

FISHERIES AND MARINE SERVICE

Translation Series No. 4471

The taxonomy and palaeoecology of subfossil chironomids  
(Diptera) in lake sediments

by W. Hofmann

Original title: Zur Taxonomie und Palokologie subfossiler  
Chironomiden (Dipt.) in Seesedimenten

From: Ergeb. Limnol. Suppl. 6: 1-50, 1971

Translated by the Translation Bureau (RAT)  
Multilingual Services Division  
Department of the Secretary of State of Canada

Department of the Environment  
Fisheries and Marine Service  
Freshwater Institute  
Winnipeg, Man.

1979

88 pages typescript



CANADA

F 5 M 4471

TRANSLATED FROM - TRADUCTION DE German	INTO - EN English
---	----------------------

AUTHOR - AUTEUR

Wolfgang Hofmann

TITLE IN ENGLISH - TITRE ANGLAIS

The taxonomy and palaeoecology of subfossil  
chironomids (Diptera) in lake sedimentsTITLE IN FOREIGN LANGUAGE (TRANSLITERATE FOREIGN CHARACTERS)  
TITRE EN LANGUE ÉTRANGÈRE (TRANSCRIRE EN CARACTÈRES ROMAINS)Zur Taxonomie und Palökologie subfossiler  
Chironomiden (Dipt.) in SeesedimentenREFERENCE IN FOREIGN LANGUAGE (NAME OF BOOK OR PUBLICATION) IN FULL. TRANSLITERATE FOREIGN CHARACTERS.  
RÉFÉRENCE EN LANGUE ÉTRANGÈRE (NOM DU LIVRE OU PUBLICATION), AU COMPLET, TRANSCRIRE EN CARACTÈRES ROMAINS.

Ergebnisse der Limnologie

REFERENCE IN ENGLISH - RÉFÉRENCE EN ANGLAIS

Research results in limnology

PUBLISHER - ÉDITEUR E. Schweizerbartsche Verlagsbuchhandlung	DATE OF PUBLICATION DATE DE PUBLICATION			PAGE NUMBERS IN ORIGINAL NUMÉROS DES PAGES DANS L'ORIGINAL 1 - 50
	YEAR ANNÉE	VOLUME	ISSUE NO. NUMÉRO	
PLACE OF PUBLICATION LIEU DE PUBLICATION Stuttgart	1971		Suppl. 6	NUMBER OF TYPED PAGES NOMBRE DE PAGES DACTYLOGRAPHIÉES 88

REQUESTING DEPARTMENT  
MINISTÈRE-CLIENT Fisheries and EnvironmentTRANSLATION BUREAU NO.  
NOTRE DOSSIER N° 1846246BRANCH OR DIVISION  
DIRECTION OU DIVISION Fisheries  
Scientific Information and  
Publications BranchTRANSLATOR (INITIALS)  
TRADUCTEUR (INITIALES) R. A. T.PERSON REQUESTING  
DEMANDÉ PAR Dr. W.F. Warwick

APR - 3 1979

YOUR NUMBER  
VOTRE DOSSIER N° \_\_\_\_\_DATE OF REQUEST  
DATE DE LA DEMANDE 2 February 1979UNEDITED TRANSLATION  
For information only  
TRADUCTION NON REVISÉE  
Information seulement



MULTILINGUAL SERVICES DIVISION - DIVISION DES SERVICES MULTILINGUES

TRANSLATION BUREAU

BUREAU DES TRADUCTIONS

Client's No.—N° du client	Department — Ministère	Division/Branch — Division/Direction	City — Ville
Bureau No.—N° du bureau	Language — Langue	Translator (Initials) — Traducteur (Initiales)	APR - 3 1979

1. ARCHIVES OF HYDROBIOLOGY, Organ of the International Association of Pure and Applied Limnology, Supplement 1
2. Research Results in Limnology
3. Published by Prof. Dr. H.-J. Elster      Prof. Dr. W. Ohle  
       Limnological Institute of the              Max-Planck-Institute  
       University Freiburg                        for Limnology  
       Konstanz/Bodensee                        Plön/Holstein
4. Number 6
5. Wolfgang Hofmann
6. The Taxonomy and Palaeoecology of subfossil Chironomids(Diptera) in lake sediments.
7. With 50 text figures
8. E. Schweizerbart'sche Verlagsbuchhandlung  
       (Nägele u. Obermiller). Stuttgart 1971

**UNEDITED TRANSLATION**  
 For information only  
**TRADUCTION NON REVISEE**  
 Information seulement

1. All rights reserved, including translation.
2. Reproduction, including photomechanical reproduction, only by  
express permission of the publisher.

Printed in Germany

ISBN 3 510 47004 4

3. Printed by: Gebrüder Ranz, Dietenheim

THE TAXONOMY AND PALAEOECOLOGY OF SUBFOSSIL CHIRONOMIDS (DIPTERA)

IN LAKE SEDIMENTS

p.1

By Wolfgang Hofmann

Max-Planck-Institute for Limnology in Plön

With 50 text figures

Abstract

The paleolimnological interpretation of chironomid remains in lake sediments is discussed. Short descriptions of the subfossil head capsules of 49 taxa are given. An identification key is provided.

## Contents

- I. Introduction
- II. Taxonomy
  - a) General aspects
  - b) Brief description of the taxa
  - c) Keys
- III. Methods
- IV. Thanatocoenosis - Necrocoenosis
- V. Ecological Assessment
  - a) Habitat Ecology
  - b) Ecology of Distribution

Summary

Bibliography

### I. Introduction

Subfossil plant and animal remains in lake sediments provide information concerning not only the former distribution of the organisms but also the development of the biotope. For this reason analysis of microfossils, in addition to chemical and physical sediment investigations, has attained great importance in Palaeolimnology. Following publication by Rossolimo of the first illustrations of animal remains in sediments (1927), few similar studies were published for a number of decades. ~~Only in the course~~

p.2

Methodical study of microfossils began only during the 1950's, simultaneously with the increasing interest in limnological sediment research. These studies were stimulated to a great degree by the comprehensive studies by Frey (1964) Korde(1966) and Juse(1966).

The chironomids are particularly interesting because of their close association with the soil-faunistic lake types as conceived by Thienemann; investigation of the postglacial development of profundal chironomid associations makes it possible to reexamine the previous concepts concerning lake types and lake type succession. As a matter of fact, this group of animals, occurring in all bodies of water with a large number of ecologically different species, is particularly suitable for palaeolimnological investigations.

The first researcher to point out the extraordinary palaeolimnological significance of the chironomids was Andersen(1938). Since then, a number of studies concerning this subject have been published; their results have been summarized in two comprehensive publications (Frey 1964, Stahl 1969).

Based on the detailed examination of the chitin remains of chironomid larvae found in the postglacial sediments of 2 lakes in Holstein (Hofmann 1971), the scope of this subfossil analysis was expanded; consequently, it now appears necessary to review critically and describe in detail the results published so far. At the same time, the taxonomic review of the material yields information for determining the subfossil larval head capsules. In addition, the possibilities of clear, ecological assessment of the chironomid thanathocoenoses are discussed in detail.

## II. Taxonomy

### a) General Aspects

Taxonomic revision of subfossil head capsules of chironomid larvae is made inherently difficult by several unfavourable conditions: namely, the confused situation of chironomid systematics and taxonomy generally (Fittkau 1961) which - in addition - is essentially based on the morphology of the male imago. Furthermore, the subfossil material contains only some of the larval characteristics. Because the investigations relate to the past, it is not feasible to support them faunistically.

Consequently, differentiation in many of the studies published so far is only slight. In addition to Corynocera duffi (sub Dryadotanytarsus) Deevey (1955) differentiates only "Chironomus", "Tanypus" and "Orthocladius"; Frey (1955) differentiates only Eutanytarsus and "other midges", and Goulden (1964) differentiates only Chironomus, Sergentia and Tanytarsus. The Chironomini present the least difficulties; some authors have segregated them into a series of genera: Deevey (1942), Stahl (1959), Bryce (1962) and Roback (1970); the same applies to the Tanypodinae (Stahl 1959, Roback 1970). In contrast, the Orthocladiinae and the Tanytarsini which are particularly important for ecological assessment are problematic. The former are always treated under "Orthocladiinae" or "Orthocladius"; Stahl (1959) differentiates between an Orthocladiinae species A and Corynoneura; Roback provides generic names

p.3

(e.g. Heterotrissocladius, Rheorthocladius) to which he adds a question mark; even with the aid of drawings it is not possible to determine them at this time. Apart from the conspicuous Corynocera, the Tanytarsini are summarized as "Tanytarsus", "Eutanytarsus" or "Tanytarsus genuinus group". The "Tanytarsus connectens group", described and illustrated by Stahl (1959), is a Pseudochironomus. Roback (1970) reports 4 Tanytarsini-forms (as "Tanytarsini species 1 to 4"); the most important differentiating characteristic is the presence or absence of the tripartite condition of the labial middle tooth - a characteristic that is very much subject to wear. It is not possible to name the genera involved in this group.

Nevertheless, very detailed identification of the chironomids has been carried out in two studies: Lastochkin (1949) and Konstantinov (1951). The former lists approximately 70 taxa, the latter approximately 40. Konstantinov segregates for instance 4 Chironomus and five Tanytarsus species. However, the authors do not discuss the characteristics on the basis of which the individual species were recognized; the publications also lack any information concerning taxonomic revision.

Investigation of subfossil chironomids from drill cores from the Schöh Lake and the Grosser Plöner Lake, involved approximately 11,500 head capsules. Assessment of this very extensive material was only meaningful following optimal taxonomic differentiation; its results will be discussed in the following.

The systematics is based on the following authors:  
Tanypodinae on Fittkau (1962), Orthocladiinae on Brundin (1956 a),  
Chironomini on Lenz (1954 to 1962) and Tanytarsini on Thienelmann

(1924, 1929) and Reiss & Fittkau (1971). The morphology of the larval head is explained in Bause (1921), Thienemann & Zavrel (1921), Zavrel (1941), Hennig (1948, 1950) and Gouin (1957). According to some recent studies (Mozley 1970, Hirvenoja, in press) the row of teeth formerly referred to as labium is in reality a hypochilum.

The specimens belonging to the various subfamilies and tribus are in different states of preservation. The head capsules of the Tanytarsini are usually entire specimens. In the Orthoclaadiinae and Chironomini clypeus and labrum have often been broken out; in these instances the mandibles, premandibles, epipharynx, etc. are also missing - only the labium with the lateralia remains. Labia with paired middle teeth frequently are broken in the centre:

Heterotrissocladus grimshawi, Microtendipes, Sergentia coracina. In contrast, species with unpaired central teeth, particularly of the Tanytarsini, are almost always complete. An exception is Pseudochironomus whose Labia with a few exceptions always were found in halves. It is interesting to note that Stahl, with reference to the same genus, also writes: "it seems odd that all the remains of this form were half-heads"(1959: 63, sub Tanytarsus connectentes).

However, even when labrum and epipharynx are still present it is often not possible to recognize identifying criteria on them because the structures in the specimens are usually slanted or covered by sediment residues that have remained in the head capsule. The antennae are almost always broken off. This is a drawback particularly in the Tanytarsini, where they are important systematic criteria. However, even when antennal residues are present they are usually confined to the basal segment. All antennal

segments are present only in exceptional cases, but even then Lauterborn's organs cannot be recognized. This situation is similar with the Labral setation of the Orthoclaudiinae: it is systematically of importance but - with the exception of the large, SI bristles of Psectrocladius - it is scarcely evident in the subfossil specimens.

Because in addition to many criteria of the head capsule, the criteria of the abdomen are also absent (setation of the segments, preanal brush, anal papillae, tubuli, caudal disks), the possibility of definitive identification, which is difficult even when the Larvae are complete, is limited from the start.

To differentiate material as extensively as possible criteria were searched for that formerly were not known, or were only casually mentioned in the literature. For this purpose the Plön collection provided abundant material for comparison.

The Tanypodinae were divided only in three taxa. Determination of the taxa is easy and is based on the glossae, paraglossae and paralabial combs.

In the Orthoclaudiinae the morphology of the labium and mandibles is usually adequate to characterize the taxa.

It is possible to determine the Chironomini to the genus level based on only the labium. Not only the formation of the row of teeth is characteristic, but also the form and pattern of the paralabial plates. Because the latter were formerly usually neglected in larval descriptions, although they are quite useful for determining specimens with damaged rows of teeth and are of great importance, for instance, in Sergentia, they will be treated with special emphasis.

It was found that in the Tanytarsini the shape of the

premandibles is a useful diagnostic criterion. The premandibles of the larvae of the genera Micropsectra and Paratanytarsus end distally in 2 points; the premandibles of the genus Tanytarsus have at least 3 distal teeth, in addition they have a bristle-like "interior tooth" (cf. Kruger 1945). Because the criterion used formerly - spur on the antennal socket - occurs also in larvae of Tanytarsus (e.g. Tanytarsus curticornis) the premandibles appear to be more useful criteria for differentiating Tanytarsus and Micropsectra. A new criterion on the generic level was discovered in the Paratanytarsus larvae: whereas Tanytarsus and Micropsectra larvae have a tripartite epipharyngeal comb with parts that distally bear distally three to five small teeth, in Paratanytarsus this consists of three to four unsegmented teeth and is very reminiscent of Microtendipes.

Furthermore, new criteria were observed on the mandible: some Tanytarsus larvae have two mandibular interior teeth and one to two teeth on the interior surface of the dentate part.

p.5

In addition, a few subfossil hypopygia were found that were significant insofar as they permit definite placement in Lauterbornia coracina of the larvae of the Micropsectra type and resulted in new species that were not recognized in the larval material: Tanytarsus niger Andersen and Paratanytarsus penicillatus Goetghebuer.

In the following the taxa are briefly characterized; for this purpose only criteria are given that are also recognizable in subfossil material. The following abbreviations are used:

AS	antennal socket
ET	exterior tooth of mandibel
FB	frontal bristle(s)
HC	head capsule
IT	interior tooth of mandib <sup>ely</sup> or premandib <sup>ely</sup>
LT	lateral tooth of the labium
LWI	length:width index
MT	middle tooth of the labium
PLL	paralabial lamella
PLPL	paralabial plate(s)
PM	premandib <sup>ely</sup>
T	tooth, teeth

In the bibliography, easily accessible items with text figures were preferred.

It was possible to use material from the collection Plön for comparison in the case of almost all taxa; however, this material is listed individually only in a few important instances.

Most forms were determined only to the genus level; however, where for reasons of ecology or faunistics only one species or a few species are considered, reference is made to that affect. These statements apply only to the North German region.

Finally, the criteria on the basis of which the taxa are segregated have been summarized in very brief keys.

b) Short Description of the Taxa

## Tanypodinae

1. Labrundinia longipalpis Goetghebuer (Fig. 1)

Johannsen 1937: 13-14 (sub Pentaneura pilosella); Botnariuc & Candea  
1953: 55-57 (sub Ablabesmyia pectinata); Roback 1957: 41 (sub  
Pentaneura nr. pilosella); Fittkau 1962: 374

Glossa with 5 T; the middle tooth is the largest;  
paraglossae with two points; mandible with one lateral and one  
secondary tooth; head capsule particularly narrow, LWI: 40-44%  
without paralabial combs.

In Europe only the species L. longipalpis (Fittkau l.c.).

## 2. Pentaneurini (sensu Fittkau 1962) part. (Fig. 2)

Zavrel-Thienemann 1921: 599-600, 674-725 (sub Pelopia Meigen); Lenz  
1936: 66-68 (sub Ablabesmyia Johannsen); Fittkau 1962: 87-89.

Head capsule narrow, LWI: 66%; glossae with 5 T, the  
middle one of these is the smallest; paraglossae with two points; no  
paralabial combs.

According to Fittkau(1962; 78) this tribus consists of  
eighteen genera; of these, only Labrundinia is separately treated  
here (see above).

p.6

3. Procladius Skuse (Fig. 3)

Zavrel-Thienemann 1921: 754-767 (sub Subgenus Trichotanypus

Keiffer); Lenz 1936: 60-65; Cernovski 1949: 156, Fig. 143, 1961: 262-263, Fig. 143; Fittkau 1962: 87-89.

Head capsule wide, LWI: > 75%; glossa with 5 T, the middle one of these is the smallest; paraglossae scale-like; paralabial combs present.

According to this combination of characteristics, Procladius includes the taxon Psilotanypus Kieffer.

#### Orthoclaadiinae

##### 4. Corynoneura (Winn.) Edwards (Fig. 4)

Zavrel 1928: 653-656; Pankratova 1970: 314-316

Head capsule narrow; the row of labial teeth strongly curved: MT not paired and distinctly smaller than the first lateral teeth; six lateral teeth; mandible with point and three T; point is only as long as the first T.

It may be assumed that none of the head capsules belong to the very similar genus Thienemanniella because the species of this genus are usually confined to flowing waters (Brundin 1956: 171; Illies 1967: 369).

##### 5. Cricotopus (v.d. Wulp) Edwards A (Fig. 5)

Potthast 1921: 298-315 (sub Trichocladus Kieffer); Thienemann 1936: 531-553 (sub Eucricotopus, Trichocladus, Rheorthocladus) 1944: 649-650 (sub Trichocladus Kieffer) t.p. 623 (sub Eucricotopus Thienemann); Cernovski 1949: 119-121; 1961: 184-185; Pankratova 1970: 187-204

Labium with unpaired MT and 6 LT; MT broader than the LT; row of teeth strongly curved; PLL narrow, only slightly developed; mandibel with dark point and three dark T; labrum: SI are forked bristles; PM distally with 2 T; Eucricotopus type: second LT of the labium small and fused at the base with the first; back of mandibel with transverse wrinkles; Trichocladius type: second LT of the labium as large as the adjacent teeth, not fused with the first; back of mandibel smooth. The combination of criteria of the Trichocladius type applies also to the larvae of the genus Orthocladius; some Orthocladius species occur in lakes (c.f. Illies 1967: 361-363) but in standing waters the "Trichocladius" species predominate (c.f. Thienemann 1944: 650).

6. Cricotopus (v.d. Wulf) Edwards B (Paratrichocladius) (Fig. 6) Thienemann 1939: 10-12 (sub Trichocladius inserpens Walker); 1944: 625-626 (sub Paratrichocladius Thienemann); Cernovski 1949: 130; 1961: 196-197 (sub Trichocladius inaequalis Kieffer); Pankratova 1970: 204-206.

Labium with a very broad, distally hyaline MT and 6 small, pointed LT. PLL narrow. Mandibel with a dagger-like point and three T inserted into the margin; point and T light in colour; PM with two long, narrow T. Labrum: SI are forked bristles.

Thienemann (1939: 10-12) places the species with the above described larvae into the genus Paratrichocladius which was erected by him. However, according to Brundin (1956) and Hirvenoja (in press) they belong into the genus Cricotopus.

Doctor Hirvenoja, Helsinki, who is revising the genus Cricotopus kindly consented to examine some of the subfossil head capsules. In his opinion the specimens from the older sediments probably are all C. alpicolus Zetterstedt (he was able to determine one definitively). One specimen from the subatlantikum II probably belongs in C. inserpens Walker. p.7

7. Cricotopus triquetrus Cernovski (Fig. 7)

Cernovski 1949: 129-130; 1961: 195-196 (sub Orthocladiinae Gen? triquetra);

Pankratova 1970: 206-207 (sub Paratrichocladus triquetra).

Labium with a broad, hyaline MT which is triangular in outline and five small LT which are brightly coloured; they are completely covered by the PLL; mandib<sup>(al)</sup> with a slender point and three T inserted into the interior margin, the distal of these teeth is trapezoid in outline, the others are triangular; the entire HC is very light coloured, just as the labium and the mandibel; HC is approximately the same size of that of Microcricotopus.

The species description is based on the larvae. Pankratova places the species in Paratrichocladus. This genus was included in the genus Cricotopus by Brundin (1956) and Hirvenoja (in press).

8. Heterotrissocladus grimshawi Edwards (Fig. 8)

Potthast 1921: 362-366 (sub Metriocnemus cubitalis

Kieffer - Heterotrissocladus marcidus Walker); Zavrel 1934 (H. marcidus Walker); Brundin 1949: 815-816; Pankratova 1970: 149

Compared material: H. marcidus Walker (Sauerland, leg. Dittmar), H. scutelatus Goetgh. (= H. grimshawi) (Lunzer Untersee); both from the collection Plön.

Labium with two large MT, somewhat smaller first and second lateral tooth, and three additional, distinctly smaller lateral teeth; all teeth are dark; PLL within the region of the fifth LT very broad, exceeds the lateral margin of the Labium; mandibel with a slender, dark point and three dark T, a fourth T is indicated by a dark brown spot; TM distally with two T. The long, slender antennae that are typical for Heterotrissocladius had been preserved in two of the specimens.

Species characteristics according to Brundin are the paired MT and the light coloured gula.

9. Microcricotopus bicolor Zetterstedt (Fig. 9)

Albrecht 1924: 194-196 (sub Cricotopus parvulus); Thienemann 1944: 632; Cernovsk: 1949: 132-133; 1961: 198 (sub Eukiefferiella bicolor Zetterstedt); Pankratova 1970: 229-230.

Head capsule very small, Labium with a broad, paired MT and 6 LT, the first of the LT is particularly large; PLL narrow and long, they extend at a slant anally; mandibel with long, dagger-like point and three conspicuously small T; labium, mandibel and the entire HC are light coloured.

The Microcricotopus HC were placed in M. bicolor which occurred very commonly. According to Fittkau & Lehmann (1970) only one additional but rarer species, M. balticus, occurs in lakes within the region.

10. Monodiamesa Kieffer (Fig. 10)

Thienemann 1918: 209-212; Cernovski 1949: 106-107; 1961: 175-176;  
 Brundin 1952: 45-51; Saether 1967: 197-200; Pankratova 1970:  
 109-111 (sub Prodiamesa bathyphila).

Labium with a broad MT which is dented in the centre and laterally has a small notch on each side. The two rows with six LT slope steeply; large PLL extend at a slant laterally; mandibel very stout; it has a slender point and only two T; the PLL bear approximately 8 thin bristles in their distal third.

p.8

So far only M. bathyphila is known from Northern Germany; in Scandanavia, in addition, there occurs M. ekmani Brundin (Brundin 1962: 45-51; Illies 1967: 364). In the present material these two species must be considered before all others. According to Reiss (1968 b: 188-190) Monodiamesa must be considered a separate genus (cf. Brundin 1956 a).

11. Parakiefferiella bathophila Kieffer (Fig. 11)

Potthast 1921: 274-276 (sub Dactylocladius bathophilus); Thienemann - Harnisch 1933: 35 (sub Dactylocladius bathophilus); Cernovski 1949: 136; 1961: 203 (sub Orthocladus bathophilus).

Labium with unpaired, light-coloured MT; first LT small and also light coloured; in addition five dark LT which are distinctly larger than the first; PLL extend below the six LT beyond the labial margin; mandib<sup>le</sup> slender, with long point and three T, a fourth T is indicated by coloration; the point is of lighter colour than the T.

Of the six Parakiefferiella species listed in the "Limnofauna europaea", four are considered lake-inhabiting forms.

Of these four forms one (P. coronata Edwards) has a labium that differs from those described above, and the other species (P. dentifera Wülker) has been found in the Alps; consequently, two species, P. bathophila Kieffer and P. nigra Brundin, may be taken into consideration here. The latter has only been found in Sweden and the Alps and its larvae are unfortunately not known. P. bathophila occurs in Northern Germany; the larval description applies to this species. Consequently, the Parakiefferiella HC were included in this species; nevertheless, it must be born in mind that some specimens, particularly from old sediments, may belong to P. nigra (Illies 1967: 363-364; Wülker 1957).

12. Protanypus (Kieffer) Edwards (Fig. 12)

Lenz 1925: 85-94 (sub Didiamesa miriforceps Kieffer); Zavrel 1926: 208-213 (sub Didiamesa); Cernovski 1949: 97; 1961: 169-170; Brundin 1952: 39-45; Pankratova 1970: 59-63.

Labium: row of teeth straight; a very broad, unpaired MT and free LT on each side: the first LT on each side also is broad and only the distal LT are pointed; mandib<sup>el</sup> with long, dagger-like point and five thin, pointed T; the toothed portion of labium and mandibel is dark.

Of the three European species, P. morio Zetterstedt and P. caudatus Edwards are known from Northern Europe and only p. morio has been found in our region (Brundin 1956 a: 61; Illies 1967: 365).

13. Psectrocladius (Kieffer) Edwards (Fig. 13)

Potthast 1921: 316-325; Thienemann-Harnisch 1933: 24-30; Cernovski  
1949: 112-114; 1961: 180-181; Pankratova 1970: 210-225.

Labium with broad, paired or unpaired MT and five LT on each side; PLL narrow (the "beard-like hairs" on the PLL are scarcely visible in the subfossil specimens); mandib<sup>(a)</sup> with a long, slender point and three T; PM ends distally in only one point; labrum: SI are very large and usually easily recognized, they are distally dentate shovel-like bristles. The numerous species of the genus Psectrocladius ("Limnofauna europaea": 51 species; Illies 1967: 365-366) belong taxonomically to the most difficult chironomids (Brundin 1956 a: 118). Further differentiation was not attempted for this reason.

## Chironominae - Chironomini

p.9

14. Chironomus Meigen (Fig. 14, 15)

Lenz 1954-62: 146-163; Curry 1956: 225-236, Konstantinov 1956:  
157-168.

Labium with broad, unpaired MT, small first LT which has fused basally with the MT; with high second LT which exceeds beyond the MT; with a narrow third LT which has basally fused with the second LT, and four additional T which decrease laterally more or less evenly in size; PLPL broadly fan shaped and extending far laterally; the pattern consists of a row of short, distinctly visible grooves in the basal part, these may be extended as thin lines to the vicinity of the oral margin; the oral margin is smooth; mandib<sup>(el)</sup> with three ET and one light coloured IT on surmounted by an additional, very small T.

Based on the characteristics of labium and mandib<sup>(el)</sup> the subfossil HC may be divided into two types:

Plumosus-Type: labium: fifth LT distinctly smaller and narrower than the adjacent teeth; mandib<sup>(el)</sup>: the three ET are approximately of the same size and of the same dark colour (Fig. 14).

Anthracinus Type: labium: fifth LT distinctly smaller and narrower than the adjacent teeth; mandib<sup>(el)</sup>: third (proximal) ET much smaller and lighter than the other two T (cf. Rempel 1936: 209-221) (Fig. 15).

The Chironomus larvae from the Plön collection and from our own collection were examined for this combination of characteristics. In this process it was possible to place clearly the species Ch. plumosus and Ch. anthracinus into the forms characterized above. The plumosus type includes also, for instance, Ch. thummi, Ch. salinarius, Ch. halophilus; the anthracinus type includes Ch. alpestris and Ch. annularius.

The result important to our discussion is that the species Ch. anthracinus Zetterstedt and Ch. plumosus Linné, which are characteristic for the depth of eutrophic lakes, can be segregated on the basis of the structure of the mouth parts. However, in this regard it is also possible, particularly in the case of subfossil head capsules from old sediments, that other species are involved.

Curry (l.c.) lists the species characteristics of the larvae of Ch. staegeri Lundbeck, Ch. hyperboracus Staeger and Camptochironomus tentans Fabricius. These characteristics relate to the form of the labral combs, the median part of the labral sclerite and the epipharyngeal comb. Determination is possible only in the case of "uniform orientation" (Curry) of the three elements. Because these parts of the labrum and the epipharynx - if present at all - are no longer in their original position in the subfossil specimens or they break off or become dislodged during preparation, it was not possible to consider them as characteristics.

15. Cryptochironomus (Kieffer) Lenz (Fig. 16).

Harnisch 1923: 271-299; Cernovski 1949: 60; 1961: 105 (sub C. defectus Kieffer); Lenz 1954-62: 224-229

Labium with a broad, hyaline MT and 5 LT on each side; the fourth of the LT is smaller than the adjacent teeth; a sixth LT has fused with the MT, but can be recognized by its dark colour; the rows of teeth incline from the MT in the direction of both sides; consequently, on the whole, the row of labial teeth is curved

concavely; PLPL narrow-wing shaped; surface - except the marginal areas - narrowly striate; mandibel with two ET.

16. Cryptocladopelma Lenz (Fig. 17)

Cernovski 1949: 64; 1961: 108 (sub Cryptochironomus rp. viridulus); Lenz 1954-62: 212-214; 1960 b: 173

Labium with a narrow, paired MT, a laterally declining row of four LT and a group of three additional LT, the first and the third of these are small, the middle T is large (the largest T of the labium): these are the relations as they apply to the lateralis type; in the laccophilus type the LT 5-7 are set off by a gap from LT 1-4; both types have 7 LT (cf. Lenz l.c., figure 277 and 278: in the lateralis type LT 7 is missing; it is indicated in Cernovski (l.c.) in figure 27 on the right); mandibel<sup>(el)</sup> with three T which are trapezoid and do not exceed beyond the contour of the interior margin. p.10

PLPL short-triangular; short, strong striation in the basal part; very fine lines continue the pattern orally but do not extend to the oral margin; the oral margin is smooth. The predominant part of the material belongs to the lateralis type; laccophilus head capsules were found only occasionally.

The lateralis type includes the species C. lateralis Goetgh. and C. torbora Lenz; for the laccophilus type only G. laccophila Kieffer has been listed (Lenz l.c.).

17. Demicryptochironomus Lenz (Fig. 18)

Cernovski 1949: 60; 1961: 105 (sub Cryptochironomus rp. vulneratus Zetterstedt); Lenz 1954-62: 222-224; 1960: 454-456

Labium with a broad hyaline middle tooth and 7 point LT of equal size; the row of teeth forms a concave curve; LT brown; mandib<sup>el</sup> with two T and one long, dagger-like point; PLPL narrow-wing shaped, extending far laterally; surface pronouncedly striate except for the marginal zones; oral margin smooth.

Lenz (l.c.) lists three species for this larval form; of these, D. ploenensis Lenz and D. vulneratus Zetterstedt occur in our region (Illies 1967: 371).

18. Dicrotendipes Kieffer (Fig. 19)

Cernovski 1949: 74; 1961: 117-118 (sub Limnochironomus Kieffer);

Lenz 1954-62: 188-195 (sub Limnochironomus Kieffer)

Labium with one unpaired MT and six LT; of these, the first is approximately as long as the MT, the second is especially small and has fused basally with the first; the remaining four T become uniformly smaller laterally; mandib<sup>el</sup> with three dark ET and one light IT; PLPL short-triangular; basally and along the oral margin strong striation, in between there is a zone without pattern; oral margin coars<sup>ley</sup> crenate, containing a pattern with dark fields which are separated by narrow, light stripes.

The oral margin of the clypeus is characterized by structures that are typical for the species (Lenz l.c.; 191). In subfossil specimens, unfortunately, the clypeus has often been broken out or its oral margin is not visible in the preparations; consequently, these characteristics were not taken into consideration.

The "Limnofauna europaea" lists 7 species for the region (sub Limnochironomus Kieffer) (Illies 1967: 373), they are all, at least facultative, lake forms.

It should be mentioned here that, according to Freeman (1957: 356-357), Limnochironomus Kieffer is a synonym of Dicrotendipes Kieffer.

19. Einfeldia Kieffer (Fig. 20)

Lenz 1937 a: 289-301; 1954-62: 164-167; Cernovski 1949: 74; 1961: 118-119 (E. rp. carbonaria Meigen)

Labium with an unpaired MT and 6 LT; MT is higher and broader than LT; mandib<sup>el</sup> with three weakly developed ET; PLPL broadly fan-shaped; basally, a row of short, pronounced grooves that continue orally as fine lines; oral margins smooth.

p.11

In the present material LT four of the labium is distinctly smaller than the adjacent teeth. Lenz (l.c.) lists this characteristic only for E. insolita. Nevertheless, the HC cannot be simply included in this species because, firstly, Lenz (l.c.) places his larval groups only into four species ("Limnofauna europaea" lists ten species [Illies 1967: 371]) and, secondly, because Cernovski (l.c.) illustrates under E. carbonaria Meigen a labium with a small LT 4.

20. Endochironomus intextus Walker (Fig. 21)

Lenz 1954-62: 185-186; 1955: 116-117

Labium with a paired MT and 7 LT; the largest T is LT 1, it is distinctly higher than the MT; LT 2 smaller than LT 3; LT 3-5 become uniformly smaller towards the outside; mandib<sup>(al)</sup> with three ET and 1 small IT. PLPL broadly fan-shaped; on its surface, two rows of grooves, the oral row is more pronounced; a zone without pattern directly at the oral margin; oral margin smooth. It is possible that additional species belong to this larval type.

21. Endochironomus tendens Fabricius (Fig. 22)

Cernovski 1949: 81-83; 1961: 124; Lenz 1954-62: 182-185

Labium with a paired MT and 7 LT; LT 1 larger than MT; LT 2 smaller than LT 3; T 3-7 become uniformly smaller towards the outside; the LT adjacent to MT have basally fused; mandib<sup>(al)</sup> with 3 free ET and 1 small, light IT; PLPL narrow, extending far laterally; lateral angle rounded; pronounced stripes in the basal part, orally, a zone without pattern, and directly at the oral margin a row of short lines; oral margin very finely crenate (this cannot be shown at the scale used in Fig. 22).

22. Glyptotendipes Kieffer (Fig. 23)

Cernovski 1949: 69-70; 1961: 113-114; Wundsch 1943: 369-370; Lenz 1954-62: 169-177.

Labium with unpaired MT and 6 LT; LT 1 somewhat exceeds beyond MT, and LT 4 is smaller than the adjacent teeth; mandibel with three ET, a light IT with short point; PLPL extend very far laterally, consequently, the basal angle is oblique; on the surface in the basal part a row of distinct lines which become weaker orally; at this

point a second field starts, approximately of the same width, with a pattern, extending close to the oral margin; the oral margin is finely crenate.

23. Lauterborniella agrayloides Kieffer (Fig. 24)

Bause 1921: 69-72 (sub Tanytarsus agrayloides Kieffer); Lenz 1942: 50-52.

Labium with a paired MT and 6 LT; LT 1 small, LT 2 large and somewhat higher than MT; LT 3 distinctly smaller than LT 2; size of LT 3-6 decreasing laterally; PLPL trapezoid, in this instance the oral margin is entirely straight and constitutes the base of the trapeze; striation dense, basally particularly strong; no pattern in a broad zone along the oral margin; labial bristles (usually preserved even in the subfossil specimens) pinnate; mandib<sup>el</sup> with two ET and 1 IT; mandib<sup>el</sup> and labium and the other parts of the HC light coloured.

24. Lenzia Kieffer (Fig. 25)

Cernovski 1949: 81; 1961: 123 (sub Pentapedilum exsectum Kieffer); Lenz 1954-62: 246-248

Labium with a paired MT and 7 LT; MT very small, they are greatly exceeded by the large LT 1; LT 2 smaller than LT 3 and 4; LT 5-7 also small; row of teeth strongly curved in a convex manner; mandibel with very short point (not longer than the first ET) and 3 ET; the middle ET is distinctly smaller than the others; IT absent; PLPL broadly fan-shaped; 2 rows of striae of approximately the same width form a strong pattern; oral margin smooth. p.12

25. Microtendipes Kieffer (Fig. 26)

Bause 1921: 109-112 (sub Tendipes abbreviatus Kieffer); Lenz 1942: 41-45; 1954-62: 254-258; Cernovski 1949: 91; 1961: 130.

Labium with paired MT and 6 LT; sometimes an additional, very small, T occurs between the MT; LT 1 small and fused at the base with LT 2; LT 2 is the largest T of the labium, it tends beyond MT; LT 3 distinctly smaller than LT 2, but larger than T 4-6; MT may be light or almost as dark as LT; mandib<sup>les</sup> with 3 dark ET and 1 light IT. PLPL broadly fan-shaped; basal angle approximately 90°, very brief striae, in the basal third, above these is a zone without pattern and then very pronounced striae, forming an arch-like pattern closely to the oral margin; oral margin smooth.

26. Pagastiella orophila Edwards (Fig. 27)

Brundin 1949 b: 841-843; Cernovski 1949: 77; 1961: 120 (sub Tendipedini gen? I. minuta Kruglova); Lenz 1954-62: 251; Mothes 1968: 95.

Labium with paired MT and 7 LT; LT 1 very thin, scarcely visible (not shown in the illustrations by Brundin l.c., Lenz l.c.); LT 2 broader than MT; LT 3-7 smaller than LT 2; the row of teeth is a strongly convex arch; LT 1 clipped at a slant distally; mandibel slender; with 3 ET and 1 IT; labium and mandibel light.

27. Parachironomus Lenz (Fig. 28)

Harnisch 1923: 271-299; Lenz 1938: 700-714; 1954-62: 196-205;  
Cernovski 1949: 67; 1961: 112 (Crytochironomus rp. pararostratus  
Lenz).

Labium with unpaired MT and 7 LT; MT somewhat broader than the LT; all T narrow and pointed at the lower end; row of teeth forms a shallow arch; mandib<sup>(el)</sup> slender, scarcely curved, with 2 ET; PLPL small with strong striation that does not extend to the oral margin; oral margin undulate.

28. Paracladopelma obscura Brundin (Fig. 29)

Harnisch 1923: 271-299; Cernovski 1949: 56-57; 1961: 102-103 (sub Crytochironomus ex gr. camptolabis Kieffer); Lenz 1954-62: 214-220; 1959: 429-449.

Labium with paired MT and 7 LT; the MT are only indistinctly separated and the first LT have become fused with them at the base; consequently, this creates the impression of a single, large MT; the remaining LT become laterally uniformly smaller; the labium is light, and details often cannot be recognized; PLPL start far outside on labium and are broadly wing-shaped; their oral part is strongly striate; the striae extend into the notches of the oral margin, consequently, the coarse notches of the oral margin and the striation form a unit; the mandib<sup>(el)</sup> is slender and light; with 3 T which are distally pointed, their outline in view from above is triangular (cf. Paracladopelma spp.).

Paracladopelma larvae with the forementioned characteristics are included by Lenz (l.c.) in the nigritula group; of these,

olstadtii Kieffer is a species that is not listed in the "Limnofauna europaea", and hirticeps Kieffer is not a definite member of the genus (in "Limnofauna europaea" it has been placed in the genus Cryptochironomus) (Illies 1967: 371). The species nigritula Goetgh. p.13 and obscura Brundin remain. According to Reiss (1968 b: 203) nigritula Goetgh. is synonymus with obscura Brundin.

29. Paracladopelma Lenz spp. (Fig. 30)

Harnisch 1923: 271-299; Cernovski 1949: 57; 1961: 102-103 (sub Cryptochironomus ex gr. camptolabis Kieffer); Lenz 1954-62: 214-220; 1959: 429-449.

Labium with unpaired MT and 7 LT; MT light, LT dark; MT very broad; LT 1-5 broad and distally truncate at a slant; LT 5 and 6 narrow and pointed; PLPL as in obscura; mandib(ale) with 3 T, of these the middle T is acute-triangular and the other two are very broad and trapezoid when viewed from above.

Lenz (l.c.) places these larvae in the camptolabis group. He lists the species camptolabis Kieffer and Laminata Kieffer in this group; both occur in the lakes of Holstein. The other species of the genus (according to Illies 1967: 374, there are 5 species, two of these - sinuosa Kieffer and viridis Kieffer have been recorded in our region) have not been placed into the larval groups.

30. Paralauterborniella nigrohalteralis Malloch (Fig. 31)

Lenz 1942: 48-50; 1954-62: 260.

Labium with a broad, light MT and 6 dark LT which become smaller laterally; PLPL start far laterally and are large in comparison with the labium; their form is broadly wing-shaped; the pattern consists of striae which are strong, but not very closely placed; mandib(1) with a short, narrow point and 3 ET, the first of these is narrower than the others.

31. Paratendipes Kieffer (Fig. 32)

Bause 1921: 106-108; Lenz 1942: 45-48; 1954-62: 258-259; Cernovski 1949: 89-90; 1961: 128-129.

Labium with a paired MT and 7 LT; the 2 MT and LT 1 are light coloured and small; they form a homogeneous central group; LT 2 is also small and has basally fused with LT 3; LT 3 is the largest T of the labium; T 4-7 are smaller than LT 3, their size decreases from the centre to the outside; the mandib(1) has a dark point and 2 free, dark ET (a third ET is partially fused with the interior margin of the mandibel) and 1 light IT. PLPL broadly fan-shaped; short striae only along the oral margin, otherwise no pattern; oral margin smooth.

32. Polypedilum Kieffer (Fig. 33)

Lenz 1942: 12-21; 1954-62: 237-243; Cernovski 1949: 77-80; 1961: 120-122.

Labium with a paired MT and 7 LT; MT and LT 2 are larger than LT 1 and LT 3-7; mandibel with a dark point and 2 free dark ET (a third ET has fused with the interior margin of the mandib(1)) and 1 light IT. PLPL broadly fan-shaped; pattern consists of striae extending from the basis to the oral margin; the oral margin is smooth.

The larvae with these characteristics belong to the nubeculosum and convictum groups (sensu Lenz).

33. Pseudochironomus Staeger (Fig. 34)

Lenz 1937 b: 1-11; 1954-62: 252-254; Cernovski 1949: 69; 1961: 112.

Labium with unpaired MT and 6 LT; MT broader than LT 1; LT 1 approximately of the same height as MT; LT 2 very small and narrow; LT 3 only slightly smaller than LT 1; from T 3-6 the size decreases uniformly; the row of teeth forms a very shallow arch; PLPL narrow, meet almost at the centre, i.e. similar to Tanytarsus; a row of short striae at the middle of the surface; mandib<sup>al</sup> slender; point lighter than 3 ET; IT absent. p.14

34. Sergentia coracina Zetterstedt (= S. longiventris Kieffer syn. nov.) (Fig. 35)

Lenz 1927: 178-183 (S. longiventris Kieffer); 1942: 31-35; 1954-62: 246-248; Cernovski 1949: 84, 1961: 124-125; Stahl 1959: 56-60; Wulker 1961: 310-315; Megardi 1964, Fig. 19.

Sergentia "longiventris" specimens were available for comparison from the following lakes: Tjernosen, Nedre Sjudalsvand (Norway), the Lunzer Mittersee; and of S. coracina: from the Lunzer Untersee, Pulsee, Sampacher See and Schaalsee.

Labium with paired MT and 7 LT; LT 1 larger than MT; LT 2 smaller than LT 3; LT 3-7 decrease laterally in size; the row of teeth is a shallow arch; mandib<sup>al</sup> with a dark point and four dark free ET and 1 light IT; PM ending distally in 2 teeth, proximally no

additional teeth. PLPL - broad fan-shaped; the pattern consists of short striae along the oral margin, they are formed of 2 closely adjacent groups, and of indistinct, irregular striae on the surface which start in the central part and peter out laterally.

Kieffer (1924: 83) described the species S. longiventris from the material from the lakes Tjernosen and Nedre Sjudalsvand (leg. Lenz) in Norway. Wülker(1.c.) examined the pupae and found that they fitted into the variation range of S. coracina; he demanded: "if the larvae and imagoes of these collections sites do not differ from S. coracina, the two species must be considered synonymus." In the course of our investigation we observed the exterior of the larvae of S. coracina. In contrast to S. "longiventris" from the Mittersee, their PM have no additional teeth. Wülker is of the opinion that the Mittersee population and the population found by Brundin (1949 b: 774-776) in lakes in Southern Sweden, belong to the species S. albescens Townes. Consequently, there are two species, S. coracina and S. albescens whose larvae can be easily differentiated by the form of their PM. The HC must be placed in S. coracina. S. psiloptera Edwards is probably the third European species. It has become known only from Swedish Lapland and the Bear Island (Wülker 1.c.; Brundin 1949 b: 667).

The 3 species described by Cernovski (1.c.), i.e. S. flavodentata, S. baicalensis and S. bathyphila were based on larval characteristics and were placed in Sergentia with reservation. Details of the labia differ from the species discussed here.

35. Stenochironomus Kieffer (Fig. 36)

Cernovski 1949: 74-75; 1961: 119; Lenz 1954-62: 179-182

Labium with paired MT and 4 LT; row of teeth curved concavely; MT and LT 1 of equal size; LT 2-4 narrower and fused basally; PLPL not of the typical fan-like shape of the Chironomini and without striation; mandib<sup>el</sup> stout; point not longer than the 2 T.

36. Stictochironomus Kieffer (Fig. 37)

Lenz 1927: 173; 1942: 173-178; 1954-62: 230-236; Roback 1966: 169-172.

Labium with paired MT and 7 LT; MT very small; LT 1 is the largest tooth of the labium; of the other LT, 3 and 4 are large, 2, 5, 6 and 7 are small; mandib<sup>el</sup> with a short point and 3 free ET, a fourth ET has become fused with the interior margin of the mandib<sup>el</sup>; p.15  
ET 1 - and faintly suggested also in ET 2 - broadly shovel shaped; PLPL broadly fan-shaped; surface not patterned; oral margin smooth. The criterion for differentiating the species St. histrio Fabricus and St. rosenschöldi Zetterstedt, i.e. along the epipharyngeal comb (Lenz l.c.), was not suitable for the subfossil specimens. The combs, if they were present at all, had usually become dislodged in the preparations and details were no longer visible.

With regard to the larvae of the species Allochironomus crassiforceps Kieffer Lenz (1954-62: 236) states, "agreement with the larvae of Stictochironomus"; consequently, the 2 forms cannot be segregated.

37. Xenochironomus xenolabis Kieffer (Fig. 38)

Pagast 1934: 155-158 (sub Chironomus xenolabis; Cernovski 1949: 65;  
1961: 110; Lenz 1954-62: 177-179

Labium with unpaired MT and 10(?) LT. The last of these are very small; the row of teeth is straight LT 4, than it slopes down almost at a right angle; MT and LT 2, <sup>which</sup> is even higher than MT, are large; all other T are small; PLPL broad and almost straight; the entire surface has densely placed lines; only in the central part along the oral margin there is a zone without pattern; mandibel with a long point and three minute T; point and the part bearing the teeth are dark.

X. xenolabis is the only European species of the genus. According to Illies (1967: 376) its distribution is holarctic.

## Chironominae - Tanytarsini

38. Cladotanytarsus (Kieffer) Kruger (Fig. 39)

Bause 1921: 67-69 (sub "Attersee-Tanytarsus"); Krüger 1938: 209-222; Cernovski 1949: 50; 1961: 97 (sub Tanytarsus rp. mancus v.d. Wulf).

Labium with 1 unpaired MT and 5 LT; LT 2 is distinctly smaller than the adjacent teeth; PLPL narrow, they meet at the centre; mandibel with a point, 2 free ET (a third ET has fused with the interior margin of the mandibel) and 1 IT; PM end distally in 3 long T, the first of these is narrow and the second is the longest;

a bristle-shaped IT is present.

Krüger (l.c.) lists species characteristics for the larvae; however, the systematic and taxonomic situation within the genus is presently so difficult that not even the male imagoes can be determined with any degree of certainty (Reiss 1968 b: 271).

The greatest proportion of the subfossil material corresponds approximately to the dispersopilosus type (Krüger l.c.: 209-210): the MT of the labium is not as broad as in mancus and it has a light central part and dark lateral part.

39. Corynocera ambigua Zetterstedt (Fig. 40)

Andersen 1943: 174-178 (sub Dryadotanytarsus edentulus Anders.);

Deevey 1955: 312-315 (sub Dryadotanytarsus duffi Deevey); Hirvenoja

1961: 105-110

Labium with 1 unpaired MT and 2 LT on each side; the row of teeth is bent dorsally at the lateral corners, consequently, LT 2 are situated dorsally of LT 1; mandib(ul) with a short point, without T; PM with 5 T; the first of these is narrow, the second extends farthest distally, the others become proximally uniformly smaller; the bristle-shaped IT is present; frontal bristles simple.

40. Lauterbornia coracina Kieffer (Fig. 41)

Bause 1921: 102-104; Zavrel 1926: 203-207; Thienemann 1929: 98;

(1946): 145-149 (sub Lauterbornia gracilentata Holmgren); Cernovski

1949: 48; 1961: 94.

Lauterbornia coracina - material was available from the  
Pulvermaar, Gemündener Maar, Madüsee, Schaalsee, Lunzer Untersee, in

addition, several species of Micropsectra were available.

Labium with 1 unpaired MT and 5 LT; MT light at the centre, dark laterally; PLPL narrow, meeting at the centre; mandib<sup>el</sup> with a dark ET, 3 dark ET and 1 light IT; AS with a short, distal spur; FB simple. PM end distally with 2 teeth, the first of these is narrow and pointed and the second is broad and distally rounded; the bristle-shaped IT is absent.

All characteristics apply not only Lauterbornia but also to all the Micropsectra larvae examined.

The HC were placed in L. coracina because in the same sediment layers hypopygia of this species were found rather frequently. They were in such good condition that they could be determined definitively (det. Reiss). Nevertheless, this fact does not preclude the presence of a profundal Micropsectra species.

41. Paratanytarsus (Bause) Kieffer (Fig. 42)

Bause 1921: 60-63 (sub Tanytarsus Lauterborni group; T. Lauterborni, T. bauseellus); Thienemann 1929: 114-117 (sub Paratanytarsus group); Thienemann-Krüger 1951 (sub subsection Paratanytarsus)

Labium with 1 unpaired MT and 5 LT; row of teeth forms usually a distinct arch (not as straight as in Tanytarsus and Micropsectra); Mandib<sup>el</sup> with a dark point, 2 or 3 free dark ET and 1 light IT; AS without distal spur.

PM ending distally in 2 teeth, the first of these is narrow and pointed and the second broad and distally rounded; the epipharyngeal comb consists of 3 to 4 inarticulate, large teeth

(in Tanytarsus and Micropsectra they consist of 3 groups of 3-5 teeth each).

42. Stempellina (Bause) Brundin (Fig. 43)

Bause 1921: 64-66 (sub Bausei group: Tanytarsus bausei Kieffer);

Brundin 1949 a: 6-7, 14-19; Cernovski 1949: 47; 1961: 93.

Labium with 1 unpaired MT and 6 LT; MT lighter than LT; broad\*; they do not meet at the centre but are far apart; with dense striation except for a zone along the oral margin; mandib<sup>(al)</sup> pointed 2 free ET and 1 IT; PM distally with 2 slender T, proximally 2 somewhat shorter T; FB cleft, on a socket or not; AS mediolaterally with a large, hand-shaped appendage.

According to Brundin (l.c.) the FB of St. bausei are not on sockets but in St. subglabripennis they are. On the basis of some subfossil specimens it was observed that both forms are contained in the material; because the characteristic was visible only on a few HC, it was not possible to segregate the 2 forms. However, apart from these 2 species they are 4 additional species in Europe; of these, 2, i.e. St. paludosa Goetgh. St. almi Brundin occur in lakes (Illies 1967: 378). They have not been included in the keys by Brundin (l.c.).

43. Stempellinella Brundin (Fig. 44)

Brundin 1949 a: 6, 8-13.

Labium with 1 unpaired light MT and 6 dark LT; LT 1 is fused to half its height with the MT; in worn T it appears as a dark, lateral part of the MT; PLPL broader than in Tanytarsus and curved; densely

---

\* Translator's note: At this point one or several words are missing in the source text.

striate except for a zone along the oral margin; mandibel pointed, 2 ET and 1 IT; PM with 3 distal T; AS with a large, distally rounded spur; FB simple or cleft. p.17

According to Brundin (l.c.) St. minor has simple FB, St. brevis has cleft FB. Both are present in the subfossil material. However, this characteristic is visible only in a few specimens that are in especially good condition. Furthermore, the larvae of the other 3 European species, St. distinctissima, Brundin, St. flavidula Edwards and St. saltuum Goetgh. (Illies 1967: 379) have not been described.

44. Tanytarsus chinensis Gruppe (sensu Reiss & Fittkau 1971) (Fig. 45 u. 46)

Brehm 1923: 61-62 (sub Tanytarsus spec.); Thienemann 1929: 98, 107 (sub Tanytarsus minusculus); 1946: 107 (sub Micropsectra spec.); Cernovski 1949: 48; 1961: 95 (sub Micropsectra curvicornis); Brundin 1949 b: 788 (sub Micropsectra monticola); Mothes 1968: 93 (sub Tsnytarsus curticornis)

This taxon corresponds to Tanytarsus B in Hofmann (1971).

Labium with 1 unpaired MT and 5 LT; LT 1 basally fused with MT; PLPL narrow and approaching at the centre; mandibel pointed, 2 or 3 free ET and 1 IT; PM end distally with 3 long T, the first of these is narrow and pointed, the others are broader and rounded distally; FB simple or asymetrically cleft; AS with long (approximately 50  $\mu$ ), curved, thin spur.

Two forms of the described type occurred in the subfossil interior: in the first, the MT of the labium is light in the centre and dark at the sides, the mandibel has only 2 free ET and the FB are

asymmetrically cleft (Fig. 45), in the other, the MT of the labium is uniformly dark, the mandibel has 3 free ET and the FB are simple (Fig. 46).

Tanytarsini larvae with a long spur on the AS have been described repeatedly and under different names. One of them - Micropsectra trivialis - , based on the form of its PM, belongs into the genus Micropsectra. Its spur is not thin, in contrast to the type under discussion here, but rather broadly triangular.

On the other hand, the individually reared larva placed by Mothes (l.c.) into the species Tanytarsus curticornis Kieffer agrees rather well with the subfossil HC.

Reiss & Fitttkau (1971) place T. curticornis, T. brundini and T. chinyensis Goetgh. together with 2 crenobiontic species into the chinyensis group. According to these authors, the affinities of the Stechlinsee specimens, i.e. whether they belong to curticornis or brundini, has not yet been elucidated with any degree of certainty.

Because the subfossil material, as mentioned earlier, is heterogenous, the described larval type is not placed into a definite species but into the chinyensis group.

45. Tanytarsus lugens-Gruppe (sensu Reiss & Fitttkau 1971) (Fig. 47)  
Thienemann 1924: 334; 1929: 98-99, 105-106; 1946: 72-75, 83-86;  
Cernovski 1949: 50; 1961: 96 (sub Tanytarsus gregarius); Roback  
1956: 113-116 (sub Calopsectra confusa)

This taxon corresponds to Calopsectra pro parte in Hofmann (1971).

Labium with unpaired MT and 5 LT, LT 1 slants towards the MT

and is basally fused with it; mandib<sup>(el)</sup> with a short point, 3 ET and 2 IT (on the dorsal surface of the mandibel); in addition there is 1 T on the interior surface (dorsal side) within the region of the portion bearing the teeth; PM distally with 3 T, the first of these is narrow and pointed and the others are broader and distally rounded; 2 smaller T further proximally; the bristle-shaped IT is present; FB simple; AS distally without spur.

So far this larval type has been determined with any degree of certainty only for 2 species of the Lugens group; it is also a fact that the larvae of T. gregarius Kieffer - a species that earlier p.18 was placed with bathophilus in the genus Calopsectra - has no additional teeth on the mandibel. On the other hand, the Plön collection contains 2 preparations designated "Tanytarsus gregarius" and "Tanytarsus gregarius Holzmaar", which have the mandibular characteristics described above. According to Thienemann (1946), Bause (1921) revised the larvae from the original material; he makes no mention of special characteristics. Cernovski (1949, Fig. 8) illustrates 1 mandibel of "Tanytarsus sp. gregarius Kieff."; in this illustration a second ET is visible. The discrepancies can probably be attributed to mistaken identification of the larvae.

Reiss & Fittkau (1971) dissolve the genus Calopsectra Kieffer and place T. bathophilus and T. lugens into the lugens group; in other words, this group is not only characterized by the morphology of pupa and imago but also by a common larval type.

46. Tanytarsus pallidicornis group (sensu Reiss & Fittkau 1971)

(Fig. 48)

Bause 1921, Fig. 16 (Tanytarsus lobatifrons); Krüger 1945: 1 102-105  
(Tanytarsus heusdensis), 1 111 (Tanytarsus tetramerus); Thienemann  
1946: 70-79; Cernovski 1949: 50; 1961: 96 (Tanytarsus  
lobatifrons)

This taxon corresponds to the Tanytarsus heusdensis circle  
in Hofmann (1971).

Labium with unpaired MT and 5 LT; MT light in the centre and  
dark at the sides; LT 1 basally not fused with MT; mandib<sup>(al)</sup> with a  
dark point, 3 dark ET and 1 light IT; FB cleft and pinnate; PM  
distally with 3 T; of these, the first is narrow and pointed, the  
others are broader and distally rounded; in addition, 1  
bristle-shaped IT; one point of the distal margin of the AS is  
slightly sinuate, but this situation cannot be considered a spur.

Thienemann (l.c.) includes in his heusdensis circle species  
whose larvae have pinnate FB (and other mutual characteristics).  
These species are found in the pallidicornis group which has been  
conceived according to imaginal characteristics (Reiss & Fittkau  
1971); it contains the following lacustrine species: T. gibbosiceps  
Kieffer (only identified definitively from the Alps), T. nigricollis  
Goetgh, T. pallidicornis Walk. and T. usmaënsis Pagast. The larva  
of T. nigricollis is unknown, the larvae of all other species have  
pinnate FB.

47. Tanytarsus spec. C. (Fig. 49)

Roback 1957, Abb. 501-504 (sub Calopsectra spec. 7); Stahl 1959: 62, Fig. 29 u. 30 (sub Tanytarsus genuinus group)

Labium with 1 unpaired MT and 5 LT; LT 1 and MT are clearly higher than the other T and have partially fused; PLPL narrow and long, approaching at the centre; mandibel with a short point, 3 ET and 2 IT (on the back of the mandibel) and 2 T on the interior surface (dorsally) within the region of the portion bearing the teeth; of the latter 2 T the distal is the larger; PM distally with 3 teeth; of these, the first is narrow and pointed, the others are broader and distally rounded; a fourth, smaller tooth, is located further proximally; a bristle-shaped IT is present; AS with a distally rounded spur; FB simple.

In addition to the illustrations listed above (both without description in the text), which agree well with the larval type described here, but are unfortunately not identified in detail, there are no references in the literature. Consequently, there are no criteria for placement in any Tanytarsus species. It definitely belongs into the genus Tanytarsus v.d. Wulp s. str. (sensu Reiss & Fittkau 1971) because it does not fit into the genus Micropsectra or Paratanytarsus on account of its PM with the 3 distal teeth.

Tanytarsus C is not identical to the larval species T. radens described by Krüger (1944: 200-208). Although the 2 forms agree in so far as the mandibel bears 2 IT and 2 T on the surface, there are differences in the mandibular comb, in the FB, the labium and the PM.

48. Tanytarsus v.d. Wulp (sensu Reiss & Fittkau 1971) part.

Bause 1921: 53-58 (sub Eutanytarsus gregarius group); Thienemann

1929: 96-97 (sub Eutanytarsus gregarius group); Krüger 1945:

1084-1087 (T. herbaceus).

Labium with one unpaired MT and 5 LT; PLPL long, narrow and approaching at the centre; mandib<sup>(el)</sup> pointed, with 2 or 3 free ET and 1 IT; AS distally without spur; FB simple; PM with 3 distal T: the first of these is narrow and pointed, the others are broader and distally rounded; it is possible that proximally additional T are present.

The foregoing characterization of the larva includes the species of the genus Tanytarsus not showing any special characteristics. If it is assumed that the segregation of larvae that has been carried out here agrees with the imaginal categories, i.e. the chinyensis, lugens and pallidicornis groups, <sup>or</sup> undefinable rest remains which, according to the presentation by Reiss & Fittkau (1971), may be segregated into ten species groups with 41 species.

49. Thienemanniola Keffer (Fig. 50)

Labium with 1 unpaired MT and 6 LT; MT and ST 1 somewhat lighter than the remaining T; LT 1 is small and is inserted, in part, in a lateral notch of MT and has basally fused with it; the row of teeth is slightly curved concavely; PLPL curved and not approaching at the centre; they are densely striate on the surface and a broad margin remains without pattern; mandib<sup>(el)</sup> with a dark point, 3 dark ET, the third of which has proximally fused with the interior margin of the mandibel, and 1 light LT; the first (distal) "bristle" of the

mandibular comb is set off from the comb, substantially larger than the other "bristles" and often cleft longitudinally; a long, thin spine occurs in the proximal third of the interior margin of the mandibel; PM with 2 very long, narrow teeth and one small, distally rounded tooth; AS with a large, distally centred spur which has longitudinal folds at the end; anal part of clypeus strongly wrinkled; the simple FB on shallow indistinct elevations; the SI bristles of the labrum are not pennate.

This must be considered a tentative description because it takes into consideration only characteristics present in the subfossil material. Nevertheless, it shows clearly that Thienemanniola, as indicated by its larva, belongs into the section Tanytarsus connectens.

Brundin (1949 a: 6-7, 19-20) describes the larva of Constempellina brevicosta, which was only tentatively placed, but which agrees generally with the larval type discussed here. The same applies to the larval species Stempellina septentrionalis which was erected by Cernovski (1949: 47; 1961: 93).

As shown by a comparison with larva that were placed with certainty (larval exuviae were still attached to the pupae; material collected by Lellak) the Thienemanniola larva largely agrees with the foregoing 2 species: Labium, mandibel, antennal socket, antennae, wrinkling of the clypeus and preanal brush conform well. Differences occur only in details: in this species LT 1 of the labium is smaller, the FB are not on elevations, and antennal segments 3 and 4 are substantially longer, and the preanal brush has only one long, uncleft bristle instead of 2. On the other hand, the conformity includes important special characteristics: antennal

socket with large spur which is distally "folded"; Lauterborn's organs opposite, relatively small, on long stalks; the conspicuous wrinkling of the clypeus which is not known to occur in this manner in other chironomid larvae. In the course of an unbiased examination the listed differences would be considered only species differences. p.20

An examination of all metamorphic stages of Thienemanniola and Constempellina is required.

### c) Keys

#### 1. Subfamilies

1. The labium is a hyaline structure and can be seen only with difficulty; glossa with 4 or 5 teeth and paraglossae present, either with 2 points or scale-like; antennae retractile, as a result often within the head capsules; premandibels and epipharynx absent (Fig. 1-3) . . . . .Tanypodinae.

- A dentate, usually dark labium is present; antenna not retractile; premandibel and epipharynx present . . . . 2

2. Striate paralabial plates absent (Figs. 4-13). .Orthocladinae

- Striate paralabial plates present . . . . . 3

3. Labium with unpaired middle tooth and 5 lateral teeth;

paralabial plates narrow, straight, elongate, almost meeting at the centres; high antennal socket with or without spur; or labium with unpaired middle tooth and 6 lateral teeth; paralabial plates curved, not approaching at the centre; high antennal socket with spur or hand-shaped appendage (Figs. 39-50) . . . . . Tanytarsini

- Labium with paired or unpaired middle tooth and at least 6 lateral teeth; paralabial plates triangular fan-shaped; when narrow and approaching in the centre, more than 5 lateral teeth and no high antennal socket (Figs. 14-38) . . . . . Chironomini

## 2. Tanypodinae

1. Paralabial combs present; paraglossae scale-like (Fig. 3) . . . . . Procladius
  - Paralabial combs absent; paraglossae with 2 points . . . 2
2. Middle tooth of glossa is the largest (Fig. 1) . . . . . Labrundinia longipalpis
  - Middle tooth of glossa is the smallest (Fig. 2) . . . . . Pentaneurini pro parte.

## 3. Orthocladiinae

1. Labium with at most 5 lateral teeth . . . . .2  
 - Labium with 6 lateral teeth . . . . .5
2. Labium with 3 lateral teeth; of these the first and the middle tooth are very broad and low and distally not pointed; the other 2 lateral teeth are narrow and distally pointed; mandib<sup>(al)</sup> with 5 teeth (Fig. 12)  
 . . . . . Protanypus  
 - Labium with 5 lateral teeth; mandib<sup>(al)</sup> with fewer than 5 teeth . . . . . 3
3. Labium with large, triangular, hyaline middle tooth; lateral teeth entirely covered by the paralabial lamellae; labium and mandibular teeth light (Fig. 7)  
 . . . . . Cricotopus triquetrus  
 - Middle tooth of labium of different shape and dark; lateral teeth not completely covered by the paralabial lamellae; teeth of labium and mandib<sup>(al)</sup> more or less dark. . . . . 4 p.21
4. Labium with large, paired middle tooth; lateral teeth 1 and 2 almost as large as the middle tooth; in contrast, lateral teeth 3-5 very much smaller; very pronounced broadening laterally of the paralabial lamellae; premandibels distally with two points; gula light (Fig. 8).  
 . . . . . Heterotrissocladus grimshawi  
 - labium with paired or unpaired middle tooth which is much

larger and broader than lateral tooth 1; lateral teeth 1 and 2 not much larger than lateral teeth 3-5; paralabial lamellae laterally only increasing slightly in width; premandibels distally with 1 point (Fig. 13) Psectrocladius

5. Paralabial lamellae extend at a slant and laterally far beyond the portion of the labium that bears the teeth....6
  - Paralabial lamellae do not extend far beyond the portion of the labium that bears the teeth . . . . .7
  
6. Middle tooth with a median and a lateral notch on each side; lateral teeth all approximately the same size; mandib(als) stout with two teeth (Fig. 10) . . . . . Monodiamesa
  - a small point is set off at the centre of each middle tooth; lateral teeth 1 and 2 distinctly broader than the other lateral teeth; mandib(al) slender, with 3 very small teeth (Fig. 9) . . . . . Microcricotopus
  
7. Middle tooth of labium very much smaller than lateral tooth 1 (Fig. 4) . . . . . Corynoneura
  - Middle tooth larger than lateral tooth 1 . . . . . 8
  
8. Lateral tooth 1 very small and basally fused with the middle tooth; middle tooth and lateral tooth 1 lighter than the other lateral teeth; point of mandib(al) lighter than the portion bearing the teeth (Fig. 11)
  - . . . . . Parakiefferiella bathophila

- Lateral tooth 1 not smaller than lateral tooth 2, not basally fused with the middle tooth; middle tooth and lateral tooth 1 not lighter than the other lateral teeth; point of mandib<sup>al</sup> not lighter than the portion bearing the teeth . . . . . 9
  
- 9. Middle tooth of labium very broad and distally light (Fig. 6) . . . . . Cricotopus B
- Middle tooth of labium at most 2-3 times as broad as lateral tooth 1, distally not light (Fig. 5) . . . . . Cricotopus A
  
  
- 4. Chironomini
- 1. Row of labial teeth curved concavely. . . . . .2
- row of labial teeth curved convexly or straight . . . . .4
  
- 2. Middle tooth paired, not broader than lateral tooth 1, dark; paralabial plates reduced (Fig. 36). . . . Stenochironomus
- Middle tooth of labium unpaired, much broader than lateral tooth 1, hyaline; paralabial plates narrowly wing-shaped. . . . . .3
  
- 3. Labium with 6 free lateral teeth (Fig. 16)..Cryptochironomus
- Labium with 7 free lateral teeth (Fig. 18) . . . . . Demicryptochironomus
  
- 4. Middle tooth of labium unpaired. . . . . .5
- Middle tooth of labium paired . . . . . 13

5. Paralabial plates narrow, elongate, almost meeting at the centre (Fig. 34) . . . . . Pseudochironomus
- Paralabial plates triangular, fan-shaped, not approaching in centre . . . . . .6
6. Lateral tooth 1 smaller than lateral tooth 2 . . . . . .7
- Lateral tooth 1 not smaller than lateral tooth 2 . . . . .8
7. 7 lateral teeth; lateral tooth 1 fused basally to the middle tooth, lateral tooth 3 fused basally to lateral tooth 2; row of teeth forms a shallow arc (Figs. 14 and 15) Chironomus
- a. Lateral tooth 5 of the labium not smaller than the adjacent teeth; mandible with three large, dark external teeth (Fig. 14). . . . . plumosus-type
- b. Lateral tooth 5 of the labium smaller than the adjacent teeth; mandible with two large, dark and one small, light external tooth (Fig. 15) . . . . . anthracinus-type
- More than 7 lateral teeth; lateral teeth 1 and 3 free; row of teeth straight to lateral tooth 4, then curving inwardly almost vertically (Fig. 38). . . . . Xenochironomus
8. Middle tooth of labium lighter than the lateral teeth . . 9
- Middle tooth of labium approximately as dark as the lateral teeth . . . . . .10
9. Labium with 7 lateral teeth; oral margin of the paralabial plates coarsely notched (Fig. 30) . . . . Paracladopelma spp.

- Labium with 6 lateral teeth; oral margin of paralabial plates more or less smooth (Fig. 31)  
 . . . . . Paralauterborniella nigrohalteralis
  
- 10. Oral margin of paralabial plates smooth (Fig. 20) Einfeldia
  - Oral margin of paralabial plates notched . . . . . 11
  
- 11. Labium with 7 lateral teeth; row of labial teeth forms a shallow arc; all teeth narrow and pointed; size of teeth decreases uniformly from the centre to the sides, no teeth smaller than the one following laterally (Fig. 28)  
 . . . . . Parachironomus varus-gr. monochromus-gr.
  
- Labium with 6 lateral teeth; all of teeth curved strongly in a convex manner; all teeth more or less rounded; lateral tooth 2 or 4 smaller than the following tooth . . . . . 12
  
- 12. Lateral tooth 2 of the labium particularly small and basally fused with lateral tooth 1; lateral tooth 4 not smaller than lateral tooth 5; paralabial plates do not extend far laterally, basal angle approximately 90°; oral margin coarsely notched (Fig. 19) . . . . . Dicrotendipes
  
- lateral tooth 2 of the labium not particularly small, not fused basally with lateral tooth 1; lateral tooth 4 smaller than lateral tooth 5; paralabial plates extend very far laterally, basal angle obtuse; oral margin finely notched (Fig. 23) . . . . . Glyptotendipes

13. Middle tooth extends beyond the first lateral tooth . . . 14  
 - First lateral tooth extends beyond middle tooth, or both  
 teeth approximately the same size . . . . . 17
14. Lateral tooth 2 distinctly larger than lateral tooth 1. . 15  
 - Lateral tooth 2 not distinctly larger than lateral tooth 1  
 . . . . . 16
15. Labial teeth dark; 7 lateral teeth; oral margin of . . . . . p.23  
 paralabial plates curved (Fig. 33). . . . . Polypedilum  
 - Labial teeth light; 6 lateral teeth; oral margin of  
 paralabial straight (Fig. 24). .Lauterborniella agrayloides
16. Labial teeth light, last lateral teeth not set off from the  
 row of teeth and not larger than the other lateral teeth;  
 paralabial plates large, extending far laterally, wing-  
 shaped (Fig. 29). . . . . Paracladopelma obscura  
 - Labial teeth dark, last lateral teeth set off from the row  
 of teeth and larger than the other lateral teeth; paralabial  
 plates small, not extending far laterally (Fig. 17)  
 . . . . . Cryptocladopelma
17. Lateral tooth 1 smaller than lateral tooth 2 or both approxi-  
 mately of the same size . . . . . 18  
 - Lateral tooth 1 not smaller than lateral tooth 2. . . . . 20
18. Lateral tooth 1 narrow, visible as a thin line; lateral tooth

- 2 distally pointed at a slant (Fig. 27)  
 . . . . . Pagastiella orphila
- Lateral tooth 1 broader and distinctly visible; lateral  
 tooth 2 distally tron at a slant
19. Lateral tooth 1 of labium distinctly smaller than lateral  
 tooth 2 and basally fused to lateral tooth 2 (Fig. 26)  
 . . . . . Microtendipes
- Lateral tooth 1 of the labium not distinctly smaller than  
 lateral tooth 2 and not basally fused to lateral tooth 2  
 (Fig. 32) . . . . . Paratendipes
20. Mandible with 4 free external teeth (Fig. 35)  
 . . . . . Sergentia coracina
- Mandible with 3 free external teeth . . . . . 21
21. Lateral tooth 3 and 4 or 3, 4 and 6 larger than the other  
 lateral teeth . . . . . 22
- Lateral teeth decreasing in size uniformly from the centre  
 to the sides . . . . . 23
22. Lateral teeth 3 and 4 larger than the other lateral teeth;  
 Paralabial plates without distinct striae; external tooth 1  
 of the mandible expanded in a shovel-like manner; external  
 tooth 2 somewhat larger than external tooth 3 (Fig. 37)  
 . . . . . Stictoichironomus
- Lateral teeth 3 and 4 larger than the others; surface of the

- paralabial plates with two row of pronounced striae;  
 external tooth 1 of the mandible not expanded in a shovel-  
 like manner; external tooth 2 smaller than external tooth 3  
 (Fig. 25) . . . . . Lenzia
23. Middle teeth basally fused; oral margin of the paralabial  
 plates finely notched; lateral angle of the paralabial  
 plates rounded (Fig. 22) . . . . . Endochironomus tendons  
 - Middle teeth basally not fused; oral margin of the  
 paralabial plates smooth; lateral angle of the paralabial  
 plates not rounded (Fig. 21) . . . . Endochironomus intextus
5. Tanytarsini
1. Labium with 2-5 lateral teeth; paralabial plates straight  
 and narrow, approaching at the centre; antennal socket with  
 or without distal spur . . . . . 2  
 - Labium with six lateral teeth; paralabial plates curved and  
 broad; far apart; antennal socket with distal spur or  
 mediolateral hand-shaped appendage . . . . . 10
2. Labium with only two lateral teeth, lateral tooth 2 is p.24  
 dorsal of lateral tooth 1, mandible without teeth (Fig. 40)  
 . . . . . Corynocera ambigua  
 - Labium with five lateral teeth; mandible with teeth . . . 3

3. Lateral tooth 2 of the labium distinctly smaller than lateral tooth 3 (Fig. 39) . . . . . Cladotanytarsus  
 - Lateral tooth 2 not smaller than lateral tooth 3 . . . . . 4
4. Premandibles with two distal teeth . . . . . 5  
 - Premandibles with at least three distal teeth . . . . . 6
5. Antennal socket with spur (in Lauterbornia often only a hint of a spur), epipharyngeal comb with at least nine small teeth (fig. 41) . . Lauterbornia coracina, Microspectra -  
 Antennal socket without spur, epipharyngeal comb with 3 or 4 teeth (Fig. 42). . . . . Paratanytarsus
6. Antennal socket with distal spur . . . . . 7  
 - Antennal socket without distal spur . . . . . 8
7. Spur short and broad; middle tooth of the labium fused basally with the first lateral tooth, both extend clearly beyond the other teeth; mandible with two interior teeth and two additional teeth on the interior surface (Fig. 49)  
 . . . . . Tanytarsus C  
 - Spur long (40-50  $\mu$ ), narrow and pointed; middle tooth and lateral tooth 1 of the labium basally fused, not extending clearly beyond the other teeth; mandible with one interior tooth and no additional tooth on the interior surface (Fig. 45) . . . . . Tanytarsus chinyensis group

8. Frontal bristles cleft and pinnate (Fig. 48)  
 . . . . . Tanytarsus pallidicornis group  
 - Frontal bristles simple . . . . . 9
9. Mandible with two interior teeth and one additional tooth  
 on the interior surface (Fig. 47). . Tanytarsus lugens group  
 - Mandible with one interior tooth, no additional tooth on the  
 the interior surface . . . . . Tanytarsus proparte
10. Antennal socket with mediolateral, hand-shaped appendage  
 (Fig. 43) . . . . . Stempellina  
 - Antennal socket with distal spur . . . . . 11
11. Lateral tooth 1 of the labium is placed partially in a  
 lateral notch of the middle tooth; lateral tooth 1 in  
 middle lighter than the other lateral teeth; premandibles  
 distally with two long, narrow teeth; an additional, very  
 much smaller, roundish tooth further proximally; large spur  
 on the antennal socket with a distal longitudinal fold,  
 anal part of clypeus strongly wrinkled (Fig. 50)  
 . . . . . Thienemanniola  
 - Lateral tooth 1 of the labium fused to 2/3 with the middle  
 tooth; middle tooth light, lateral teeth dark; premandibles  
 with two distal teeth, proximally an additional, smaller  
 tooth which is distally pointed; clypeus not wrinkled; the  
 antennal socket spurs without distal longitudinal fold (Fig.  
 44) . . . . . Stempellinella

III. METHODS

The methods used by the individual authors to prepare their samples differ in part rather widely. However, a close correlation exists between the methods used and the results obtained this has already been emphasized by Stahl (1969); consequently, this problem must be briefly discussed.

The distance between the samples in the sediment core must be such that the number of spot samples will supply sufficient material and that all climatic periods are equally represented. Deevey (1942) selected a distance of 1 m between samples, Konstantinov (1951) usually selected 40-50 cm, Stahl (1959) used usually 1 m. However, some climatic periods are represented in very long cores only by a few centimeters of sediment; consequently, these are not recorded if the distances between samples are this great. It goes without saying that at the time of sampling, dating by pollen analysis has not yet been completed; consequently, it is recommended to use a distance of approximately 10 cm as a matter of principle.

The volume of the spot samples must be related to the density of microfossils. Generally, spot samples of 1 ml were taken (Deevey 1942, Stahl 1959, Goulden 1964, Hofmann 1971); however, Frey (1955) used 0.1 ml, Konstantinov (1951) used 5-10 ml and Lastochkin (1949) used 50 ml.

For preparing the samples, boiling in 10% KOH is required. In the course of recent investigations (Hofmann, unpublished) the method described by Megard (1962) has been found very suitable: boiling for 30 minutes on a magnetic stirrer. In the case of sediments

containing an abundance of lime, subsequent treatment with 10% HCl is suggested.

To reduce the labour required for picking the microfossils from the samples, many authors have passed the prepared sediment through a sieve. This reduced the size of the sample to be examined and the microfossils are easier recognized because the fine detritus particles do not interfere and do not cover individual objects. However, it is important that the mesh of the sieve is not so large that head capsules are lost in the process of passing the samples through the sieve; this would mean that only head capsules of larger species remain. One can be certain that this was the case in Konstantinov's investigations (1951) and Coope's et al. (1961); they used sieves with a mesh of 250  $\mu$  and 600  $\mu$ . The small yield obtained by these authors is also conspicuous: Konstantinov found a maximum of 73 head capsules per 10 ml of sediment (the number of head capsules found by Coope has not been stated). Stahl (1959) and Hofmann (1971) worked with mesh of 125  $\mu$  and 132  $\mu$ ; these values are probably near the upper limit. Loss of head capsules is improbable if this type of mesh is used and can be easily compensated by more careful picking, by the smaller amount of labour required and the consequently higher number of samples.

It is necessary for taxonomic work to make permanent mounts of all specimens because they are required repeatedly for comparison and for double-checking identification. For this purpose the fossils, after dehydration in 96% alcohol, are either embedded in Euparal or they are mounted directly from the aqueous medium into polyvinyl-lactophenol or similar substances.

The total number of microfossils found is generally related to p.26  
1 ml raw sediment; only Goulden (1964) states the quantity in  
specimens/gram ashes and Roback (1970) states it in specimens/gram  
dry mass. Müller (1970) recommends to relate the number of  
microfossils to the quantity of tree pollen (% tree pollen); however,  
this value is affected not only by the population density, rate of  
sedimentation and the washed-in littoral, but also by an additional  
variable, i.e. the pollen precipitation, which varies with the  
location and the time.

The frequency of individual taxa is most suitably expressed  
as the relative abundance in percent of all Chironomidae (Hofmann  
1971).

There have been no statistical investigations yet concerning  
the quantity of material required to obtain reliable data concerning  
the frequency of a taxon. This usually depends on the scattering of  
the samples which, undoubtedly, is very variable. To compare the  
climatic periods, approximately equal quantities of material must be  
available from all sections, also including zones with very low  
fossil density, i.e. very low yield, of which a certain minimum  
quantity must be available. As a guiding figure, Hofmann (1971) uses  
approximately 100 specimens per reference unit (horizon, pollen  
zone); however this is a minimum value and in the case of samples  
from the Schöhsee and the Grosser Plöner See it is often far  
exceeded. In a few studies this number has not been obtained;  
consequently, interpretation of the results is often difficult  
because the frequency differences found are not significant (cf.  
Stahl 1969 referring to Deevey 1942). Furthermore, in some instances

certain phases of lake development are strongly over-represented, others are correspondingly under-represented. For instance, in Roback (1970) 178 of the 359 head capsules originate from a 12-cm-long section of the core which is 2.80 m long. Nevertheless, in the presence of slight scattering of samples, it is possible to demonstrate convincingly the development of a chironomid taxocoenosis even if only relatively small quantities of material (Stahl 1959) were available.

To interpret the results meaningfully it is absolutely necessary to date them with the aid of pollen analysis; only in this manner is it possible to pinpoint the time when the thanatocoenosis was formed. Unfortunately, absolute dating by using the  $^{14}\text{C}$  method does not yield fully reliable values; consequently, calculation of the rate at which the head capsules have become embedded in the sediment (specimens/cm<sup>2</sup>. year) as attempted by Livingstone et al. (1958), Stahl (1959) and Hofmann (1971) must be regarded with reservation.

#### IV. THANATOCOENOSIS - NECROCOENOSIS

Steinecke (1927) and Wasmund (1929) referred to an association of dead organisms that has been translocated into the thanatope as a thanatocoenosis, and to an association of dead organisms that has formed directly in the biotope - thanatope equals biotope - as a necrocoenosis. The very important problem concerning accumulations of subfossil Chironomidae in the lake sediments, i.e. whether they represent thanatocoenoses or necrocoenoses, is

scarcely mentioned in the literature. However, for correct interpretation it is very important to know if the animals lived at the location where they were found or whether the chitin covers were translocated to this location only after adult emergence. p.27

It has been shown that the fossil accumulations in profundal sediments are almost never pure necrocoenoses. This is shown by the constant presence of the remains of purely littoral dwellers among the remains of profundal species. For instance, Stahl (1969) assumes that the abundant Tanytarsus remains in the sediments of the Linsley Pond (Deevey 1942) originated from the littoral; he also demonstrated littoral influences in other instances. During the last developmental phase of the Grosser Plöner See, the allochthonous proportion of the association of dead organisms was so high that the question arose whether any chironomids had lived at all at this location of the profundal (Hofmann 1971).

The following taxa must be considered true shallow-water dwellers: Pentaneurini, Corynoneura, Cricotopus, Microcricotopus, Psectrocladius, Endochironomus, Glyptotendipes, Lauterborniella, Paralauterborniella, Pseudochironomus, Stenochironomus, Xenochironomus, Cladotanytarsus, Corynocera ambigua, Paratanytarsus, Tanytarsus chinyensis group, Tanytarsus pallidicornis group and predominantly also Tanytarsus pro parte.

Because sedimentation generally does not occur in the littoral, the detritus occurring there, including the chitin covers of the animals, is translocated into the sublittoral and the profundal where, as a result, a thanatocoenosis is formed which becomes intermixed with the necrocoenosis which is developing there.

Before interpreting such associations of dead organisms an attempt must be made to resegment necrocoenosis and thanatocoenosis. The origin of the littoral chironomids listed above can be easily recognized. However, other taxa, for instance Procladius, Polypedilum, Stempellina occur over a wider depth range. Above all, it is possible, as shown in the course of the Schöhsee investigations (Hofmann 1971) that the vertical distribution of the species changes fundamentally in the course of the postglacial period. It goes without saying that important facts of this nature can only be proven when drill cores from deep and shallow parts of a lake can be compared. The associations of dead organisms in sublittoral sediments are very close to true necrocoenoses because in this instance it can be assumed that no intermixing with profundal elements has occurred; this makes interpretation simpler from the very start.

In this context a study by Sublette (1969) is of great interest: in the sediment of the meromictic Rita Blanca Lake a pure thanatocoenosis ("death assemblage") was found that consisted predominantly of pupal exuviae. Among 100 pupal skins, only a single larval head capsule was found that had not become detached from the pupa. The good state of preservation of the very delicate pupal exuviae is attributed by the author to the absence of a macrobenthos and to the water circulation.

V. ECOLOGICAL INTERPRETATIONa) Habitat Ecology

p.28

There is scant discussion of individual ecological factors such as temperature, oxygen, nutrition, in the literature. The centre of discussion is usually the problem of changed degrees of trophism of the waters; these processes are derived on the basis of changing proportions of Chironomus and "Tanytarsus". If this pattern is applied to shallow waters it will lead to results that cannot be correct. Bryce (1962) found, for instance, in the Malham Tarn a decrease of the frequency of Chironomus and a corresponding increase of Tanytarsus from the recent Dryas ~~sub~~ on. In the discussion he did not consider the direct influence of temperature: under similar climatic conditions (Greenland, Ella Islands) Chironomus hyperborea is very common according to Andersen (1946). As a result of warming up, such as has occurred during the postglacial period, the cold stenothermic species would disappear and be replaced by another species. This - according to Frey (1964) - "non-classical midge succession" cannot be interpreted at all as meaning oligotrophication.

Konstantinov (1951) also applies the lake-type model to an unstratified lake (Borovoje).

In the shallow, unstratified Dead Man Lake, Tanytarsini and Orthocladinae predominate in all phases of lake history. Megard (1964) emphasizes that this fact must not be taken as proof of oligotrophism because the bottom-faunistic lake types can be applied only to deep, stratified waters.

Alhonen & Haavisto (1969) examined the chironomid remains of a drill core of 2 m length which originated from a water depth of 5 m

of Lake Otalampi. They differentiated the following: Tanypodinae, Tanytarsariae, Sergentia, Orthocladiinae and Chironomariae. Based on the percentage of these groups and by using "Orthocladiinae, Tanytarsariae and probably Chironomariae" as "oligotrophic indicators" and Chaoborus as "eutrophic indicator" they arrived at the conclusion that the lake during its initial phase was more eutrophic than later. Here the lake types based on the fauna of the bottom are applied to littoral conditions and large systematic units that are ecologically heterogeneous (Orthocladiinae, Tanytarsariae, Chironomariae) are used as indicators of an oligotrophic environment. Under these - not quite correct - conditions the authors arrive at the conclusion: ". . . we can safely say that it (the lake) has been more productive in its earlier stages."

It has been found that the development of the chironomid fauna in shallow waters can be interpreted only with difficulty because often no successions are evident. In addition to the aforementioned Dead Man Lake, this applies, for instance, also to the lakes investigated by Lastochkin (1949) and Roback (1970). The difficulty in observing trends in "littoral" waters can be in part attributed to the fact that succession only occurs on the species level and remains hidden as a result of inadequate identification of the larval remains. In this context it is interesting to note that in some shallow waters investigated by Deevey (1955) and Livingstone et al. (1958) Corynocera dominated throughout the entire lake history, in New Zealand, C. duffi (Deevey) and in Alaska probably C. ambigua Zetterstedt. p.29

In unstratified lakes and in the littoral-sublittoral of deep lakes pronounced temperature changes - corresponding to the climatic development - will have occurred during the late glacial period and the postglacial period. It is important to examine the effect of the factor "temperature" on the chironomid taxocoenosis (Hofmann 1971).

In the older sediments (the upper Dryas, the Preboreal period) of the Schöhsee and the Grosser Plöner See, a few species were found that showed their temperature preference by their vertical distribution. Sergentina coracina and Lauterbornia coracina are called stenothermic and eurybathic. In sub-Arctic lakes they colonize the littoral, in Sweden and Central Europe they colonize the profundal (Brundin 1949 b). In the Schöhsee the Subarctic and the Central European depth distribution occurred successively: in the course of the postglacial warming-up period the animals migrated from the littoral into the profundal. Abundance peaks of Chironomus and Microtendipes during the upper Dryas are also indicative of psychrophilic species; however, they cannot be taxonomically characterized.

Strong development of thermophilic chironomids during the postglacial warming up period has not been detected. However, it has been shown, based on their present distribution and their timing of the adult flight - related to European conditions - that these species that appeared slowly only during the postglacial period, prefer somewhat higher temperatures (Hoffmann 1971).

In contrast to the littoral, the profundal of stratified lakes is scarcely influenced by postglacial temperature changes. In

this instance oxygen becomes the decisive factor and there is an opportunity to demonstrate changes of the O<sub>2</sub> standard on the basis of corresponding changes in the chironomid thanatocoenosis, for instance, when forms that are sensitive to O<sub>2</sub> ("Tanytarsus") disappear and are replaced by less sensitive forms (Chironomus).

Thus, the question concerning the oxygen requirements of individual species arises only in the case of profundal dwellers; in the littoral oxygen as an ecological factor is only of slight importance. The requirements of many species are well-known. For instance, Lauterbornia coracina was found only in oligotrophic moors in the Eifel Mountains and in North German lakes with a minimal O<sub>2</sub> concentration of approximately 5 to 6 mg O<sub>2</sub>/l (Thienemann 1951). The critical value for Sergentia coracina is around 2 mg O<sub>2</sub>/l (Thienemann 1928, Wülker 1961).

With his Tanytarsus lugens association, Brundin (1949 b, 1956 b) has compiled a catalogue of polyoxybiontic profundal dwellers. This includes:

<u>Protanypus morio</u> Zett.	<u>Sergentia coracina</u> Zett.	p.30
<u>Monodiamesa bathyphila</u> (Kieff.) Pag.	<u>Stictochironomus rosenschöldi</u> (Zett.) Edw.	
<u>Heterotrissocladus grimshawi</u> Edw.	<u>Micropsectra insignilobus</u> Kieff.	
<u>Heterotrissocladus määri</u> Brundin	<u>Lauterbornia coracina</u> Kieff.	
<u>Paracladopelma obscura</u> Brundin	<u>Tanytarsus lugens</u> (Kieff.)	

In contrast, Chironomus larvae in the profundal are indicative of a low-oxygen environment.

From this arose the central problem of most authors, i.e. to demonstrate corresponding changes of the waters in the sense of eutrophication or oligotrophication on the basis of changes in the chironomid necrocoenoses. Starting with the lake types that are based on the bottom fauna, according to Thienemann and Brundin, Chironomus was equated with "eutrophic" and "Tanytarsus" was equated with "oligotrophic".

One problem occurs in almost all studies: the indiscriminate use of the term "Tanytarsus" in the sense of Tanytarsini. It has been shown in the taxonomic part of this publication that this tribe can be segregated even on the basis of subfossils into a series of genera and species groups. Only Micropsectra and Lauterbornia can be with certainty considered polyoxybiontic profundal dwellers (cf. Pagast 1940). Although the representatives of the Tanytarsus lugens group occur in the profundal, Tanytarsus lugens (Kieffer) is a characteristic species of oligotrophic lakes (Brundin 1941 b), and Tanytarsus bathophilus (Kieffer) colonizes eutrophic lakes, i.e. it is able to withstand a low-oxygen environment (Thienemann 1929). The genera Cladotanytarsus and Paratanytarsus and the species of the Tanytarsus pallidicornis group and of the T. chinyensis group are littoral elements; elements that must be placed into the collective designation Tanytarsus pro parte do not permit any interpretation because of the large number of species included here. However, they are predominantly dwellers in the littoral; exceptions are T. gregarius (Kieffer) and T. inaequalis Goetghebuer - they live in the depth of eutrophic lakes, and T. decipiens Lindeberg - this species extends into the profundal

of oligotrophic lakes (Reiss & Fittkau 1971).

Thus, it must be stated that all investigations which use only "Tanytarsus" in the sense of Tanytarsini for argument, must be very critically assessed. This applies to Deevey (1942) (cf. Stahl 1969), Frey (1955) and Müller (1970). However, in these three instances the development of lakes is demonstrated also by other factors (consistency of sediment, hydrophytes, Cladocera, Rotatoria).

It is important when, in addition to "Tanytarsus", other profundal dwellers of oligotrophic lakes can be used. This applies predominantly to the representatives of the aforementioned Tanytarsus lugens association. For instance, in Myer's Lake during a period which amounts to approximately two-thirds of the lake's history, Sergentia coracina was the dominating chironomid. A change in the conditions was indicated not only by the disappearance of this species but also by the appearance of Chaoborus (Stahl 1959). In the p.31 necrocoenoses of the Esthwaite Water, Sergentia and "Tanytarsus", apart from the uppermost strata, are clearly predominant. During the last phase of the development both taxa decreased; however, at the same time there was an increase of Chironomus. The result becomes particularly convincing because - based on the Cladocera - it was possible to prove eutrophication. It is not necessarily valid to see changing proportions of Chironomus as a confirmation of eutrophic and oligotrophic phases in the older strata also, because at that time Sergentia and "Tanytarsus" were always very much more common (Goulden, 1964).

Harmsworth (1968) found in Blelham Tarn a succession from a Sergentia-Tanytarsus association to a Chironomus association; in this

instance, Sergentia was present in small numbers right to the most recent time. It interesting to note that at approximately the same time in the zooplankton, Bosmina coregoni is replaced by Bosmina longirostris.

In the oldest strata of the Schöhsee and the Gros<sup>S</sup>er Plöner See the following members of the Tanytarsus lugens association were detected: Sergentia coracina, Lauterbornia coracina, Paracladopelma obscura and Heterotrissocladus grimshawi; the genus Protanypus may be considered a fifth representative of this group. Consequently, this phase in which the two first-mentioned species are the most common profundal chironomids, is distinctly characterized as oligotrophic. In the Schöhsee it was possible to show by comparison with drill cores from shallower parts of the lake that at that time Chironomus predominantly dwelt in the sublittoral. "Tanytarsus" occurring in the deep and Chironomus in the sublittoral: According to Lundbeck (1936) this is the typical vertical distribution in oligotrophic lakes. The development occurred in such a manner that the polyoxybiontic species disappeared and Chironomus migrated into the deep until, eventually, it was the predominant chironomid of the profundal. It was not possible to demonstrate in the Grosser Plöner See that Lauterbornia and Sergentia after becoming extinct were replaced by Chironomus because the thanatocoenosis consisted predominantly of littoral species (Hofmann 1971).

The chironomid fauna of a biotope is not only related to temperature and to the O<sub>2</sub> content, nutrition, salt and humus content, for instance, are also important. However, these problems have scarcely been investigated in paleolimnologic studies.

In accordance with Brundin (1949 b), Hofmann (1971) assumes that the migration of the Chironomus larvae from the sublittoral to the profundal in the Schöhsee was facilitated by nutrient enrichment of the sediment in the profundal.

Konstantinov (1951) makes an attempt to confirm changing levels of salt content in Tchebatchiev Lake and Maibalyk Lake on the basis of changing proportions of Chironomus salinarius and Ch. halophilus in the thanatocoenosis. Unfortunately, the author does not state how he has identified these two species.

Sublette (1969) has found that Chironomus kirklandi Sublette, which is very common in the sediments of the Rita Blanca Lake, is closely related to the halophilous Halliella and indicates that the lake is a body of saltwater. Thienemann (1954) lists a series of halobiontic and halophilic chironomids. However, they are Chironomus, Cricotopus and Glyptopendipes species that cannot be identified by their larvae. p.32

There are also species that are characteristic for waters rich in humus; in the course of paleolimnologic investigations they are capable of providing important information concerning the humus content. Brundin (1949 b), in addition to Chironomus tenuistylus Brundin whose larvae are not known by species characteristics, lists Cricotopus naumanni Brundin and illustrates the very characteristic labium of the larvae (Fig. 193).

b) Ecology of Distribution

Only Hofmann (1971) attempted a zoogeographic interpretation of the abundant material from the two lakes in Holstein. It is important to find out the species that occurred in the lake from the very beginning and those that immigrated during the postglacial period; however, presence or absence of the latter is not easily proven because negative findings in the case of the older sediments do not necessarily imply that the species did not occur within the region. It was found that initial colonizers, i.e. taxa that were present already during the Upper Dryas, have presently a nordic or boreo-alpine distribution; the postglacial immigrants that occurred eventually in the thanatocoenoses, are presently absent from the highly nordic areas and from the Alps above 1,000 m, their adults emerge in Central Europe during the summer. Thus there are two faunal elements present in the lakes, although many initial settlers have meanwhile become extinct from them (for instance Lauterbornia coracina, Sergentia coracina, Heterotrissocladius grimshawi, Cricotopus alpicolus).

Investigation of chironomid thanatocoenoses in lake sediments can yield important information concerning the understanding of ecology and zoogeography of this group of animals and of the history of the biotope. The species are not only suitable as indicators for temperature and oxygen standards, they also provide information concerning nutrient availability, salt and humus content of the environment. At this time these opportunities have certainly not been fully utilized. However, significant results can only be expected if abundant, taxonomically optimally differentiated material is available.

### SUMMARY

The special palaeolimnologic importance of the Chironomidae is evident from the large number of ecologically heterogenous species and the good state of preservation of their larval head capsules.

Forty-nine taxa are briefly described on the basis of characteristics that can be recognized in subfossil specimens. Special attention is given the Tanytarsini. In addition, identification keys for these taxa are provided.

The association of dead chironomid larvae in limnic sediments is produced usually by a mixture of the necrocoenosis which has formed in situ and of the thanatocoenosis which has been washed in from the shallower parts of the lake. The opportunities for paleolimnologic interpretation of such associations of dead organisms are discussed. In shallow waters and in the lake littoral the postglacial temperature changes have an effect to the extent that cold stenothermic eurybathic species at the beginning of the warming-up period migrate to the profundal or become extinct.

p.33

Classification of lakes on the basis of profundal chironomids (Thienemann, Brundin) is only applicable to deep, stratified lakes; it does not apply to shallow, unstratified lakes although this has been attempted by some authors. Postglacial climatic changes had little influence on the temperatures of the profundal of stratified lakes; on the other hand, the oxygen concentrations become more important here. However, to demonstrate a high-oxygen environment in the profundal, only species should be used that are known to be O<sub>2</sub> sensitive profundal dwellers. In this context, the taxon "Tanytarsus" in the concept "Tanytarsus Lake" must not be equated to "Tanytarsini". The most important depth dwellers

of oligotrophic lakes are the representatives of the Tanytarsus lugens association (Brundin). The change from oligotrophic Tanytarsus lake to eutrophic Chironomus lake is demonstrated in four publications.

Possibilities of utilization with regard to the salt and humus content of waters has been touched.

A zoogeographic treatment is difficult because it is hard to arrive at significant negative results. It is suggested that the chironomid fauna of two lakes in Holstein is a mixed fauna which consists of initial colonizers and postglacial immigrants.

- 2 = Chironomids of the late glacial period
- 5 = The metamorphosis of the genus Tanytarsus and some related Tendipedid species.
- 6 = Certain larvae of Tendipedidae are rare in the Peoples Republic of Roumania.
- 7 = A new Tanytarsus larva.
- 8 = The metamorphosis of the section Tanytarsariae connectentes (Dipt., Chironomidae).
- 9 = Chironomids and other bottom-inhabiting animals of the primeval mountain lakes of southern Sweden.
- 10 = Contribution to the knowledge of the taxonomy and metamorphosis of the chironomid genera Protanypus K., Prodiamesa K. and Monodiamesa K.
- 11 = The systematics of the Orthoclaudiinae (Dipt., Chironomidae).
- 12 = Lake types based on the bottom fauna, and the application to the southern hemisphere.
- 14 = Identification book for the larvae of the Tendipedidae.
- 19 = The present status of research into the Chironomidae.
- 20 = The Tanypodinae (Diptera; Chironomidae). Discourses concerning the larval systematics of the insects. p.35
- 21 = Revision of the genus Microcricotopus Thien. & Harn. (Dipt., Chironomidae).
- 28 = Metamorphosis and system of the genus Cryptochironomus K. s.l.
- 29 = The larval forms of the Diptera. Part 1.
- 30 = The larval forms of the Diptera, Part 2.
- 32 = Postglacial development of the sublittoral and the profundal chironomid and Chaoborus fauna (Dipt.) of the Schöhsee.
- 33 = Same title as 32.
- 36 = Diatoms in lake sediments.
- 37 = History of the chironomid fauna of certain lakes of the "Borovoje" sanctuary (Northern Kazakhstan).
- 38 = The systematics of the genus Chironomus Meig.
- 39 = Algal remains in lake sediments.
- 40 = Tanytarsus studies. Part 1. subsection Atanytarsus.
- 41 = Terrestrial Chironomids. XIII. Tanytarsus radens n. sp. p.36
- 42 = The Eutanytarsariae of the Gregarius Group (Dipt. Chironomidae) from Schleswig-Holstein.
- 43 = Notes on the paleolimnology of the Ural Mountains.
- 44 = Didiamesa miriforceps Kieff. A new chironomid from the profundal of inland lakes.
- 45 = Chironomidae from Norwegian Alpine lakes. Also a contribution to the lake type problem.
- 46 = The Einfeldia group of the Chironomidae. Morphology and ecology of larvae and pupae.
- 47 = The juvenile stages of the genus Pseudochironomus Staeg.
- 48 = The genus Parachironomus.
- 49 = The juvenile stages of the section Chironomariae (Tendipedini) connectentes (subfamily Chironominae = Tendipedinae).
- 50 = The metamorphosis of the Tendipedinae (Chironominae). Ex: Lindner, The Flies of the Palaearctic Region.

- 51 = Revision of the genus Endochironomus (Diptera, Tendipedidae).
- 52 = The metamorphosis and ecology of the Tendipedid genus Paracladopelma.
- 53 = The metamorphic stage of the Tendipedid genus Demicryptochironomus Lenz.
- 54 = The Tendipedid genus Cryptocladopelma Lenz in upper Italian waters.
- 56 = Investigations concerning the colonization of the bottom of lakes in the marginal zone of the Alps.
- 58 = A few chironomids of ecological interest from the Stechlin Lake area.
- 60 = Ecological changes in the Otterstedt Lake during the postglacial period.
- 61 = The metamorphosis of Chironomus xenolabis Kieff., a parasite of sponges.
- 62 = The composition and distribution of the chironomid fauna of the bottom of Central European lakes.
- 63 = Larvae and pupae of the midges of the subfamily Orthoclaadiinae from the fauna of the USSR (Diptera, Chironomidae). - Identification books concerning the fauna of the USSR.
- 64 = The metamorphosis of the Orthocladius group.
- 65 = Taxonomy and ecology of Tanytarsus species (Chironomidae, Diptera) distributed in Europe. p.37
- 70 = Atlas of animal remains in peat and sapropel.
- 74 = Index forms and index fossils of the Zehlau Moor. The importance of fossil microorganisms in recognizing the necrocoenoses of a moor.
- 76 = The chironomid genus Lundströmia and an identification key for the larvae and pupae of the section Tanytarsus genuinus.
- 77 = The lavaret (Coregonus lavaretus forma generosus Peters) and the lakes it inhabits.
- 78 = Metamorphosis of the Chironomidae. Part II. The section Tanytarsus genuinus.
- 80 = The metamorphosis of the Tanypinea (I).
- 81 = The use of bio-sociological concepts in bio-stratonomy.
- 82 = The chironomids of the Parakiefferiella group.
- 83 = Studies on the morphology, biology and distribution of the genus Sergentia Kieff. (Dipt., Chironomidae). Life cycle and vertical distribution of the chironomid (Dipt.), Sergentia coracina Zett. in the Titi see.
- 85 = The lakes of the Central Havel River as habitats of Glyptotendipes and the metamorphosis of Glyptotendipes paripes Edwards.
- 86 = Chironomids from the Wigry Lake.
- 87 = The juvenile stages of the tribe Corynoneurariae. p.38
- 88 = A contribution to the knowledge of the fauna of mud stream and lakes in the high Tatra Mountains.
- 89 = Comparative morphological investigations of the larvae of the Podonominae. Part I. Labrum and mandibles.

## Author's address:

Dr. Wolfgang Hofmann,  
Max-Planck-Institut für Limnologie,  
Abteilung Allgemeine Limnologie,  
(Max-Planck Institute for Limnology Dept. for General Limnology)  
D-232 Plön,  
Postfach 165.  
Federal Republic of Germany.

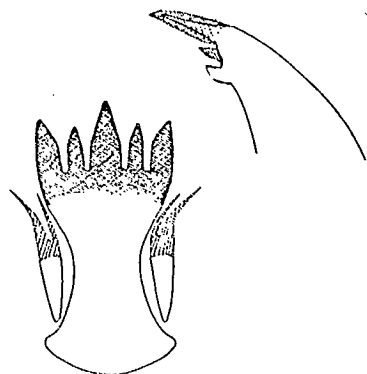


Abb. 1. *Labrundinia longipalpis*. Glossa, Paraglossae, Mandible.

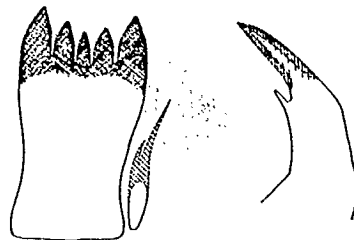


Abb. 2. Pentaneurini part. Glossa, Paraglossa, Mandible.

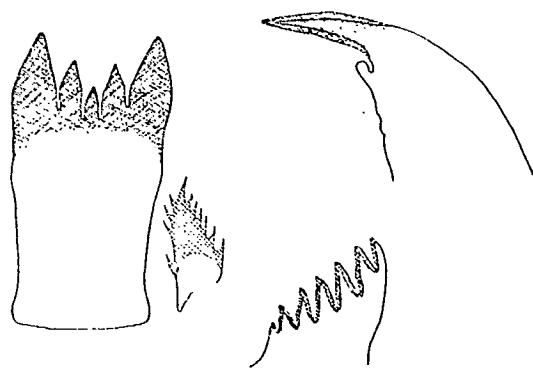


Abb. 3. *Procladius*. Glossa, Paraglossa, Labial comb; Mandible.



Abb. 4. *Corynoneura*. Labium.

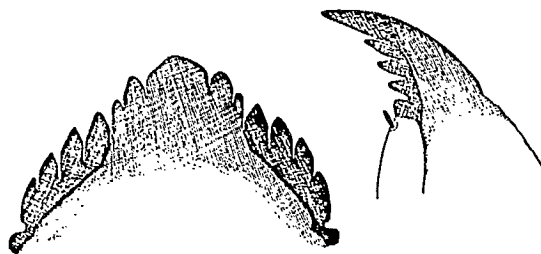


Abb. 5. *Cricotopus A.* Labium, Mandible.

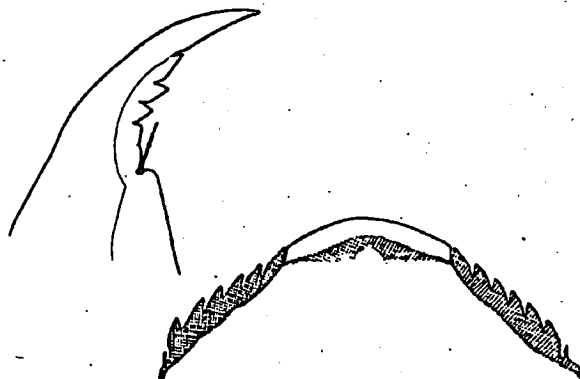


Abb. 6. *Cricotopus B.* Labium, Mandible.

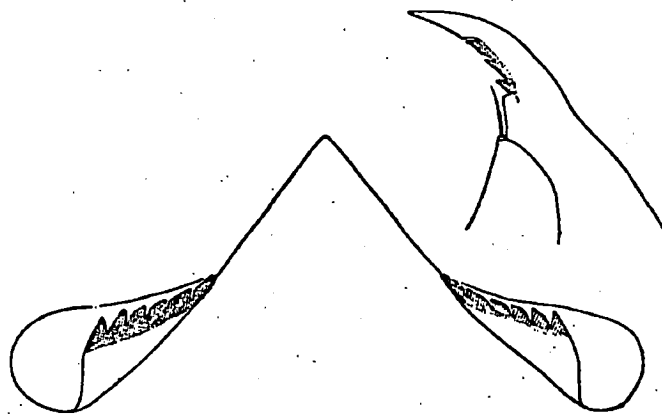


Abb. 7. *Cricotopus triquetras.* Labium, Mandible.



Abb. 8. *Heterotrissocladius grimshawi.* Labium.

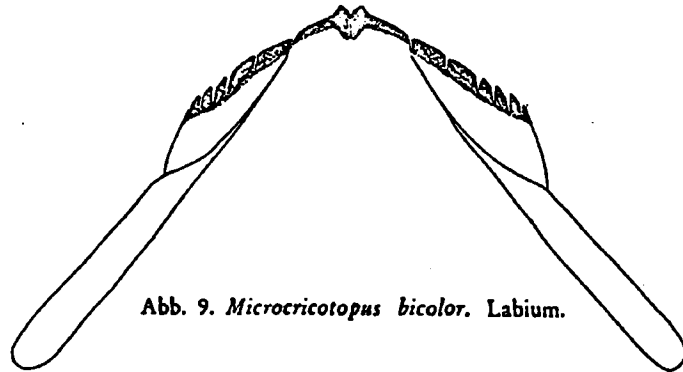


Abb. 9. *Microcricotopus bicolor*. Labium.

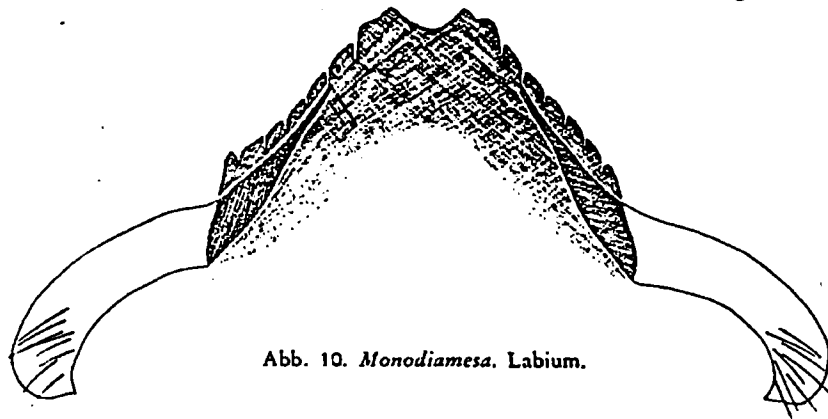


Abb. 10. *Monodiamesa*. Labium.

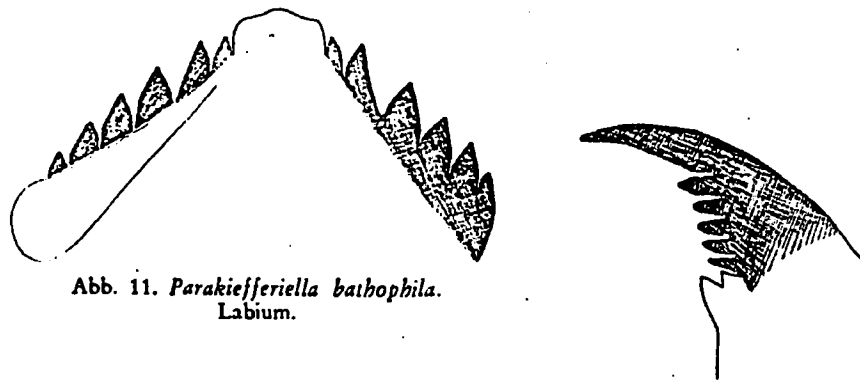


Abb. 11. *Parakiefferiella bathophila*.  
Labium.



Abb. 12. *Protanypus*. Labium, Mandible.



Abb. 13. *Psctrocladius*. Labium.

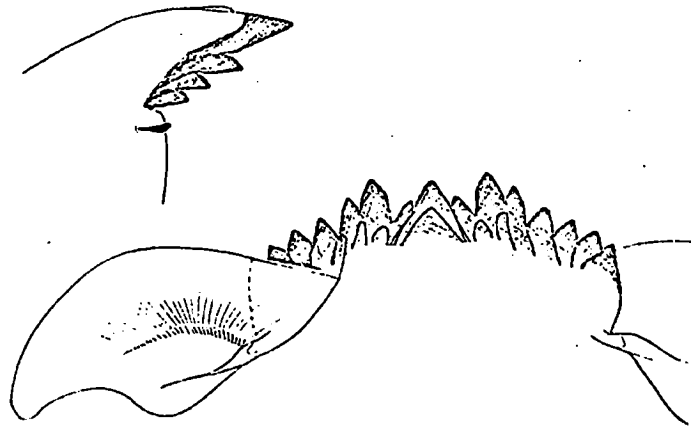


Abb. 14. *Chironomus plumosus*-Typ. Labium, Mandible.

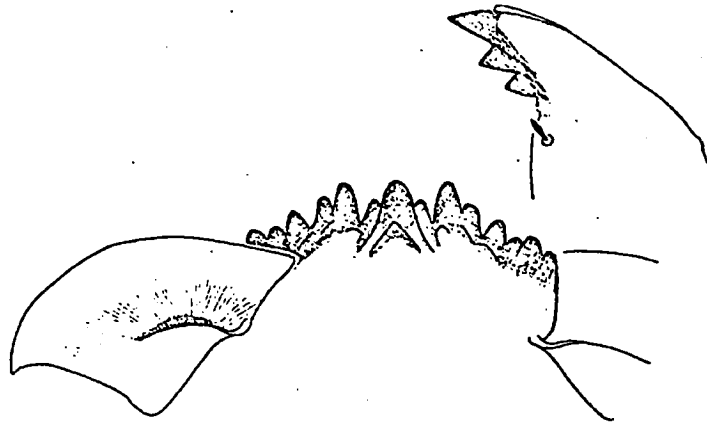


Abb. 15. *Chironomus anthracinus*-Typ. Labium, Mandible.



Abb. 16. *Cryptochironomus*. Labium.

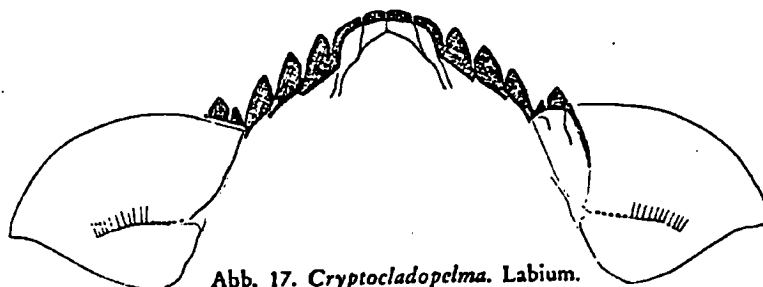


Abb. 17. *Cryptocladopelma*. Labium.



Abb. 18. *Demicryptochironomus*. Labium.

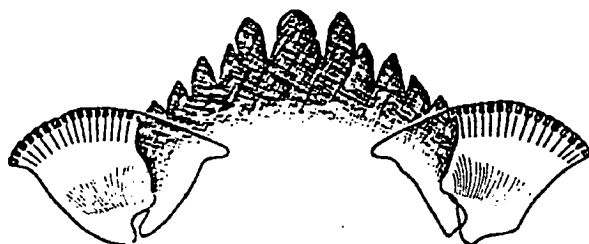


Abb. 19. *Dicrotendipes*. Labium.

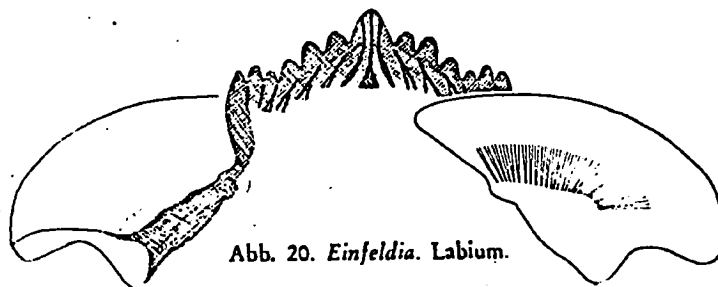


Abb. 20. *Einfeldia*. Labium.

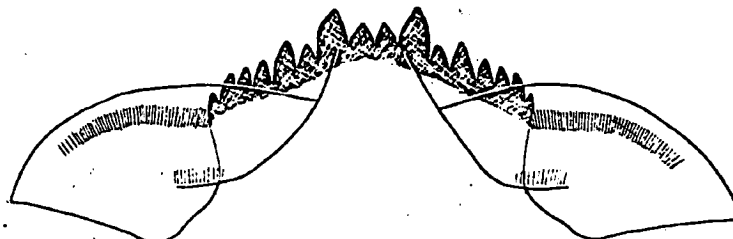


Abb. 21. *Endochironomus intextus*. Labium.



Abb. 22 *Endochironomus tendens*. Labium.



Abb. 23. *Glyptotendipes* Labium.

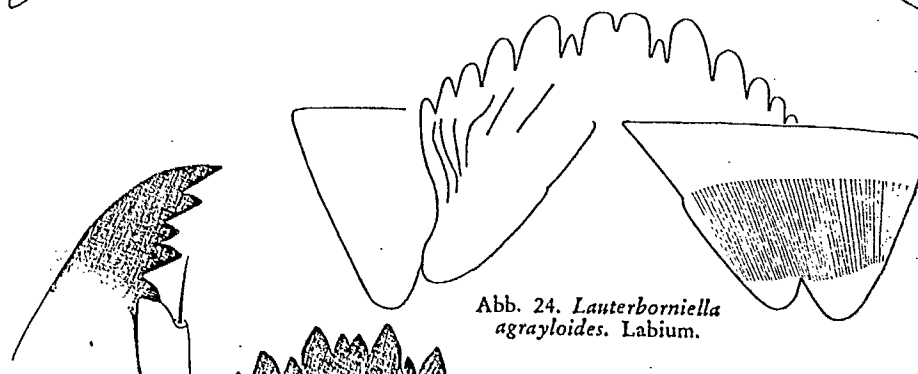


Abb. 24. *Lauterborniella agrayloides*. Labium.

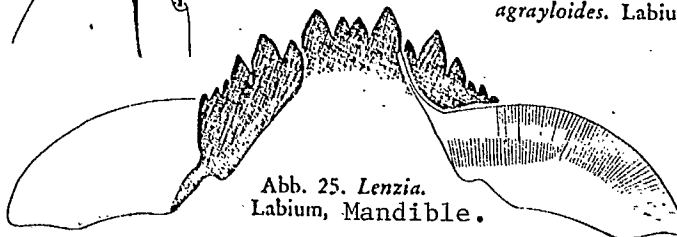


Abb. 25. *Lenzia*.  
Labium, Mandible.

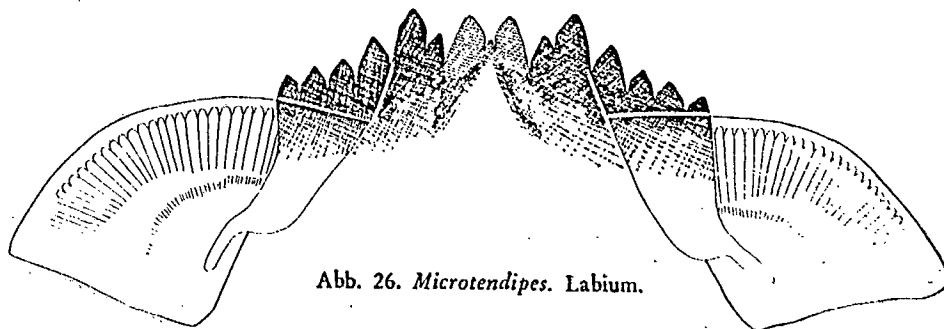


Abb. 26. *Microtendipes*. Labium.

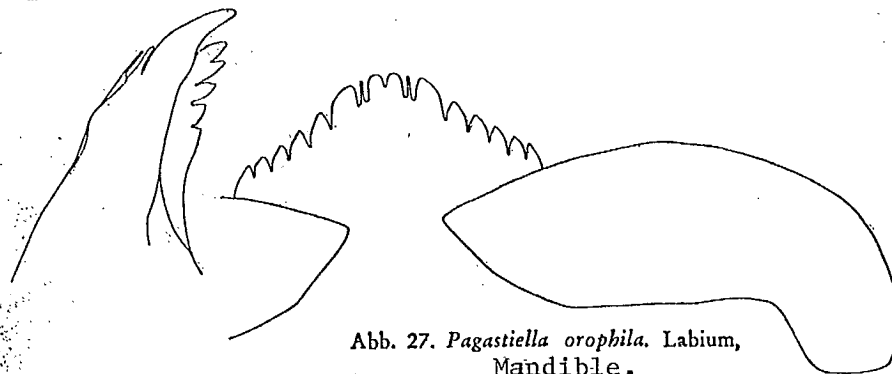


Abb. 27. *Pagastiella orophila*. Labium,  
Mandible.

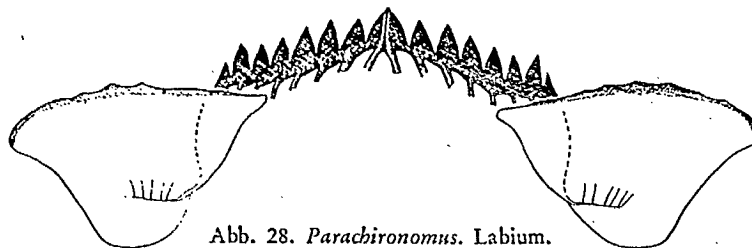


Abb. 28. *Parachironomus*. Labium.

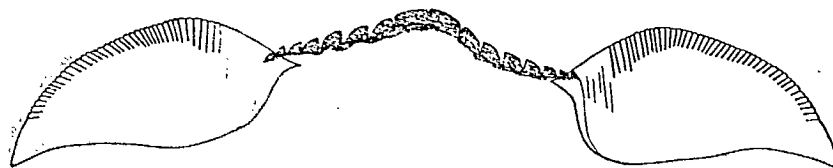


Abb. 29. *Paracladopelma obscura*. Labium.

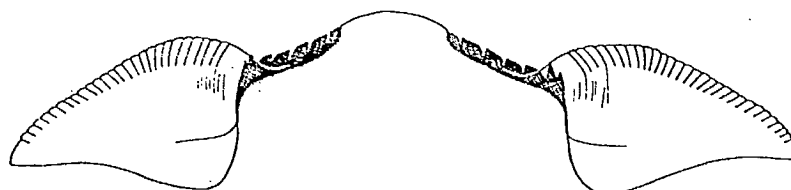


Abb. 30. *Paracladopelma* spp. Labium.

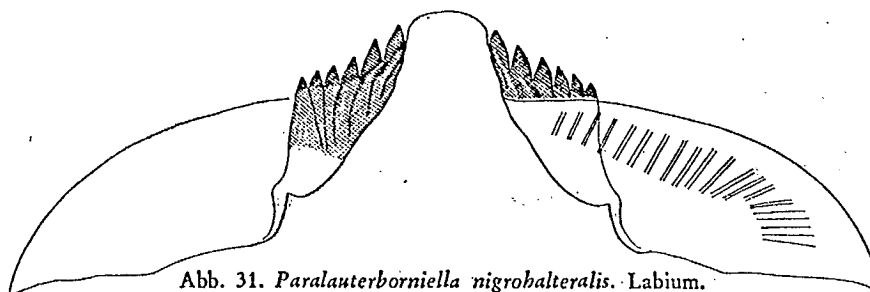


Abb. 31. *Paralauterborniella nigrohalteralis*. Labium.

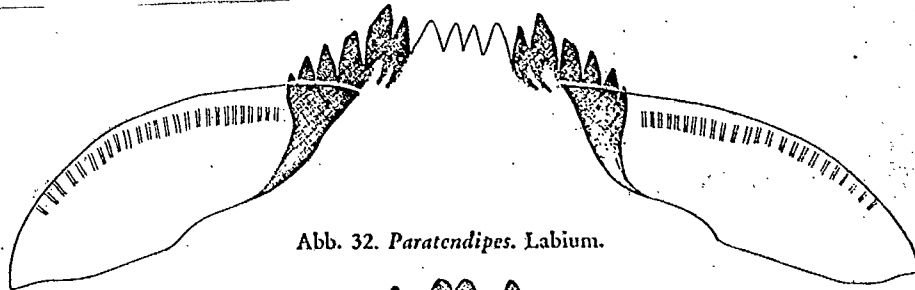


Abb. 32. *Paratendipes*. Labium.

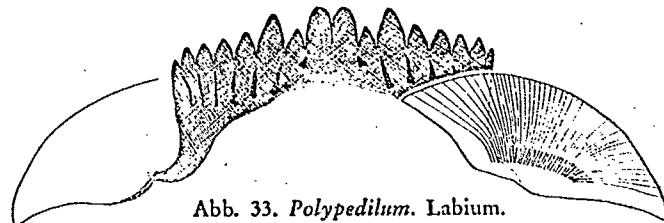


Abb. 33. *Polypedilum*. Labium.

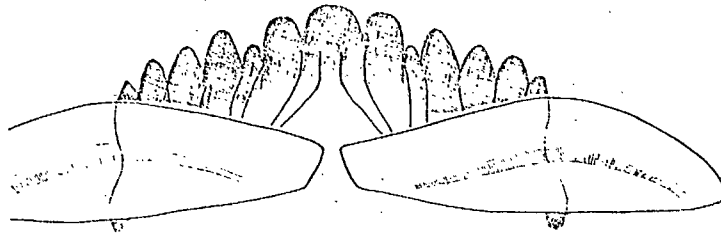


Abb. 34. *Pseudochironomus*. Labium.

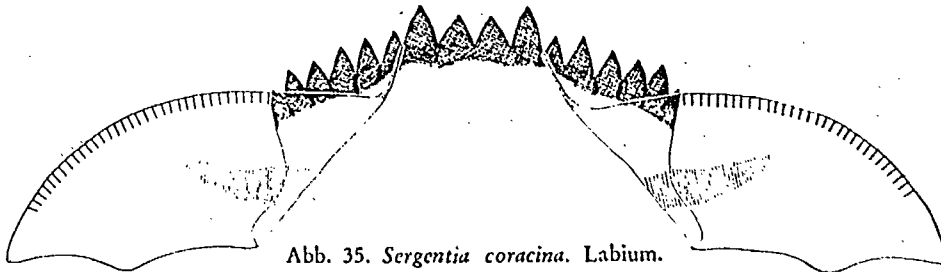


Abb. 35. *Sergentia coracina*. Labium.

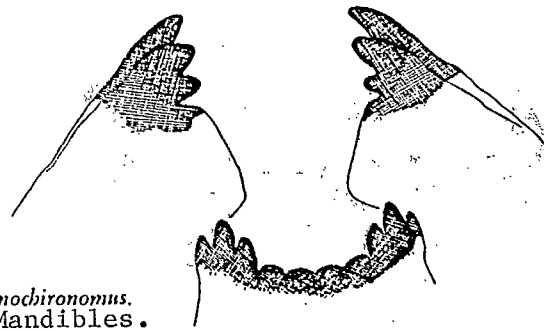


Abb. 36. *Stenochironomus*.  
Labium, Mandibles.

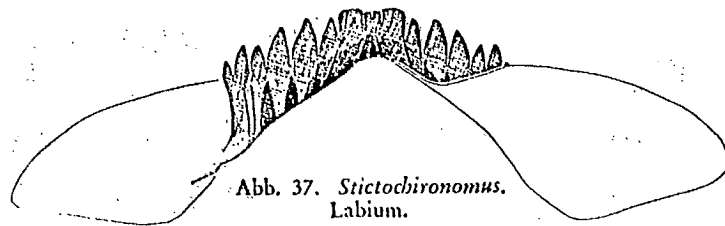


Abb. 37. *Stictochironomus*.  
Labium.

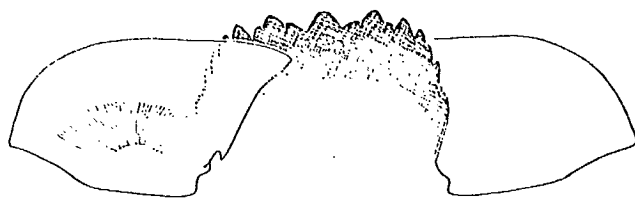


Abb. 38. *Xenochironomus*  
*xeuolabis*. Labium.

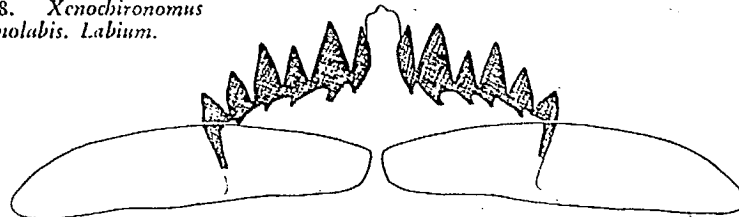


Abb. 39. *Cladotanytarsus*.  
Labium.



Abb. 40. *Corynocera*  
*ambigua*. Labium.

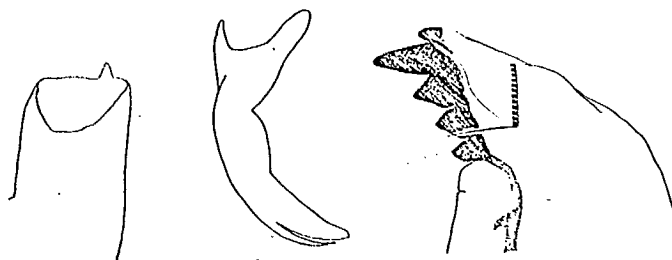
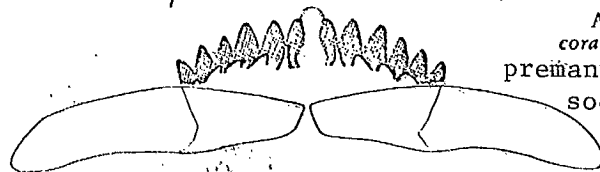


Abb. 41. *Lauterbornia*  
*coracina*. Labium. Mandible,  
premandible, antennal  
sockets.



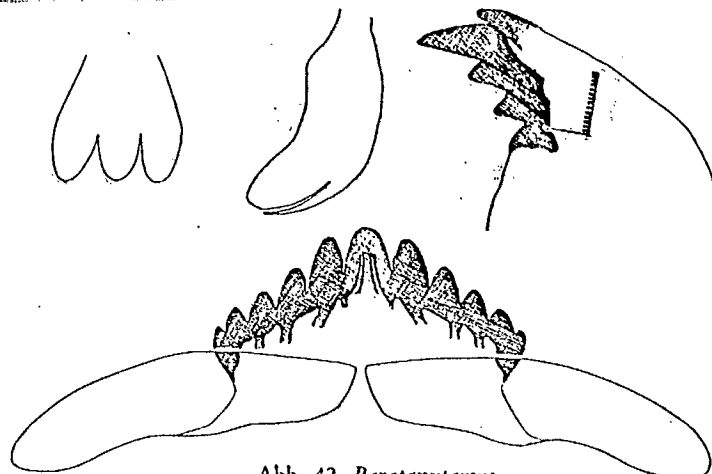


Abb. 42. *Paratanytarsus*.  
Labium, mandible, premandible,  
epipharyngeal comb.

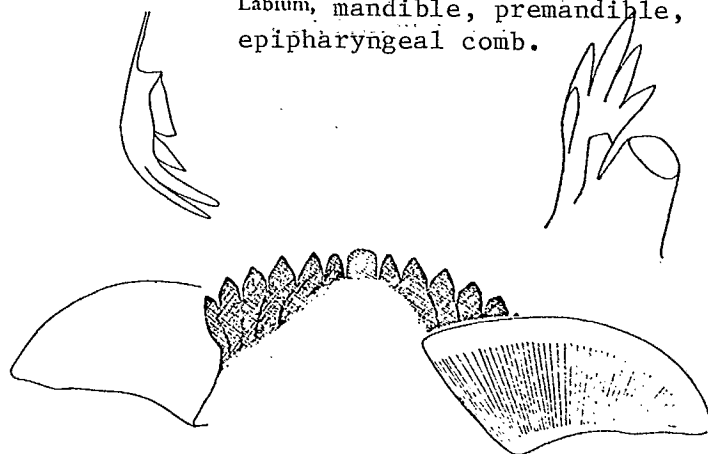
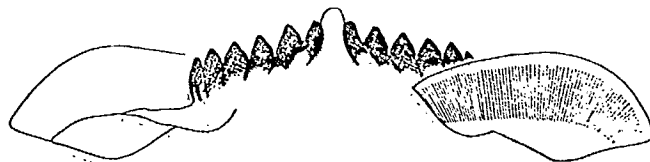


Abb. 43. *Stempellina*. Labium,  
premandible, antennal  
socket.

Abb. 44. *Stempellinella*. Labium, pre-  
mandible, antennal socket.



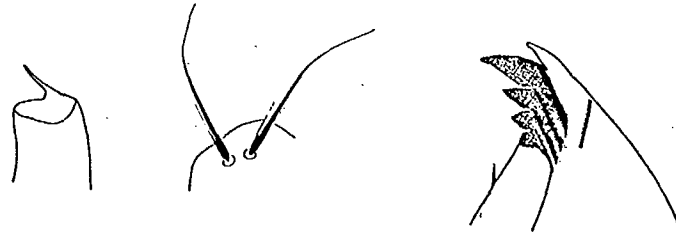


Abb. 45. *Tanytarsus chinensis*-  
Gruppe. Labium, mandible,  
antennal socket,  
frontal bristles.

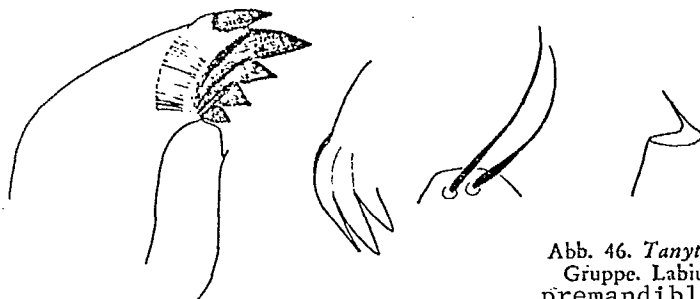


Abb. 46. *Tanytarsus chinensis*-  
Gruppe. Labium, mandible,  
premandible, antennal  
socket, frontal bristles.

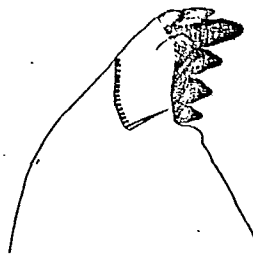
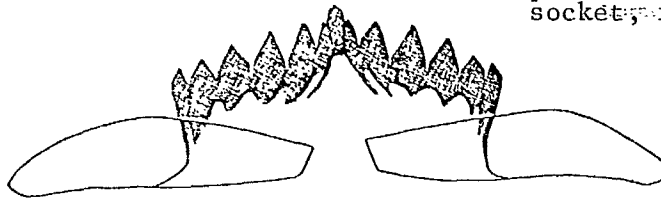


Abb. 47. *Tanytarsus lugens*-  
Gruppe. Labium, mandible.



Abb. 48. *Tanytarsus pallidicornis*-Gruppe. Labium, premandible, antennal socket, frontal bristle.

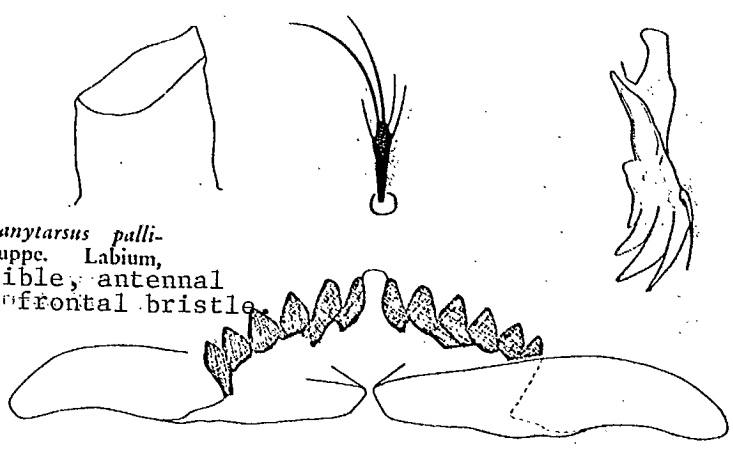


Abb. 49. *Tanytarsus* spec. C. Labium mandible, premandible, antennal socket.

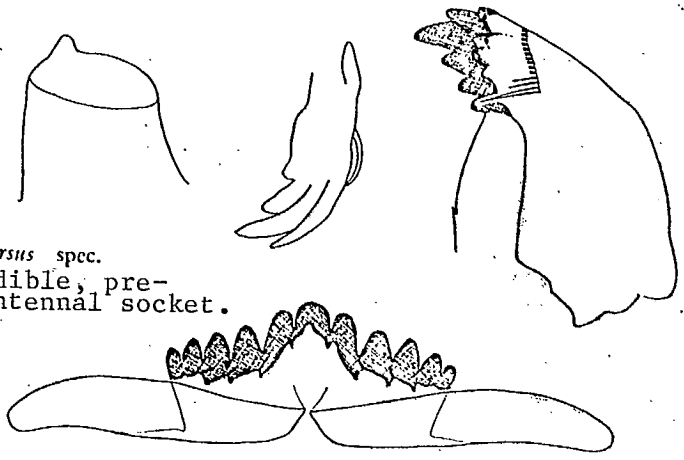


Abb. 50. *Thienemanniola*. Labium, mandible, premandible, antenna (without Lauterborn's organs), antennal socket.