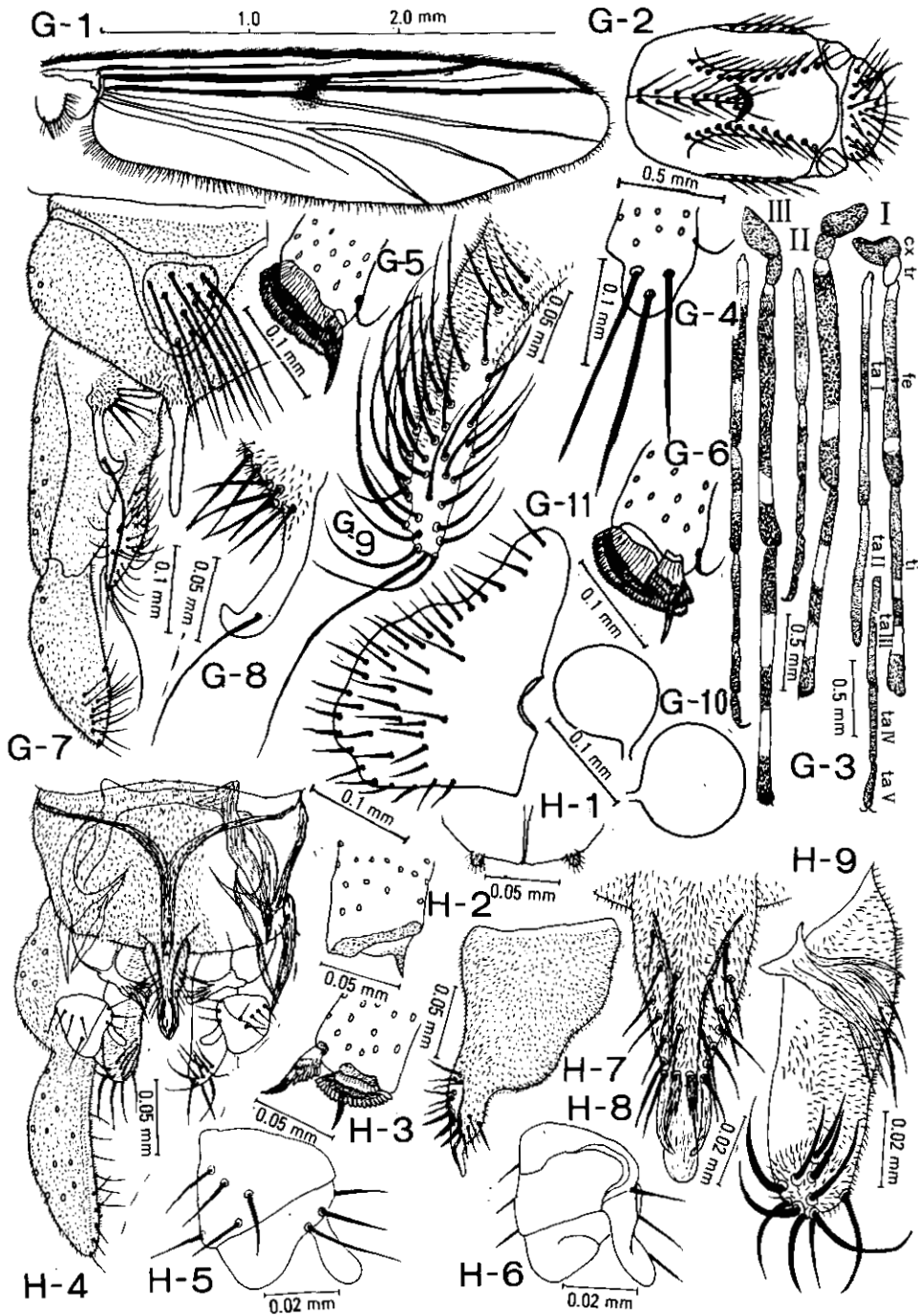


Plate III. *G. Stictochironomus histrio* (Fabricius)
H. Tanytarsus usmaensis Pagast

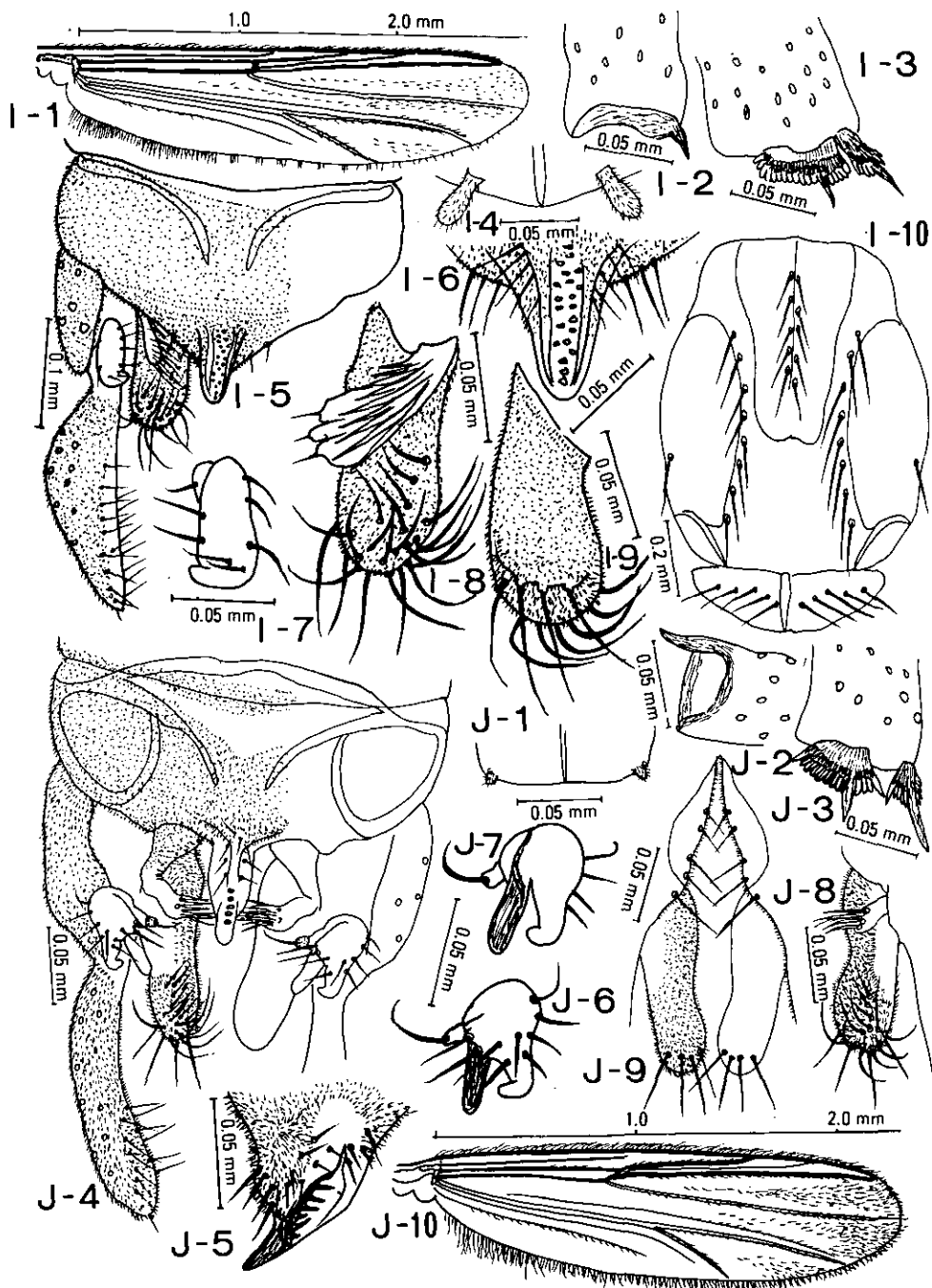


Plate IV. I. *Tanytarsus nippogregarius*, n. sp.
 J. *Tanytarsus akantertius*, n. sp.

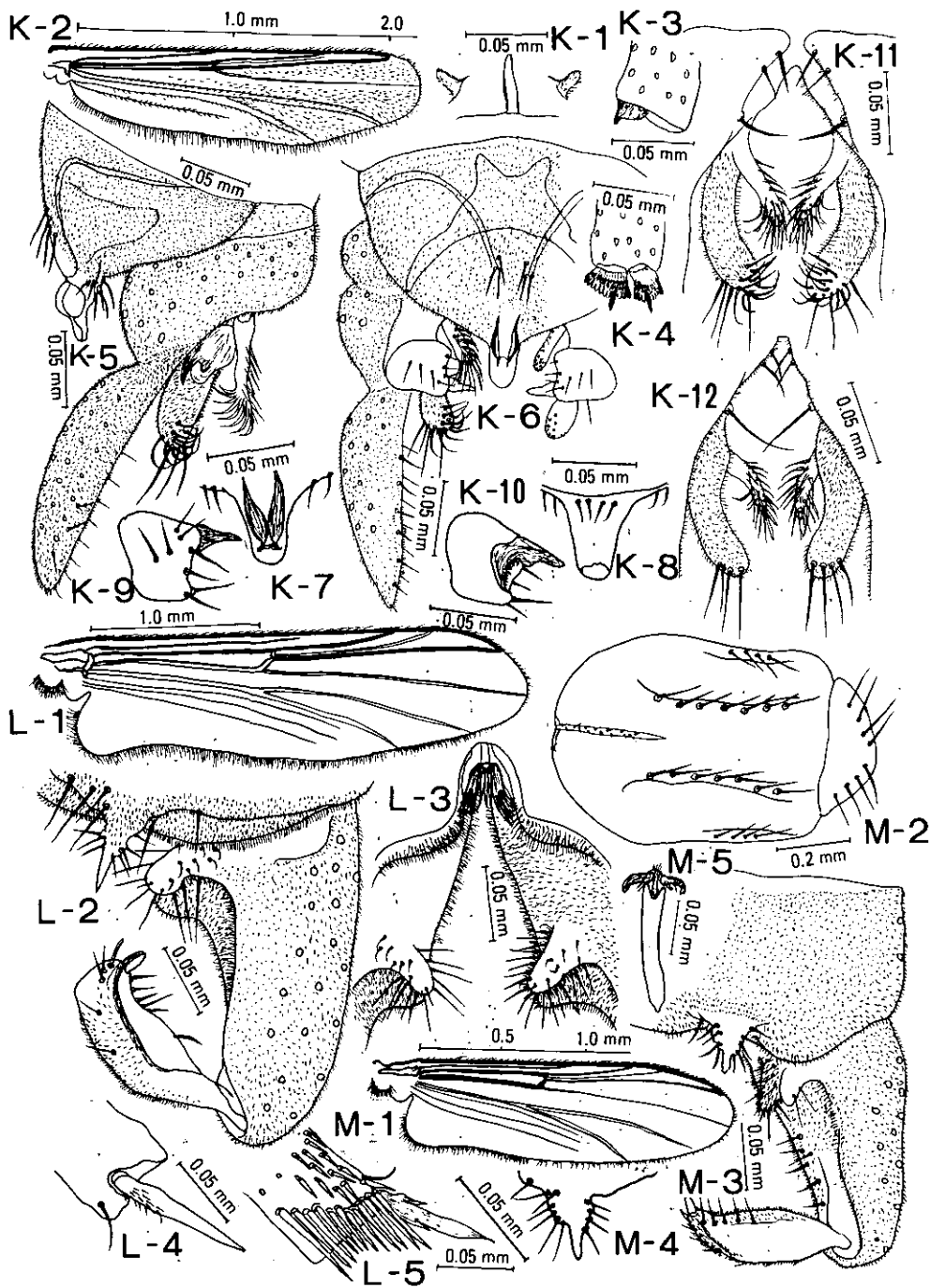


Plate V. K. *Paratanytarsus inopertus* (Walker)
 L. *Orthocladus glabripennis* (Goetghebuer)
 M. *Orthocladus akanquartus*, n. sp.

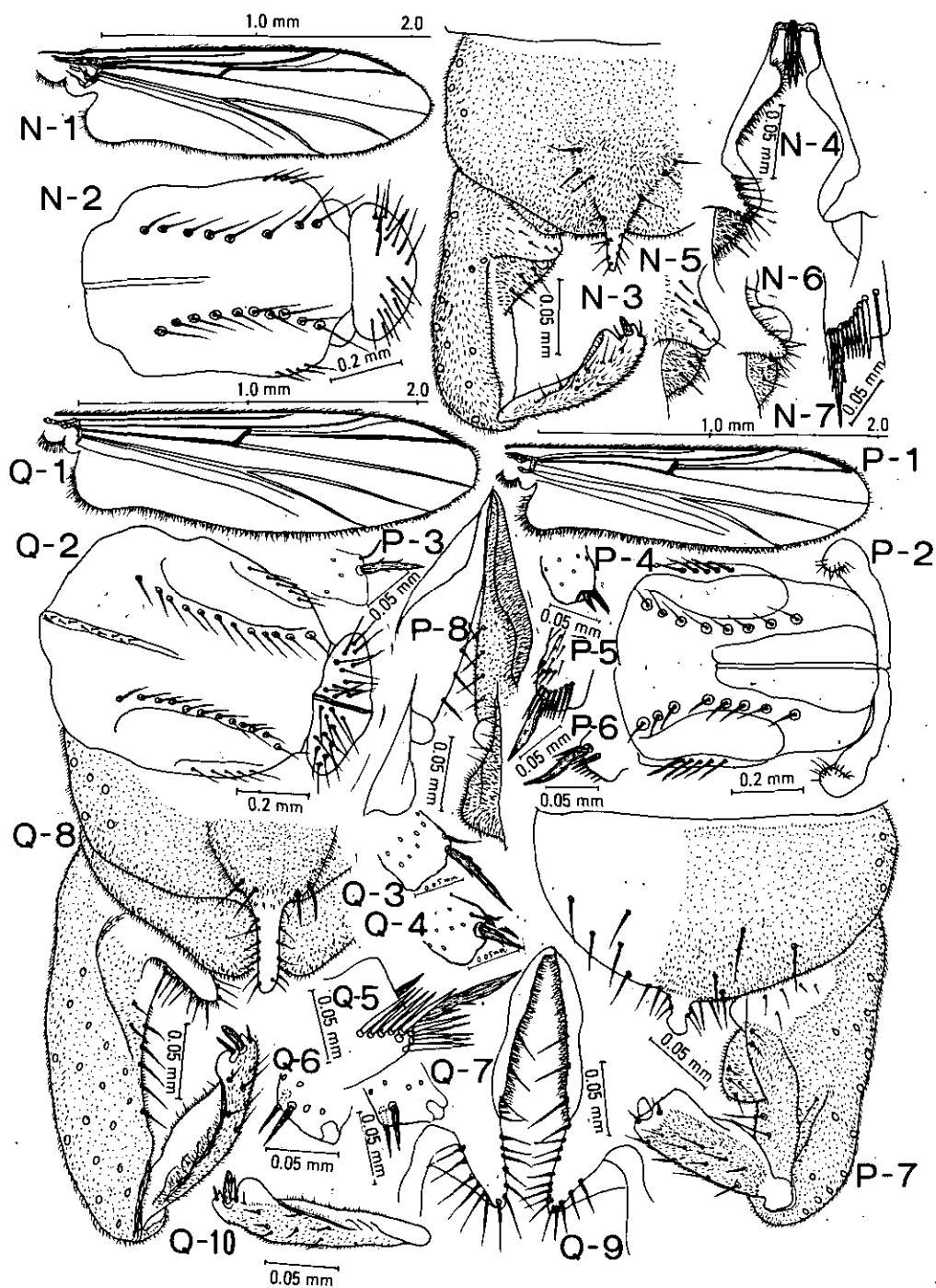


Plate VI. N. *Orthocladus kanii* (Tokunaga, 1939)
 P. *Orthocladus* sp. near *saxosus*
 Q. *Orthocladus frigidus* (Zetterstedt)

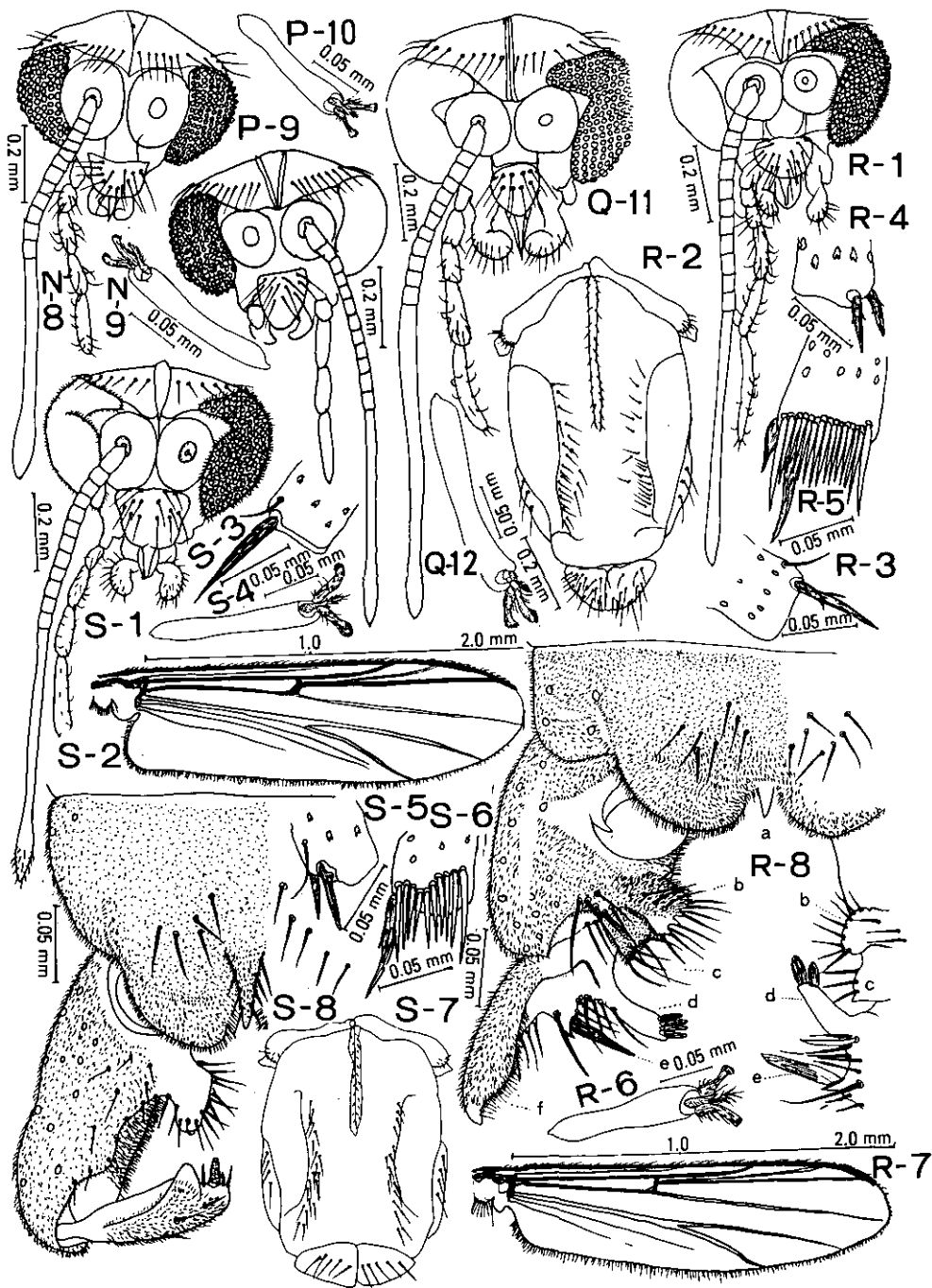


Plate VII. N, P, Q. same species as in Plate VI.
 R. *Cricotopus montanus* Tokunaga
 S. *Paracladius akansextus*, n. sp.

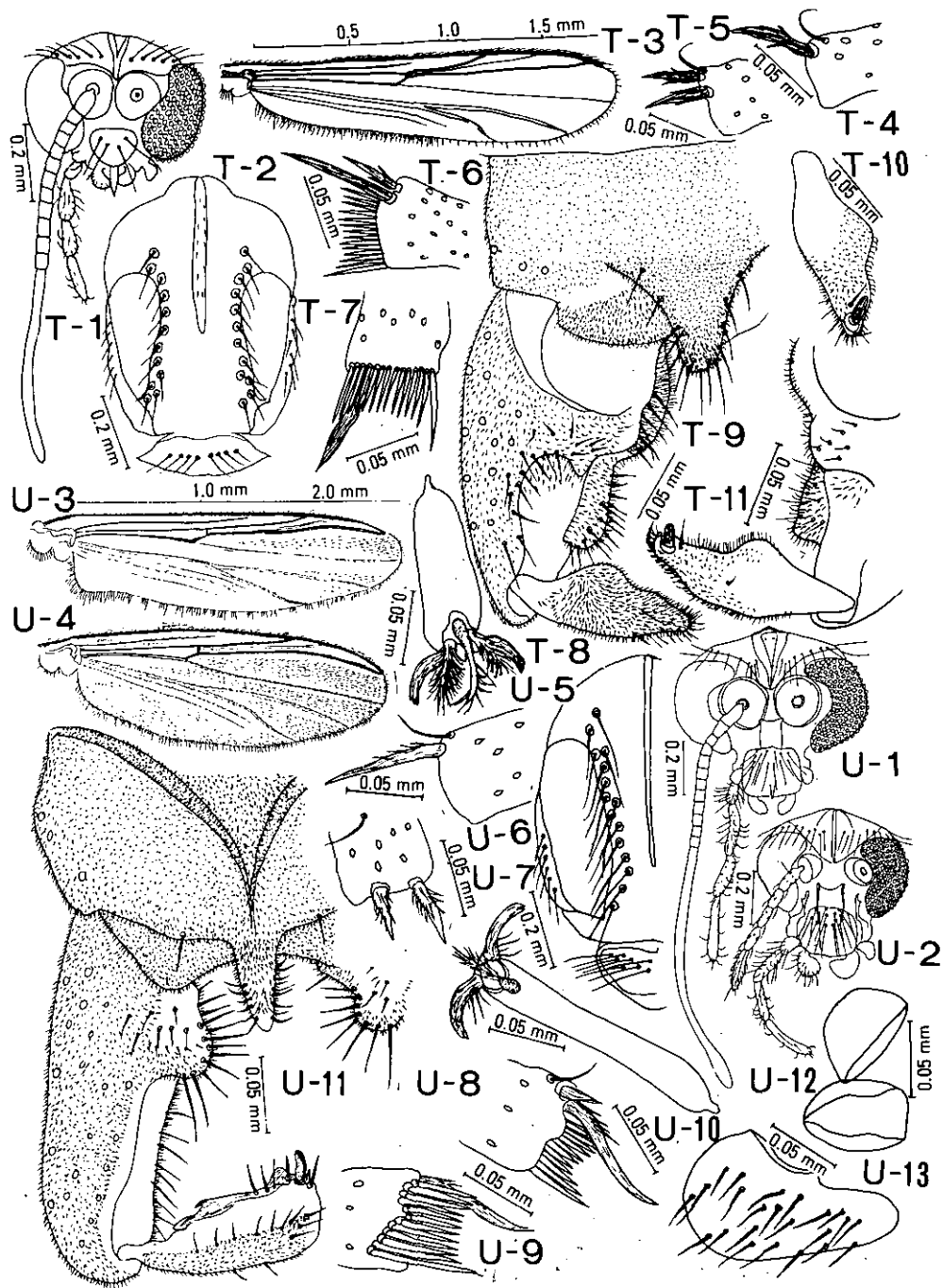


Plate VIII. T. *Pseudorthocladius akanseptimus*, n. sp.
 U. *Heterotrissocladius subpilosus* (Kieffer)

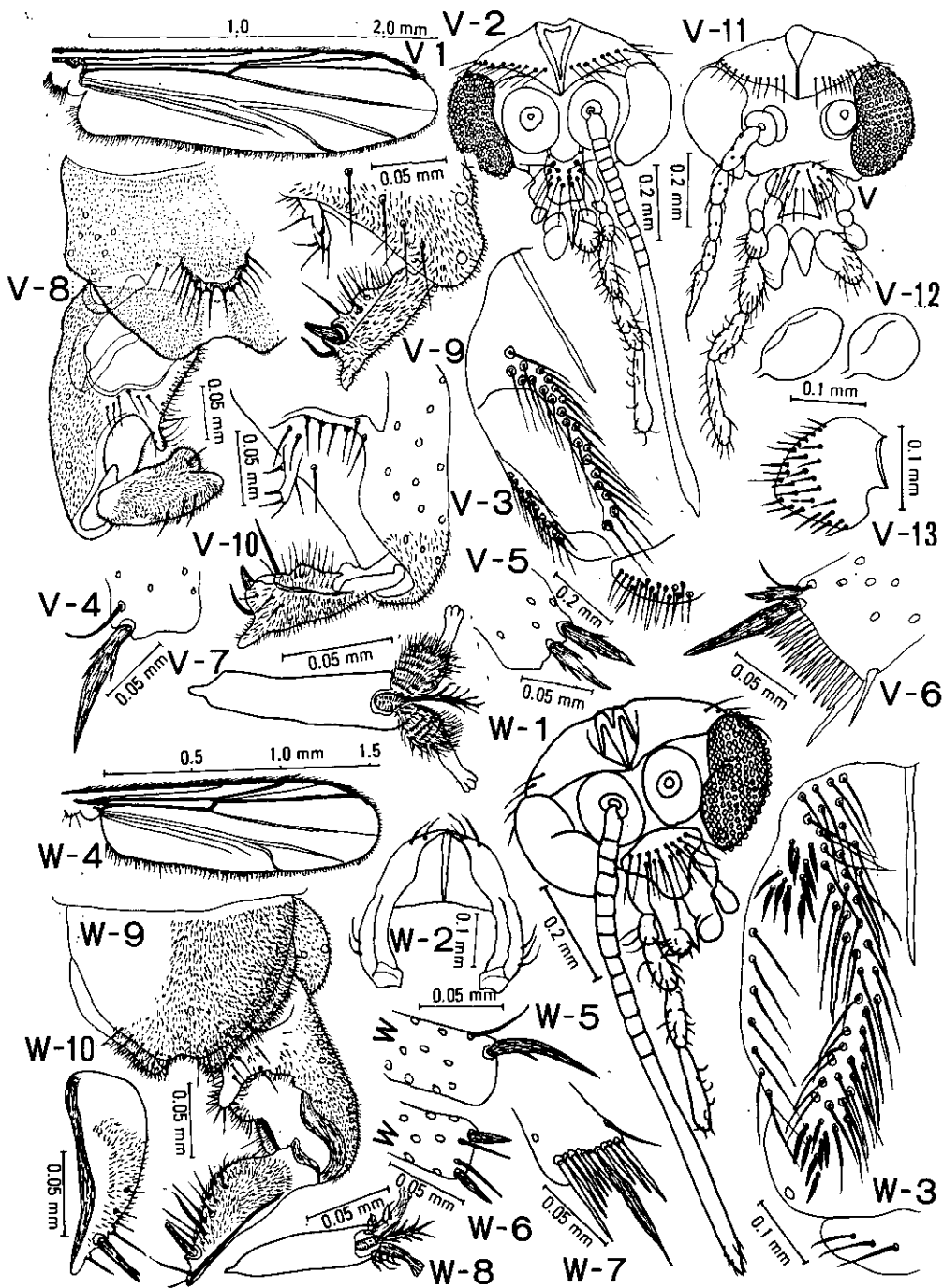


Plate IX. V. *Parachaetocladius akanoctavus*, n. sp.
 W. *Limnophyes akannonus*, n. sp.

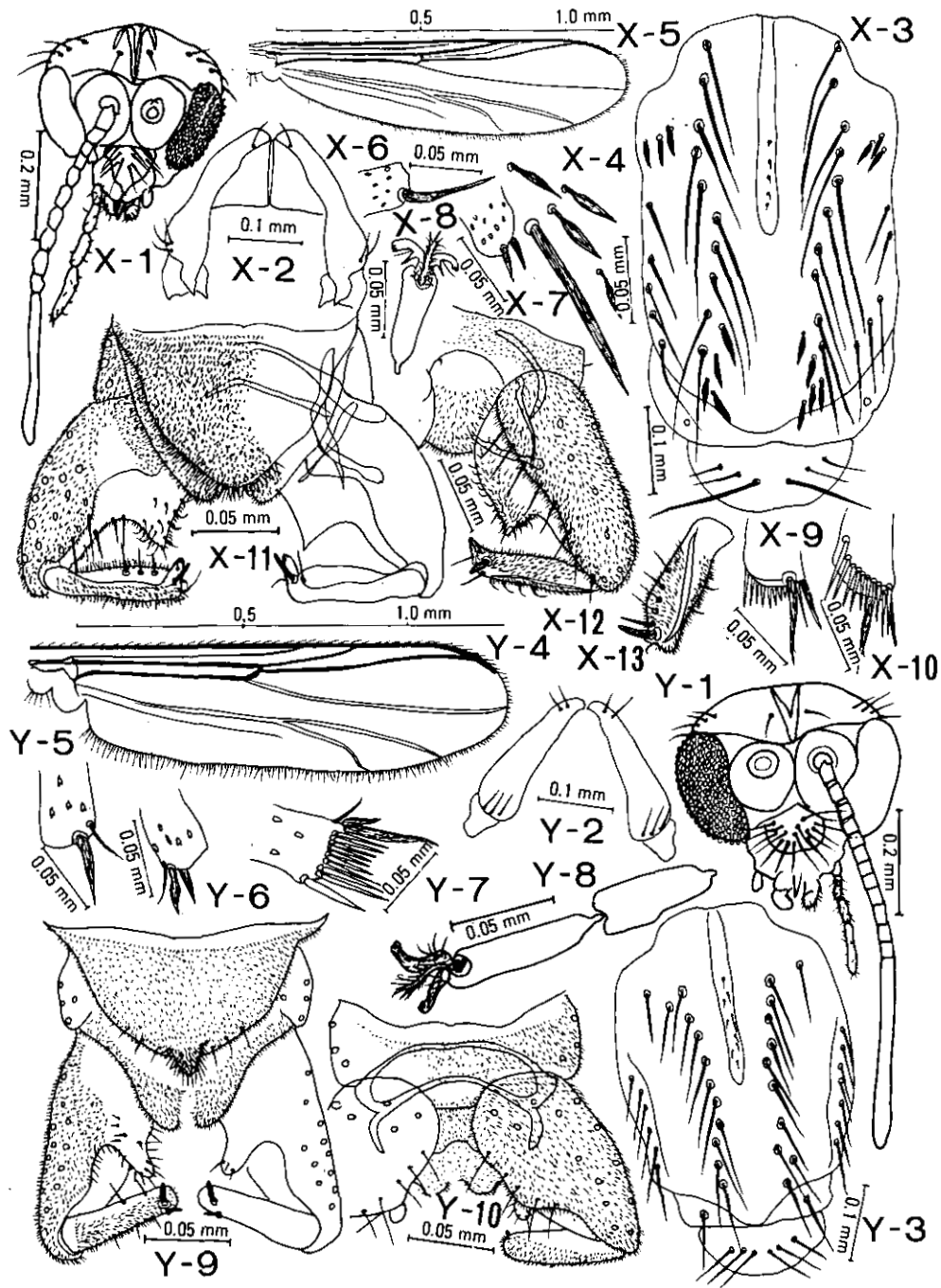


Plate X. X. *Limnophyes akanangularius*, n. sp.
 Y. *Limnophyes akanundecimus*, n. sp.

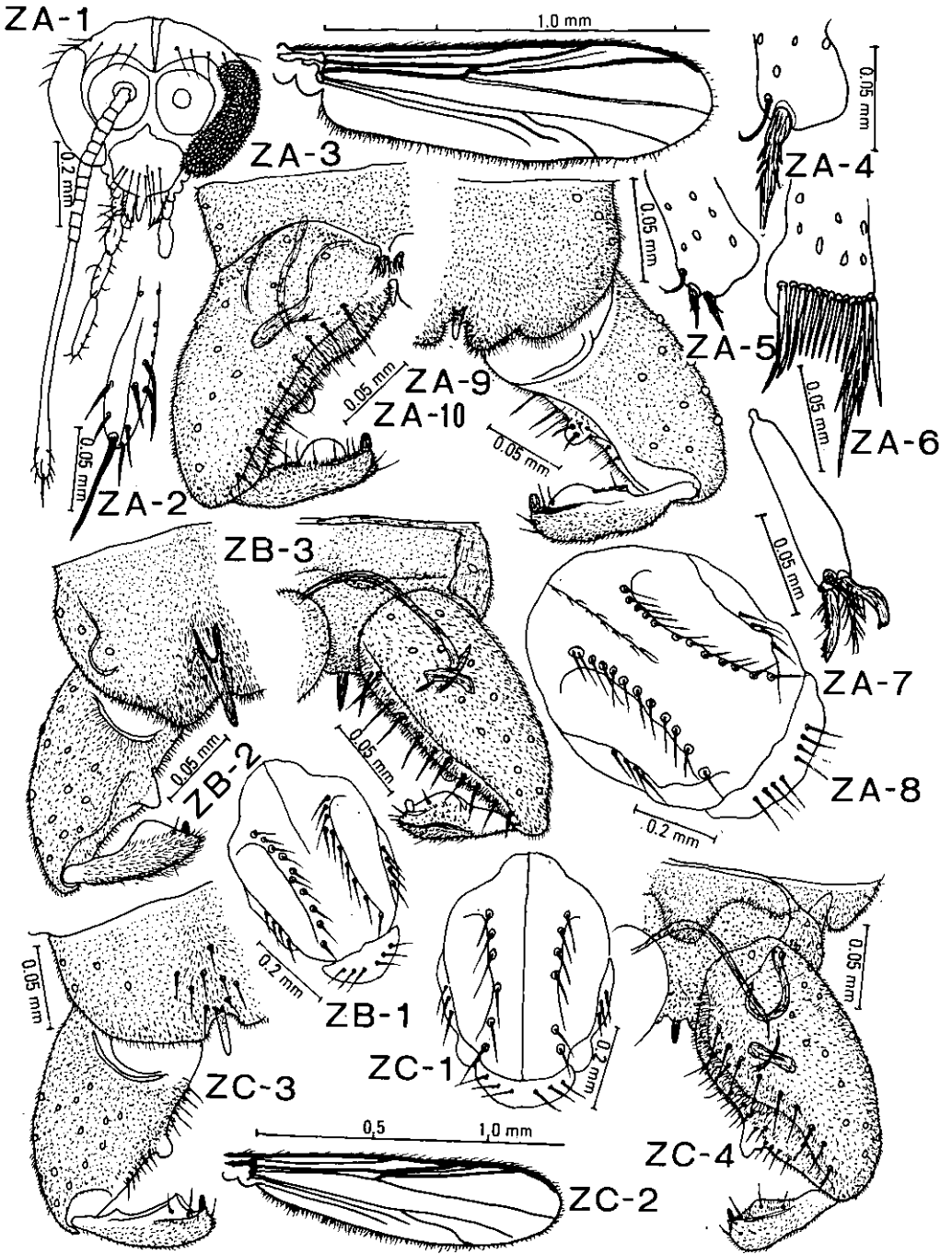


Plate XI. ZA. *Smittia aterrima* (Meigen)
 ZB. *Smittia nudipennis* (Goetghebuer)
 ZC. *Smittia akanduodecima*, n. sp.

北海道阿寒国立公園の湖岸で採集した ユスリカ類について

佐々 学¹・上村 清¹

1982年6月に阿寒国立公園の阿寒湖, 屈斜路湖, パンケ湖などの湖岸の草叢などにいるユスリカ成虫を捕虫網で採集し, 乾燥標本として研究室に持ち帰り, ガムクロラール液封入標本として形態を調べた。この採集で雄172匹, 雌29匹が得られ, それらはユスリカ亜科 Chironominae が6属12種, エリユスリカ亜科 Orthoclaadiinae が8属16種, 合計して14属, 28種に分類された。

それらのうち11種は新種として記載され, そのほか6種は日本未記録種で, さらに6種を加えた12種はヨーロッパと, その一部は北アメリカとも共通種と判断した。したがって, 他の16種は今のところ日本ないしその周辺に特産種とみなされるわけである。北海道と本州の共通種は以上のうち11種である。

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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)
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* in Japanese

※ out of stock

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[昭和61年9月17日受領]

[昭和61年11月28日受理]

RESEARCH REPORT FROM
THE NATIONAL INSTITUTE FOR ENVIRONMENTAL STUDIES, JAPAN
No.104

国立公害研究所研究報告 第104号
(R-104-'87)

昭和62年3月16日発行

発行 環境庁 国立公害研究所

〒305 茨城県筑波郡谷田部町小野川16番2

印刷 株式会社エリート印刷

〒300-12 茨城県牛久市柏田町3269

Published by the National Institute for Environmental Studies
Yatabe-machi, Tsukuba, Ibaraki 305, Japan
March 1987