

Description of imago, pupal exuviae and larva of *Chironomus uliginosus* and a provisional key to the larvae of the *Chironomus luridus* agg. (Diptera: Chironomidae)

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With 32 figures and 2 tables

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Schlagwörter: Chironomus, Loboichironomus, Chironomidae, Diptera, Insecta, Niederlande, Deutschland, Morphologie, Nomenklatur, Bestimmung, Larve, Puppe, Exuvie, Männchen

The male imago, pupal exuviae and larva are described. The larvae of five species, four belonging to the *Chironomus luridus* agg. and one belonging to the subgenus *Loboichironomus*, can be identified using a provisional key.

1 *Chironomus uliginosus* Keyl, 1960

1.1 Introduction

The morphologies of the pupal exuviae and the larva have not been described until now. The description of the male adult by Keyl (1960: 191), "Merkmale der Färbung und das Hypopygbaues stimmen mit denen von *Cb. pseudothummi* Str. überein.", has been insufficient to identify this species.

Larvae of this species, identified as belonging to the *Chironomus luridus* agg. (Vallenduuk, 1997, 2002) were first collected in 2006 by Gert Jan van Duinen in the nature reserve Bargerveen (The Netherlands, Drenthé). Later Vallenduuk collected more larvae at other locations. Some larvae have been reared to adults and others have been cytologically identified by Professor Dr. I. Kiknadze as being *Chironomus uliginosus* Keyl. After studying the karyotype of larvae from different populations it was found that the Russian population of *C. uliginosus* might be a subspecies (Kiknadze et al., 2010: 29). This species occurs mainly in peaty water bodies. The Vallenduuk collected the larvae in the Netherlands in nature reserves (Bargerveen, De Hamert, Duivelskuil, Peelvenen and Mariapeel) and in nature reserves in Germany near Oldenburg (Stapeler Moor and Leegmoor).

1.2 Morphology of the stages

Larva

The larva was collected in the "Pikmeeuwenwater" (De Hamert nature reserve, north of Arcen in the Netherlands) on 18 May 2007. The larva is slide-mounted under the label chirulig1.

Body (n=1)

The larva belongs to the *C. luridus* agg.. Body length 12 mm. Lateral tubuli at segment VII and ventral tubuli at segment VIII present (Fig. 1). Posterior parapod with 16 unpigmented claws: 10 hooked claws in an outer circle and 6 more elongate claws in the middle.

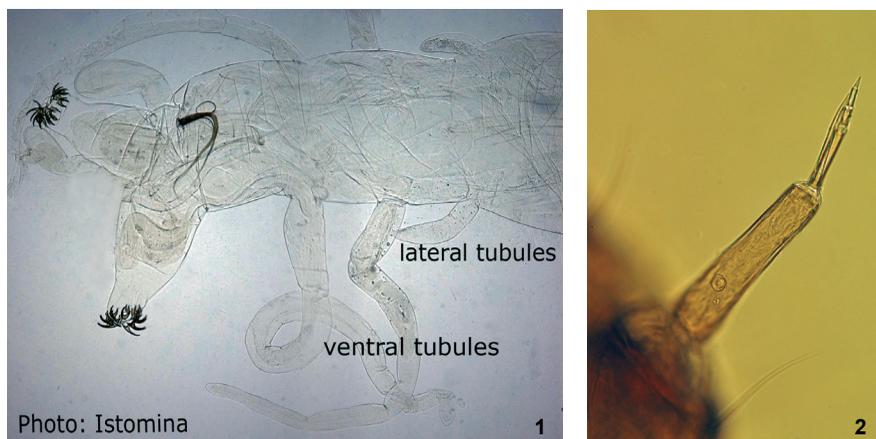


Fig. 1-2: *Chironomus. uliginosus*, larva. 1: Lateral tubuli at segment VII and ventral tubuli at segment VIII. 2: Antenna

Head (for characters see Fig. 12-15):

Head width 560 μm . LFa-Po 650 μm ("total" head length 680 μm). Unpigmented part of the postoccipital margin dorsally (Po-gap) 100 μm . IASD 150 μm . Antennal socle width 100 μm . Antenna with 5 segments (Fig. 2). Segment 1 length 142 μm , width 41 μm ; segments 2-5 length 92 μm . The gula is unpigmented. The dark yellow frontal apotome has almost the same colour as the head. Labral sclerite 2 is present with an oval lens in the middle (Fig. 3). Labral sclerite 1 is absent. The clypeus is fused with the frontal apotome, its outer line protruding between the antennal socles. Pecten epipharyngis with relatively robust and pointed teeth (Fig. 4). Upper and lower premandibular teeth almost equal (Fig. 5). Dorsal mandibular tooth (MdT) pale and three inner mandibular teeth (Fig. 6-MiT). The third mandibular tooth MiT3) is the smallest and is weakly pigmented. The mentum has sharply pointed teeth (Fig. 6). The central

mental tooth C2 is partly fused with C1 to form a roughly triangular shape (Fig. 6). Lateral mental tooth L2 is fused along about half its length with L1. The top of the lateral mental tooth L4 lies on one line with teeth L3 and L5 (Fig. 6). MS $58\ \mu\text{m}$. IPD $57\ \mu\text{m}$. VmP width $195\ \mu\text{m}$ (Fig. 7). Str L1: 6. LC1-Po $352\ \mu\text{m}$.

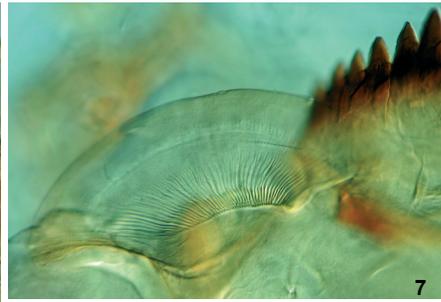


Fig. 3-7: *Chironomus. uliginosus*, larva. 3: Labral sclerite 2. 4: Mentum and labrum with pecten epipharyngis. 5: Premandible. 6: Mentum and mandible. 7: Ventromental plate

Pupal exuviae and associated adult male

Both mounted together on a slide marked *Chironomus uliginosus* leg. H. Vallenduuk.

Location: 06084-Bargerveen, Netherlands. 16.viii.2007. Leg. H. Vallenduuk. Larva reared to adult. In 2007 and 2008 Vallenduuk collected larvae at four locations in the Bargerveen nature reserve. The larvae, belonging to the *Chironomus luridus* agg., were cytologically identified by Professor dr. Iya Kiknadze as being *Chironomus uliginosus*.

Pupal exuviae (n=1)

Medium sized pupae, 8.1 mm long. Exuviae pale brown, cephalothorax and lateral margins of abdominal tergites brown. Spur of segment VIII brown (Fig. 9). Anal lobes brown outwards to the insertion of the taeniae, then colourless.

Cephalothorax. Cephalic tubercles narrow conical, $84\mu\text{m}$ long, ending in frontal setae $48\mu\text{m}$ long (Fig. 8b). Thoracic horn richly branched, plumose. Basal ring of thoracic horn $132 \times 68\mu\text{m}$, tracheal patch $100 \times 40\mu\text{m}$ about 15 tracheoles across, $2\mu\text{m}$ diameter. Thorax granulation (Fig. 8a) well developed anteriorly, small granulate between dorsocentral setae and suture, smooth above the oblique hinge line and below the dorsocentral setae.

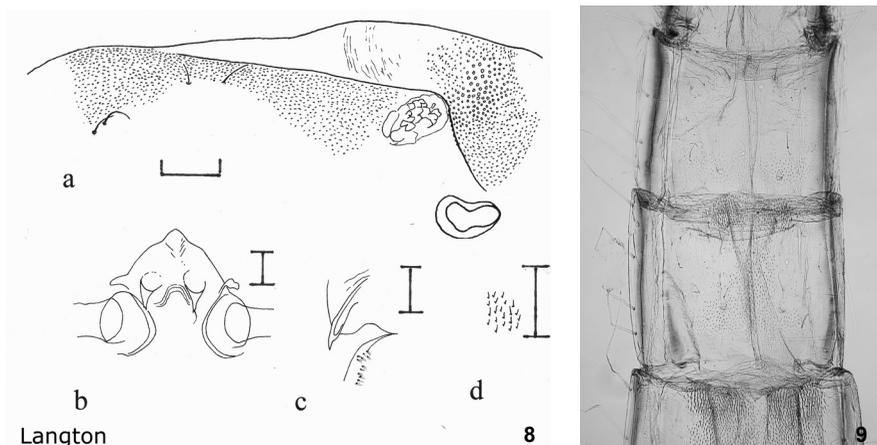


Fig. 8-9: *Chironomus uliginosus*, pupal exuviae. 8: a = thorax dorsal, b = frontal apotome, c = spur of segment VIII, d = armament of mid tergite IV. 9: Segment VI-VIII

Abdomen. Tergite I unarmed, II-V with median undivided patches of dense short points, showing little imbrication (Fig. 8d), larger posteriorly. On tergite VI the point patch narrows posteriad to about 10 points wide just anterior to setae D5.) Tergite VII with a transverse band of small points anterior to setae

D1, medially narrowed (Fig. 9). VIII with 2 lateral patches of small points, not arranged in rows. Anal segment without shagreen. Paratergites V and VI with a very narrow longitudinal band of very small points. Pleura of segment IV unarmed. Ventral shagreen consisting of extremely small points, on II the lateral longitudinal bands do not connect with the median patch posteriorly, on III the lateral bands extend for much of the sternite length, on IV apparently absent. Hook row 0.38 segment breadth, with about 80 hooks. Vortex distinct on segment IV; conspicuous pedes spurii B present on segment II. Segment VIII with dark brown, strong postero-lateral spurs (Fig. 8c), each with with 1 sturdy apical tooth.

Chaetotaxy of abdominal segments (one side)

	I	II	III	IV	V	VI	VII	VIII	IX
Ds	2	4	5	5	5	5	5	1	1
Ls	1	3	4	4					
Lt					4	4	4	5	90

The pupal exuviae runs to *Chironomus* (s.str.) Pe32 in Langton & Visser (2003), a form obtained from littoral wetlands in southern Spain, but can be distinguished by the lack of granulation above the oblique hinge line and below the dorsocentral setae of the cephalothorax (in Pe32 the granulation is stronger and much more extensive).

Adult male (n = 1)

Colour (alcohol preserved): Head yellow, pedicellus dark brown, flagellum mid-brown, palpomeres 2-4 mid-brown, 1 and 5 yellow, eyes black. Thorax yellow, scutal stripes mid-brown, median scutal band extending posteriad as far as the scutal tubercle, median anepisternum II and lower two thirds of preepisternum dark brown, halteres yellow, postnotum black except for a narrow yellow band at base dorsally. Legs yellow with tips of tibiae and metatarsi, and tarsomeres 3-5 brownish; combs of mid and posterior tibiae black. Wings unmarked. Abdominal tergites I-VI brown with posterior $\frac{1}{4}$ to $\frac{1}{2}$ yellow, VII and VIII brown; all sternites and pleura yellow; hypopygium dark brown, with projecting part of anal point black above.

Antenna. Antenna with a large globular pedicel and flagellum of 11 flagellomeres 2-10 $1\frac{1}{2}$ times as wide as long. Flagellum segment lengths: 80, 34, 32, 36, 32, 32, 32, 32, 32, 32, 1180 μm . Antennal ratio (AR) 3.2.

Head. Eye bare, with a long dorsomedial parallel-side extension, 230 μm long, 80 μm broad. Verticals 19/25. Clypeals 24. Frontal tubercles 36 μm long, 12 μm broad. Palp 5 segmented, segment lengths: 72, 72, 276, 252, 400 μm .

Thorax. Acrostichals 13. 21 dorsocentral setae. 5 prealars. Scutellum with 8 setae on the left side.

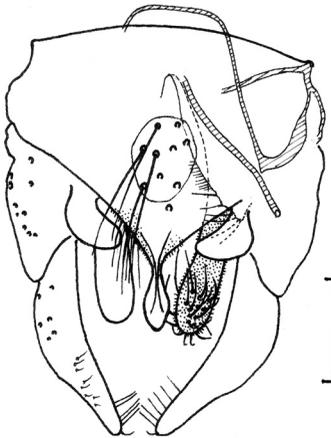
Wing. Length (arculus to wingtip) 2.9mm. R with 36, 39 setae; R1 with 31 and R4+5 38, 41. Squama with 17, 18 setae.

Legs (length in μm)

Leg	Fe	Ti	Ta1	Ta2	Ta3	Ta4	Ta5	LR	BR
1	1320	1120	1860	980	740	620	300	1.7	2.9
2	1380	1300	800	460	320	200	160	0.6	3.0
3	1560	1600	1140	660	500	300	200	0.7	4.7

Abdomen. Tergites and sternites with dense irregularly distributed setae.

Hypopygium. (Fig. 10) Central pale part of tergite IX with 11 very long setae. Anal point constricted basally and expanded in distal half. Superior volsella distally broad foot shaped (S-type, according to Strenzke, 1959). Inferior volsella covered with microtrichia, distal part with curved, long setae. Laterotergite IX with 5, 6 setae; gonocoxite with 29, 31 setae, Gonostylus narrowed subapically, with about 10 long setae; inner margin at tip with 5, 6 setae.



Langton

The adult male runs to *Chironomus* (*C.*) *pseudothummi* Strenzke in Langton & Pinder (2007), which it very closely resembles (as noted by Keyl (1960); the broader superior volsellae, fewer scutellar setae and longer dorsal setae of tergite IX may serve to identify it.

Fig. 10: *Chironomus uliginosus*, male. Hypopygium

2 The larvae of the *Chironomus luridus* agg.

2.1 Introduction

Identification of the species, belonging to the *Chironomus luridus* agg., has not been possible until now. Webb and Scholl (1985) and Vallenduuk (1997, 2002) stated that three species belonging to this group were difficult to distinguish. Unfortunately the descriptions of the larvae given by Kiknadze (1991) were insufficient to identify the species. Larvae belonging to four species of the *Chironomus luridus* aggregate have been cytologically identified by Professor Dr. I. Kiknadze, which enabled us to examine these four species.

2.2 The larva of *Chironomus longipes* Staeger

Shilova (1980: 176-180) described the species *Einfeldia longipes* Staeger. She stated that antennal segment 3 is much shorter than segment 4, the length of antennal segment 1 and the total length of segments 2-5 are equal, and the lateral mental tooth L4 is smaller than the surrounding teeth (?L3 and L5). In our material we did not see these characters (see table). Unfortunately it was not possible to examine the larvae, which are described by Shilova.

Spies and Sæther (2004: 38-40) stated that the correct name of *Chironomus longipes* Staeger is *Chironomus Loboichironomus dorsalis* Meigen. In 2010 Vallenduuk collected larvae of this species in Germany (Black Forest, near St. Peter). Some larvae were reared to adult. The pupal exuviae and imago were identified by Dr. P. Langton. The larvae of this species are morphologically very close to those of the *Chironomus luridus* agg. (sibling species). Information about distribution, water type and autecology can be found in Moller Pillot (2009).

Using this important material, Vallenduuk was able to find characters to identify the following five species:

Chironomus Loboichironomus Ryser, Wülker & Scholl, 1985

dorsalis Meigen, 1818 (syn.: *Chironomus longipes* Staeger, 1839)

Chironomus Chironomus Meigen, 1803

luridus Strenzke, 1959

parathummi Keyl, 1961

pseudothummi Strenzke, 1959

uliginosus Keyl, 1960

All five species have lateral tubuli at segment VII and two pairs of ventral tubuli at segment VIII (Fig. 1). They do not have pigmentation on the gula. However, *C. pseudothummi* may have a small patch of pigmentation medially and laterally close to the postoccipital margin.

3 Provisional key to the larvae of *Chironomus luridus* agg. and *Chironomus Loboichironomus dorsalis*

With this key it will be possible to identify the larvae of four species of the *Chironomus* s. str. *luridus* agg. and *Chironomus Loboichironomus dorsalis* Meigen. The larvae of all five species are morphologically very close (sibling species). All species of the subgenus *Loboichironomus* probably have a pecten epipharyngis with irregular teeth (Epler, 2001: 8.42) and this character might be a feature that distinguishes the two subgenera (Fig. 28-32). The abbreviations used in the key are explained in table 1. The characters and measurements given in the key and summarized in table 2 are based on examination of a small number of larvae. Note that the range of sizes, given in the key and the table, needs to be updated. The tables will be completed in a forthcoming key to all species of *Chironomus*.

The key is based on macroscopic characters (magnification up to 60x). Notice that misidentification is easy, especially when the user of the key does not have experience with identification of this group. When identifying the species for the first time we advise comparing measurements with the data given in the table.

When examining larvae we recommend putting the larvae into a petri dish with 70 % alcohol. Many characters can be seen at 40 x magnification with illumination from above. Setae can be seen best with diascopic illumination. The lens in the labral sclerite SL2 cannot always be distinguished well because the labrum is very elastic. Note that this character might be very variable. To examine its shape the labrum must be situated horizontally. Especially when making measurements the larva has to be placed in an exactly horizontal position. We advise that the larva is put on a slide next to a pile of two or three coverslips in a drop of alcohol. When covered by a coverslip (Fig. 11) the larva can be rolled by moving the coverslip to the left or right with one fingertip and will not be flattened.

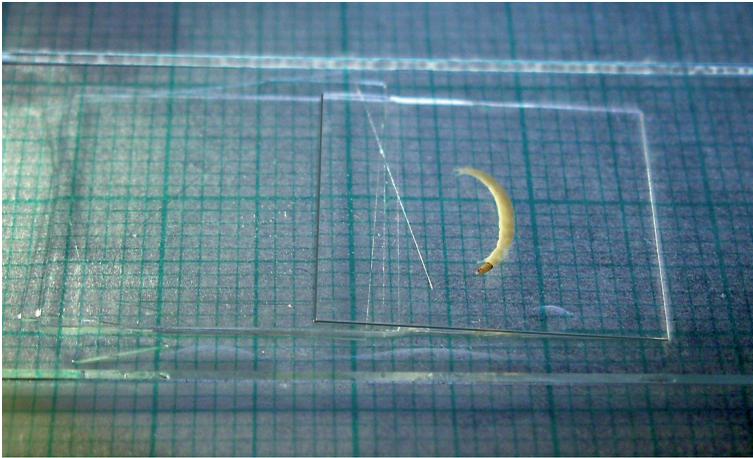


Fig. 11: Tanypodinae larva. Larva under a coverslip for rolling the larva into a good position

If details of the head cannot be seen well, we recommend the addition of a drop of lactic acid next to the coverslip. The lactic acid will mix with the alcohol and make the head transparent. We do not advise making a permanent slide, but if it is preferred it is advisable to attach a self-adhesive label the slide with the following identifying information: lateral tubuli on segment VII present or absent, pigmentation of the inner mandibular teeth, pigmentation of the gula and the LFA-Po.

Tab. 1: Glossary of the abbreviations used in the key

Term	Description	Figure
As	antenna, placed on an antennal socle	1, 14
C1,2	central mental teeth C1,2	15
FA	frontal apotome	12
FS	suture of frontal apotome	14
gula	area between mentum and postoccipital margin (Po)	13
IAsD	distance between both antennal socles	12
IPD	distance between both ventromental plates	15
L1-6	lateral mental teeth L1-6	13
L2 index	the distance taken from the incision between L2 and L1 to the incision between L2 and L3	15
LC1-Po	distance between central mental tooth C1 and postoccipital margin (Po)	13
LFA-Po	distance between frontal apotome and postoccipital margin (Po)	12
MaT	apical mandibular tooth	15
MdT	dorsal mandibular tooth	15
MiT	inner mandibular teeth	15
MS	mental size, distance between the middle of both lateral mental teeth L1	15
PE	pecten epipharyngis	13, 15
Po	postoccipital margin	13, 14
Po mark	triangular form on the postoccipital margin laterally	14
S9+10	seta 9 and 10 on the thead capsule laterally	14, 16
SI2	labral sclerite 2	12
StrL1	number of striae taken over the width of lateral mental tooth L1	15
VmP	ventromental plate	7, 13

- 1a Frontal apotome (FA) completely pigmented with a brownish colour (Fig. 12, 14) 4
 Note: Exceptionally an *uliginosus* larva has the FA weakly pigmented and the identification will run to *luridus*. In that case consult the table. Usually both species do not occur at the same site.
- b Frontal apotome (FA) unigmented. Head capsule completely yellow and sometimes the FA somewhat darker yellow than the head capsule 2
- 2a Distance S9+10 to the eye spot about half the eye-width or more (Fig. 16). Postoccipital margin over its total length, except its gap, equally pigmented (Fig. 13, 14). Suture of the frontal apotome (FS) obvious. FS is shown as a pale line running from the antennal socle to the postoccipital margin (Fig. 12, 14) 3
 Note: Eyes can be displaced in the head. Examine both sides of the head.
- b Distance S9+10 to the eye spot less than half the eye-width (Fig. 17). Postoccipital margin over its total length, except its gap, not equally pigmented. Between the triangular marks (Po mark) more weakly pigmented. Suture of the frontal apotome (FS) faint or not visible. Head width maximum 510 μm 6
 Note: Eyes can be displaced in the head. Examine both sides of the head.

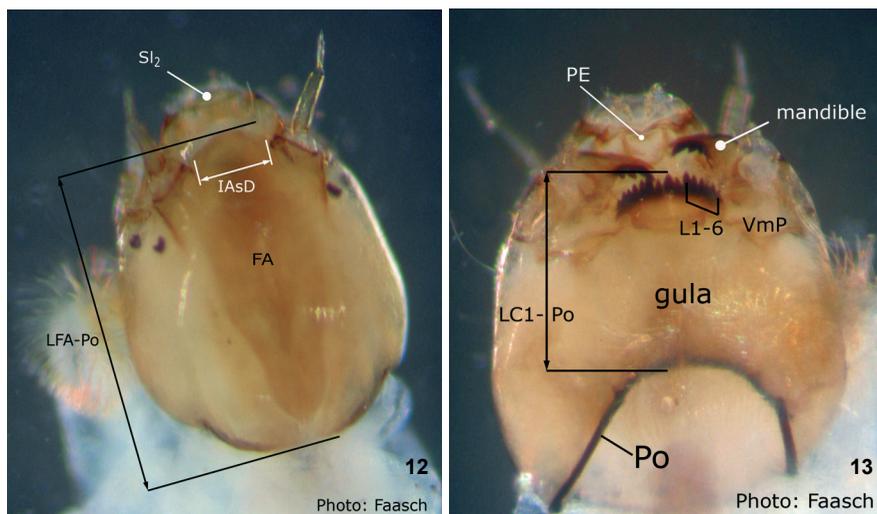


Fig. 12-13: *Chironomus luridus*, larva. 12: Head dorsally. 13: Head ventrally

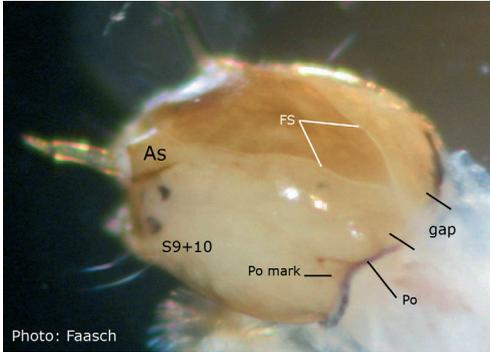


Fig. 14: *Chironomus luridus*, larva. Head laterally

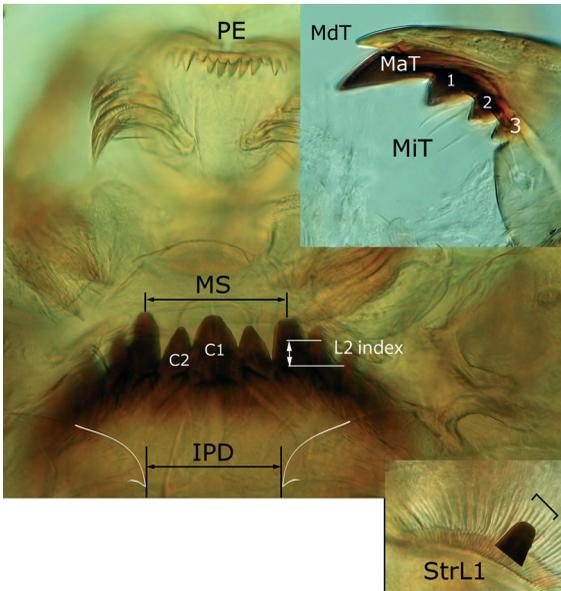


Fig. 15: *Chironomus luridus*, larva. Labrum, mentum with ventromental plate; *uliginosus*, larva. Mandible

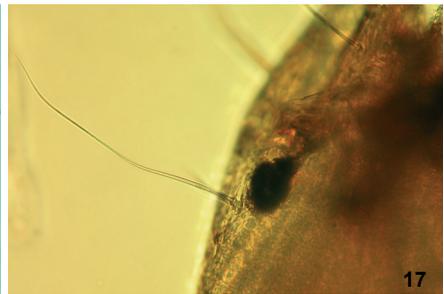
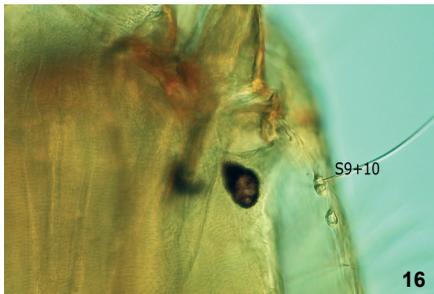


Fig. 16: *Chironomus parathummi*, larva. S9+10 and eye spot Fig. 17: *Chironomus Lobo-chironomus dorsalis*, larva. S9+10 and eye spot

- 3a Central mental tooth C2 along more than half its length fused with C1 (Fig. 18, 19) FA usually pigmented 4
- b Central mental tooth C2 fused along less than half its length with C1 to form a roughly triangular shape (Fig. 20, 21). FA unpigmented 5
- 4a Frontal apotome (FA) completely pigmented with a contrasting brownish colour (Fig. 12, 14). Lateral mental tooth L2 fused along about half its length with L1; L2 index 8-10 μm (Fig. 15, 18). Lens in Sl₂ short oval (Fig. 22) *luridus*
Note: Lens in Sl₂ might be variable.
- b Frontal apotome (FA) can be pigmented with a weak brownish colour. Lateral mental tooth L2 fused over more than half its length with L1; L2 index 12-15 μm (Fig. 19). Lens in Sl₂ elongate oval, running parallel over almost the complete sclerite (Fig. 23) *pseudothummi*
Note: Lens in Sl₂ might be variable.
- 5a Three inner mandibular teeth. MiT1 and 2 dark; MiT3 weakly pigmented and smaller (Fig. 6, 15). The incision between the lateral mental teeth L1 and L2 higher and not on one imaginary line with those of L3 to L6 (Fig. 20). Head width (480)550-620 μm . LFA-Po 570-650 μm . Lens of Sl₂ short oval (Fig. 24) *uliginosus*
Note: Lens in Sl₂ might be variable.
- b Two inner mandibular teeth are visible. MiT3 seems to be absent (Fig. 26). The incision between the lateral mental teeth L1 and L2 is almost in one imaginary line with those of L3 to L6 (Fig. 21). Head width 470-490 μm . LFA-Po 500-550 μm . Lens in Sl₂ more elongate oval (Fig. 25) *parathummi*
Note: Lens in Sl₂ might be variable.

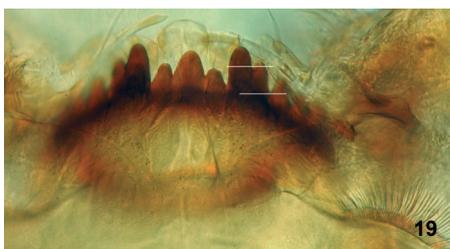
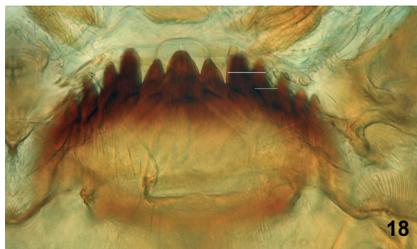


Fig. 18: *Chironomus luridus*, larva. Mentum. Fig. 19: *Chironomus pseudothummi*, larva. Mentum



Fig. 20: *Chironomus uliginosus*, larva. Mentum. Fig. 21: *Chironomus parathummi*, larva. Mentum

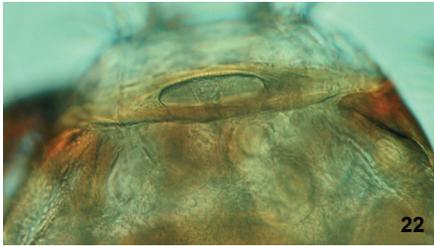


Fig. 22: *Chironomus luridus*, larva. Labral sclerite 2. Fig. 23: *Chironomus pseudothummi*, larva. Labral sclerite 2

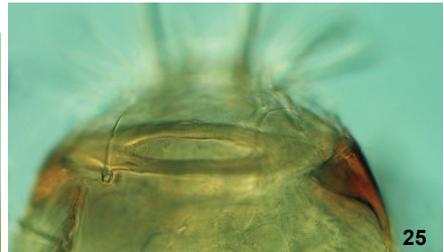
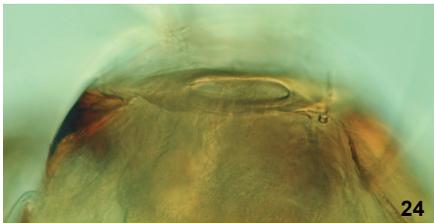


Fig. 24: *Chironomus uliginosus*, larva. Labral sclerite 2. Fig. 25: *Chironomus parathummi*, larva. Labral sclerite 2

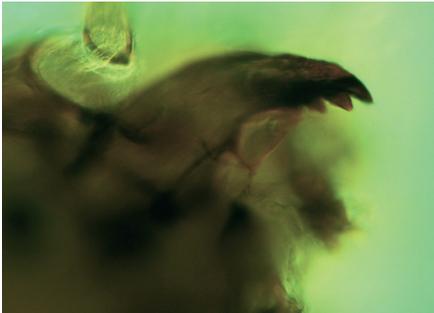


Fig. 26: *Chironomus parathummi*, larva. Mandible

- 6a Head width 410-450 μm . Teeth of pecten epipharyngis (PE) laterally with irregular shape: A very narrow and short tooth between broader teeth (Fig. 28). Third inner mandibular tooth of mandible (MiT3) hardly visible, it seems to be absent (Fig. 27)

*Chironomus Lobo**chironomus dorsalis*

- b Head width about 400 μm or smaller. Teeth of pecten epipharyngis (PE) laterally with regular shape (Fig. 29, 30, 31, 32) *luridus* agg., instar III

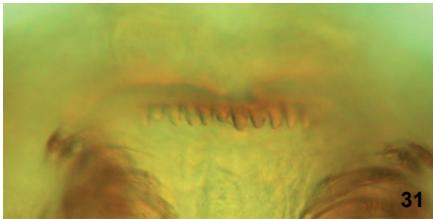
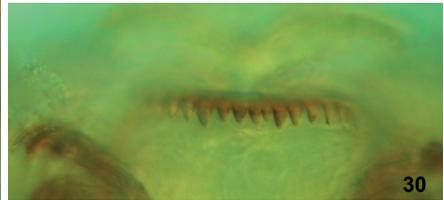


Fig. 27-28: *Chironomus Lobo**chironomus dorsalis*, larva. 27: Mandible, premandible and pecten epipharyngis. 28: Pecten epipharyngis

Fig. 29: *Chironomus luridus*, larva. Pecten epipharyngis. 30: *Chironomus parathummi*, larva. Pecten epipharyngis

Fig. 31: *Chironomus pseudothummi*, larva. Pecten epipharyngis. Fig. 32: *Chironomus uliginosus*, larva. Pecten epipharyngis

Tab. 2: Measures and features of the species treated in the key. BL max = maximum length of the body, HW = head width, L1:L2-5 = length of segment 1 compared with the total length of segments 2 to 5; consult also the glossary

Dorsally	BL max mm	LFA-Po µm	HW µm	FA colour	Antenna L1 : L2-5
pseudothummi	16	640–710	550–620	yellow– weak brown	1,5–2
luridus	12	600–710	510–620	brownish	about 2
uliginosus	12	570–710	(480)520– 620	yellow	about 1.75
parathummi	12	500–550	470–490	yellow	about 1.5
dorsalis	11,5	450–510	410–450	yellow	about 1.2
E. longipes (Shilova)		(400–500) total length	390–480		equal
Ventrally	LC1-Po µm	MS µm	IPD µm	MIT3	L2 Index
pseudothummi	340–380	55–68	55–65	obvious	13–15
luridus	320–348	58–60	50–62	obvious	8–10
uliginosus	340–360	55–60	57–68	obvious	9–10
parathummi	260–284	54–65	40–47	not obvious	± 8
dorsalis	237–253	45–52	30–38	very small	7–10
E. longipes (Shilova)					

4 Request

If you are unable to identify a species with certainty, please send an email with information about the problem to Henk Vallenduuk. This information will be very helpful in compiling the forthcoming key to all species occurring in Western Europe.

Acknowledgements

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Photographs

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