

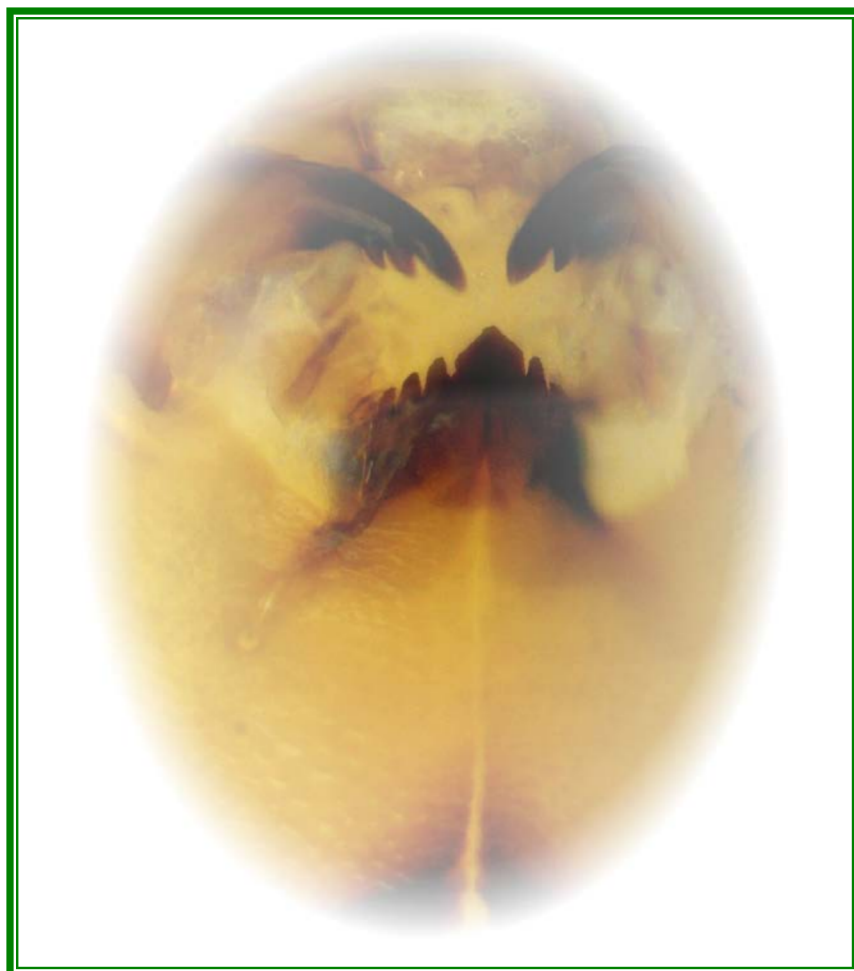


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Identification Keys for Larvae of Chironomidae (Diptera) in Brackish Waters of Germany and Adjacent Areas



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Identification Keys for Larvae of Chironomidae (Diptera) in Brackish Waters of Germany and Adjacent Areas

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slightly revised editorially

Abstract

Assessing the ecological status of the various types of habitats and waters requires correct taxonomic identification, as species differ in their ecological adaptations and thus can indicate various ecological conditions. For a number of taxonomic groups, current identification keys are poorly available or entirely absent. Therefore, it was necessary to develop keys and instructions appropriate for institutes participating in the German Marine Monitoring Programme. To this purpose illustrated identification keys for the larvae of non-biting midges (Chironomidae) in brackish waters along the German sea coasts was developed. It is considered as unequivocally valid for the Baltic Sea areas. The applicability to North Sea estuaries is probable but requires further testing. During preparation the keys, the specifications of DIN EN 16164 (for designing and selecting taxonomic identification keys were taken into account.

Based on a literature review and investigations of fresh material from ongoing water surveys, a list of taxa has been compiled that includes those forms actually recorded from German brackish waters, and additional ones considered as likely to occur in these waters. Major criteria in taxon selection were the respective taxonomic level of identification that can be reliably achieved, and the possibilities of providing information on the salinity tolerance, habitat and trophic preferences. As a result, an inventory and identification keys for all listed taxa are now available for investigations in the context of marine monitoring. This is complemented by fact sheets that describe and illustrate the main morphological features of each terminal taxon, and give brief notes on its ecology.

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Introduction

1. Concept, structure, and scope

The keys presented below serve to identify chironomid larvae from estuaries and other brackish waters of the German North Sea and Baltic Sea and adjacent areas. The taxa treated are limited to those occurring at salinities above $0.5 \text{ g Cl}^- \cdot \text{l}^{-1}$, especially in oligohaline to mesohaline waters (up to about $18 \text{ g Cl}^- \cdot \text{l}^{-1}$). In faunal communities of poly- or euhaline areas (above about $18 \text{ g Cl}^- \cdot \text{l}^{-1}$), chironomids do not play any significant roles.

The key is intended as a tool to aid evaluations in monitoring programs and to facilitate quality assurance. Its basic data have been compiled from species inventory samples and published references. Collections were made in the course of studies conducted during recent monitoring programs (UBA 2011). The literature survey included 176 works published between 1871 and 2008, but only 18 of these were found to contain information relevant here concerning the occurrence, distribution, habitats and salinity tolerance of chironomids in German and adjacent coastal waters. More than 130 taxa are considered as either recorded from or potentially occurring in German coastal brackish waters (Table 1). Only 106 of these forms are keyed, however, as numerous taxa are so similar in their habitat requirements that the present keys' taxonomic resolution suffices for evaluation (see list of taxa, Table 3). Relatively common 'semiterrestrial' taxa (e.g. *Smittia* sp., *Metriocnemus* sp., etc.), which are of limited relevance in current evaluation practice, have been included, as occasionally they are naturally washed into coastal littoral areas and encountered in corresponding collections. For the latter reasons, samples should best be taken outside of actual land-to-water transition areas.

A **glossary** explains selected terms for morphological structures used in the key. As some elements in the current specialist terminology of chironomid research (e.g., Sæther 1980) are rather complicated or less than clear, it has been regarded as productive to replace them below by more easily understandable general terms. For example, the keys consider a "long central sclerite" dorsally on the larval head capsule, in place of what is treated elsewhere as either a 'frontal apotome' or 'frontoclypeal apotome', depending on not necessarily convincing interpretations of non-intuitive details. On the other hand, use of the keys does require knowledge of standard entomological terms (e.g., mandible).

The first of the illustrated **identification keys** separates higher-level chironomid taxa that are represented in the geographic area and habitats covered by the present work. About half of those taxa represent subfamilies, whereas larvae of Chironominae are taken further, to the level of tribes. This division reasonably limits the number of taxa treated in each of the subsequent, main keys. The latter provide identification of the individual taxa listed in Table 3, i.e. to genus, species group or species. Some of the branching points in the main keys present more than the usual two alternative

When no prepupa is available for a taxon to be determined, then the larvae with the relatively largest head capsules in the corresponding material (which are not necessarily also those with the largest bodies) are the most likely (but not guaranteed) to represent the fourth instar. However, when a presorted cluster comprises two or more distinctly different head capsule sizes, none of which are prepupae, then smaller specimens should also be selected for identification. This is to safeguard against the possibility that presorting erroneously lumped representatives of several taxa which differ in average body size.¹ In any case, taxon identification will be attempted even if it is unclear whether or not the available material contains a fourth-instar specimen. When the result is that relevant features of the specimen do not clearly match what is described in the key then, on account of quality assurance considerations, it is preferable to stop at an appropriate place in the key and possibly assign an identification at a higher taxonomic level.

The latter caution applies regardless of whether such a fuzzy match with key features is suspected to be caused by instar effects or by a taxon not treated in the present work.



Fig. 1:
 a) Prepupal larvae with inflated thoracic regions and/or visible pupal and adult characters
 b) Larva with thorax area not inflated

¹ It should be noted here that absolute body size of larvae alone does not constitute a reliable sorting criterion. One reason is that the species-specific size ranges of chironomid species can vary so significantly that larvae of species with relatively small body size can be smaller in their fourth instar than larvae of species with relatively large body size in their third or even only second instar.

Tables: taxon inventory, list of taxa

Table 1

List of chironomid species or species-group taxa with immature stages found or expected to occur in brackish waters of Germany and adjacent areas (≥ 0.5 ‰), including currently achievable level of identification in the larval stage (from UBA, 2011).

Taxon	Author and year
Telmatogetoninae	
<i>Telmatogeton japonicus</i>	Tokunaga 1933
<i>Telmatogeton pectinatus</i>	(Deby) 1889
<i>Thalassomya frauenfeldi</i>	Schiner 1856
Tanypodinae	
<i>Ablabesmyia longistyla</i>	Fittkau 1962
<i>Ablabesmyia monilis</i>	(Linnaeus) 1758
<i>Ablabesmyia phatta</i>	(Egger) 1864
<i>Anatopynia plumipes</i>	(Fries) 1823
<i>Clinotanypus nervosus</i>	(Meigen) 1818
<i>Conchapelopia</i> sp.	
<i>Macropelopia nebulosa</i>	(Meigen) 1804
<i>Macropelopia notata</i>	(Meigen) 1818
<i>Macropelopia</i> sp.	
<i>Monopelopia tenuicalcar</i>	(Kieffer) 1918
<i>Procladius (Holotanypus) choreus</i>	(Meigen) 1804
<i>Procladius (Holotanypus) sagittalis</i>	(Kieffer) 1909
<i>Procladius (Holotanypus) sp.</i>	
<i>Psectrotanypus varius</i>	(Fabricius) 1787
<i>Tanypus kraatzi</i>	(Kieffer) 1912
<i>Tanypus punctipennis</i>	(Meigen) 1818
<i>Tanypus vilipennis</i>	(Kieffer) 1918
<i>Xenopelopia</i> sp.	
<i>Zavreliomyia nubila</i>	(Meigen) 1830

Table 3

List of chironomid taxa in brackish waters of the North Sea and the Baltic Sea of Germany and adjacent areas, with preliminary ecological classifications: Salinity tolerances based on directly gathered data; habitat connections, milieu preferences and oxygen requirements from literature (Moller Pillot, 2009; Moller Pillot & Buskens, 1990; Orendt, 1993; Vallenduuk & Moller Pillot, 2007) and direct data. Salinity tolerance levels: 1 = haloxenic, 2 = euryhaline, 3 = halophilic, 4 = halobiontic, 5 = marine (for details, see Table 2). Habitats: P = phytal (plants), B = benthal (soft sediments), H = hard substrates. Milieu preference and oxygen requirements: Data in regular typescript denote respective proportions of the distribution across all milieu and oxygen levels (value 1 = 10%, 2 = 20%, etc.)⁵; data in italics between angular brackets represent frequencies of occurrence after Moller Pillot & Buskens (1990) (0 = absent, 1 = very rare, 2 = rare, 3 = frequent, 4 = very frequent). – = classification unknown or inapplicable.

Taxon name	Salinity tolerance	Habitats			Milieu preferences (saprobity)							Oxygen requirements			
		P	B	H	oligo	oligo-β-meso	β	β-α-meso	α ⁶	α-poly	poly	stable	unstable	briefly deficient	regularly deficient
<i>Ablabesmyia longistyla</i>	1	x	x		1	2	2	2	2	1	0	4	4	2	0
<i>Ablabesmyia monilis/phatta</i>	1	x	x		1	2	2	2	2	1	0	4	4	2	0
<i>Ablabesmyia</i> sp.	1	x	x		1	2	2	2	2	1	0	4	4	2	0
<i>Acricotopus lucens</i>	1	x			0	0	3	3		3	2	[3]	[3]	[3]	[2]
<i>Anatopynia plumipes</i>	1		x		0	0	2	3	3	2	0	1	4	3	2
<i>Chaetocladius piger</i> -group ⁷	1	x			0	0	2	2		2	1	[2]	[2]	[1]	[1]
Chironomini Gen. sp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Chironomus</i> (<i>Camptochironomus</i>) sp. ⁸	1	x			0	0.5	1	2	2.5	2	2	2	3	3	2
<i>Chironomus</i> (<i>Chironomus</i>) "annularius"-group ⁹	1	x	x		0	1	2	2	2	2	1	1	3	4	2

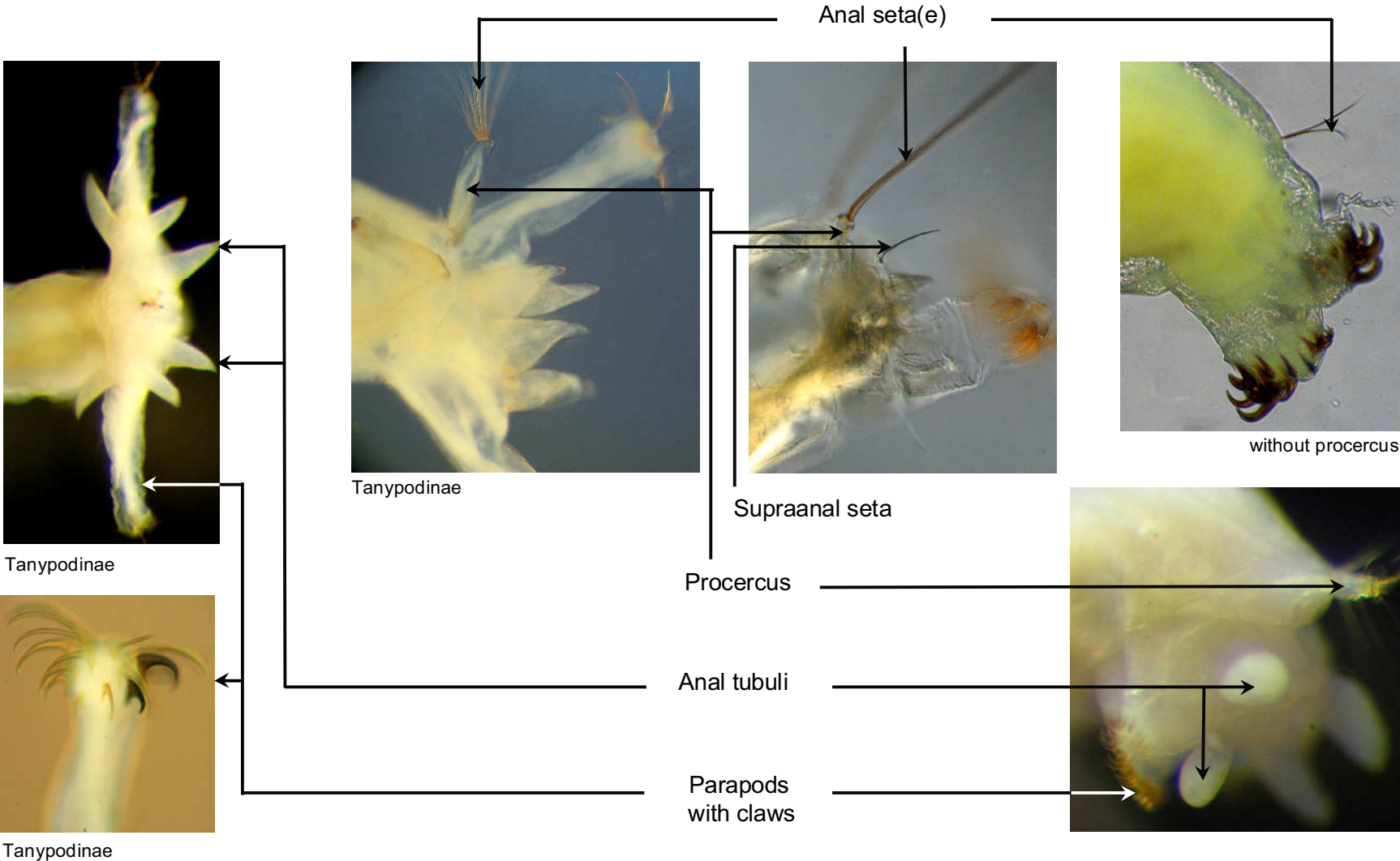
⁵ Within each line (taxon), the seven milieu preference values add up to a sum of 10 (= 100%), as do the four oxygen requirement values.

⁶ Wherever any cell in this column is completely empty, the corresponding taxon had to be classified after Moller Pillot & Buskens (1990). In that work only six milieu preference categories were used; adaptation of such data to the seven categories used here has been performed by leaving the α category unrepresented.

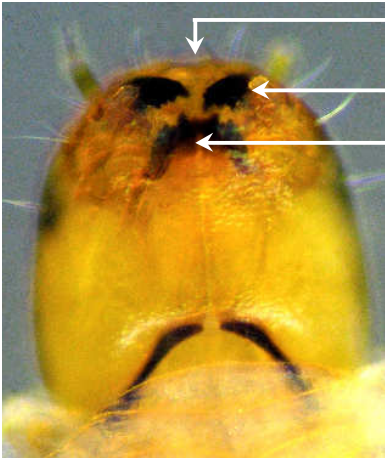
⁷ Values for *C. piger*-group

⁸ Values for *C. pallidivittatus*

Anal segment

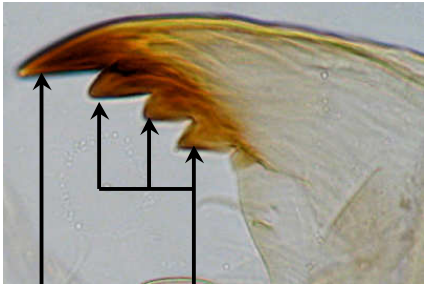


Head beside and below the mouth opening
(except in Tanypodinae)

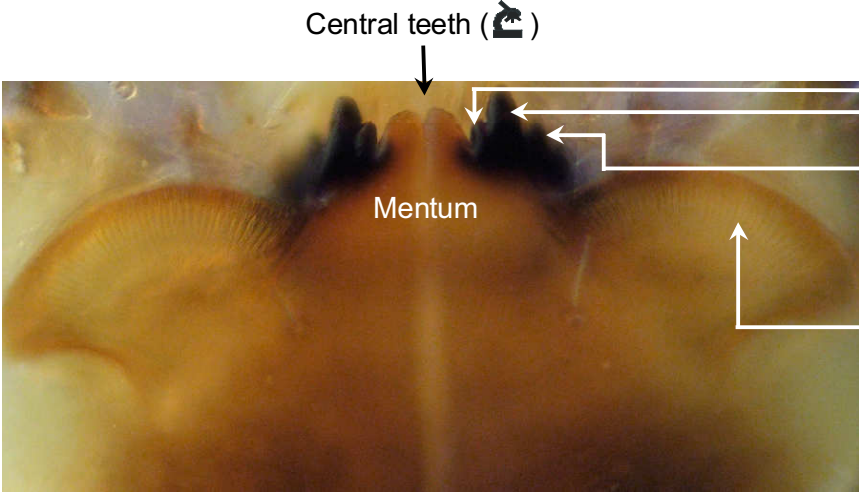


Labrum
Mandible
Mentum

Chironomini



Apical tooth
Inner teeth

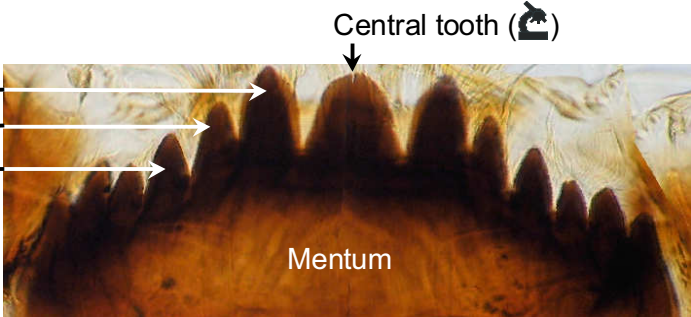


Central teeth (🦷)

Mentum

Ventromental plate

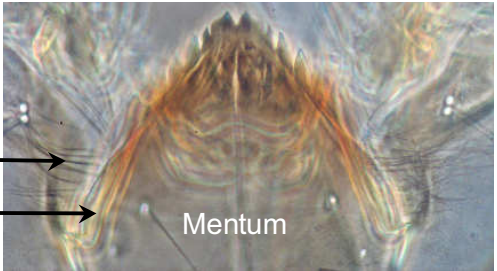
Chironomini



Central tooth (🦷)

1st lateral tooth
2nd lateral tooth
3rd lateral tooth

Mentum



Beard

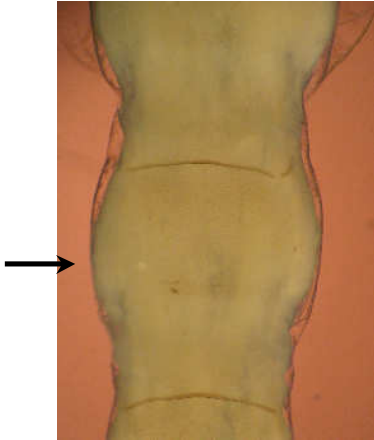
Mentum

Orthoclaadiinae

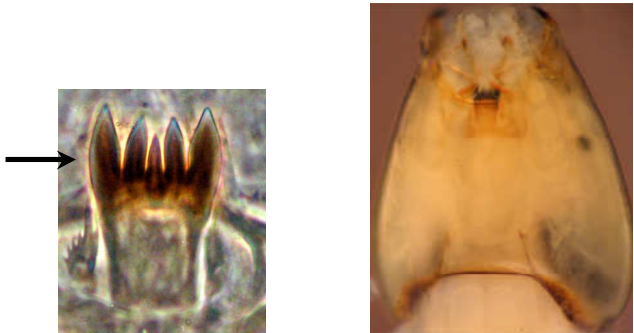
Abdomen

Ligula

segment 7 with 0-3 setae on either side, these much shorter than the lateral setae on other segments

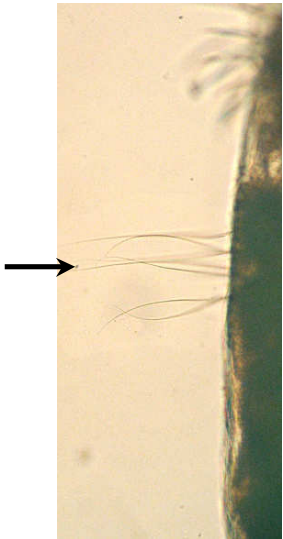


at least the teeth dark brown or black (depress the head with forceps)



Procladius sp.

segment 7 with > 3 setae on either side, these as long as the lateral setae on other segments



orange-yellow or brown



→ T-6

Body coloration

(🦷) Mentum area

whitish with dark tinges at the segment borders

anterior margin of mentum slightly concave; all teeth light-colored; central tooth broadly rectangular; 1st to 3rd lateral teeth squarish, 4th to 6th laterals subacute; beard obvious, with long setae



***Halocladus*
(*Psammocladus*)
*braunsi***

variously patterned with irregularly perforated darkened areas; frequently at least abdominal segments 6-8 with light-colored dorsal midline

anterior margin of mentum convex; all teeth brown; central tooth relatively narrower than above; beard barely distinguishable




→O-7

***Halocladus*
(*Halocladus*)**

 **Mentum**

Head dorsally

 **6** clearly separated lateral teeth on either side (press flat, if necessary), 6th lateral small but distinct




with distinct color pattern; long central sclerite **without** 'fenestra'

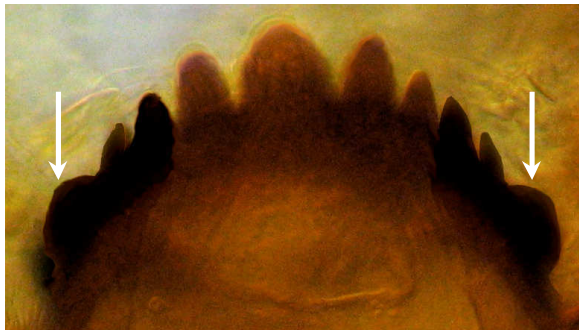


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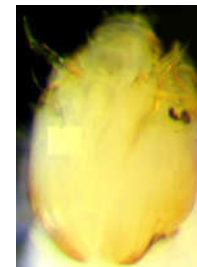
with color pattern **and** **with** 'fenestra'

Dicrotendipes
sp.

 **5** lateral teeth on either side (press flat, if necessary), 5th lateral barely distinguishable, fused into a bulging prominence of the mentum's base

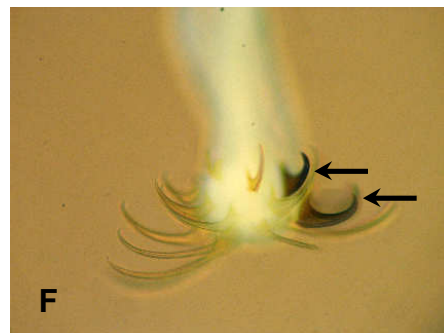
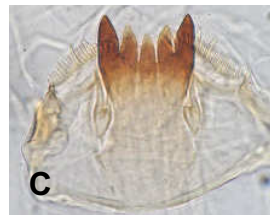
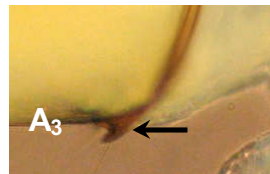
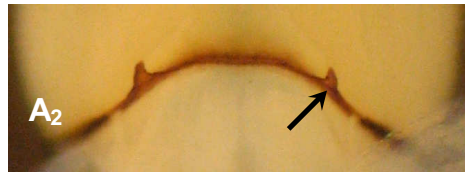
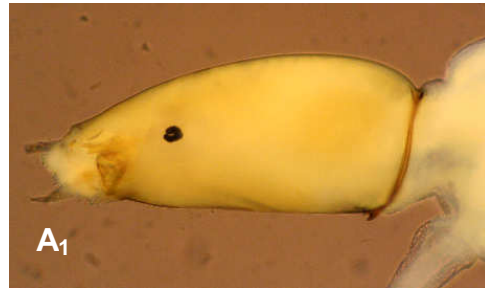


with brownish longitudinal streak, or without color pattern; **without** 'fenestra'

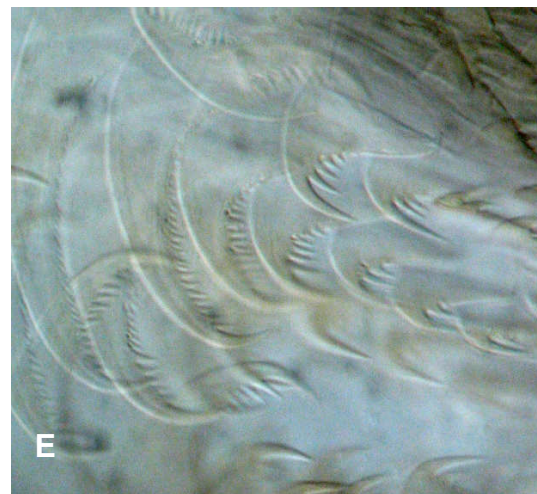
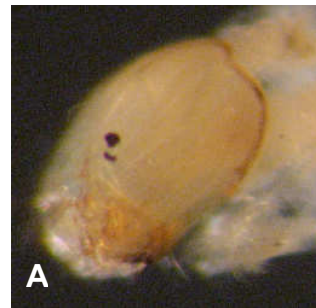


Dicrotendipes
nervosus

<p>Tanypodinae</p> <p><i>Ablabesmyia longistyla</i></p>	
<p>Head</p>	<p>(A₁) Elongate; width/length ratio < 0.7. (A₂, A₃) Ventral posterior margin with a short spine (arrows) on either side.</p>
<p>Antenna</p>	<p>Retractable.</p>
<p>Maxillary palp</p>	<p>(B) Basal segment with 4-5 subdivisions.</p>
<p>Ligula Dorsomentum</p>	<p>(C) Ligula with 5 teeth. Dorsomentum without teeth.</p>
<p>Mandible</p>	<p>(D) Inner tooth distinct.</p>
<p>Body</p>	<p>(E) Without obvious lateral fringe of setae. (F) Posterior parapod with two small hooks distinctly darker than other hooks.</p>
<p>Ecology</p>	<p>Early instars omnivorous, later instars predatory (mostly on chironomids and oligochaetes). Found in all habitats except on mineral substrates. Brackish-water records known from the literature only. Salinity tolerance 1 (haloxenic).</p>



Orthoclaadiinae	
<i>Halocladius (Halocladius) varians</i>	
Head	(A) Yellow with brown posterior margin; eyespots distinctly separate. (B) Antenna normally developed, 5-segmented.
Mentum	(C) Similar to <i>H. fucicola</i> and <i>H. variabilis</i> , but central tooth at least 2 x as wide as 1st lateral, 2nd lateral tooth distinctly smaller than and partially fused with 1st lateral. Ventromental plate very slender.
Labrum	(D) Seta SI bifid, with subequal branches; premandible with 1 apical tooth.
Mandible	As in <i>H. variabilis</i> .
Body	Less than 1 cm long; coloration similar to that in <i>H. variabilis</i> but usually paler. (E) All anterior parapod claws with apical tooth much larger than inner teeth. (F) Procercus short, carrying 5-6 strong and long anal setae; anal tubuli absent.
Ecology	Found in phytal habitats. Likely the least ecologically specific among domestic members of <i>Halocladius</i> ; in present study recorded in 8 samples from 3 western Baltic Sea sites (Mecklenburg-Vorpommern and Schleswig-Holstein), 4 of them β -mesohaline and 4 α -mesohaline. Salinity tolerance 4 (halobiontic).



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