



A Review of *Orthocladius* subgen. *Symposiocladius* Cranston (Diptera: Chironomidae)

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Abstract

Emended diagnoses of all stages of the subgenus *Symposiocladius* Cranston of the genus *Orthocladius* v. d. Wulp are given. The male imagines of the subgenus share absence of virga, collar-like superior volsella, and ventral part of inferior volsella not extended prominently below dorsal part. The larvae have prominent circular Lauterborn organs, often weak pecten galearis and vestigial premandibular brush, and usually setal brushes on abdomen. *O. (S.) schnelli* sp. n. and *O. (S.) halvorseni* sp. n. are described and *O. (S.) annectens* Sæther redescribed in all stages and both sexes, *O. (S.) bilyji* sp. n. as male and female imago and pupa, and *O. (S.) smolandicus* Brundin, not Sponis, redescribed as male imago. Other included species are *O. (S.) lignicola* Kieffer, *O. (S.) holsatus* Goetghebuer, and *O. (S.) lunzensis* Dettinger-Klemm. Keys to species for all stages are given.

Keywords: *Orthocladius*, *Symposiocladius*, new species, keys, Orthoclaudiinae, Chironomidae.

Introduction

The genus *Orthocladius* v. d. Wulp contains five subgenera, *Euorthocladius* Thienemann, *Eudactylocladius* Thienemann, *Pogonocladius* Brundin, *Symposiocladius* Cranston and *Orthocladius* s. str. Each of these subgenera at some time or another has been regarded as full genera. The first four in their strictest sense are clearly monophyletic and mostly easily definable. That is because they each consist of one or a few species and that all intermediate forms have been relegated to the nominative subgenus. However, that has rendered the nominative subgenus clearly paraphyletic, perhaps even polyphyletic. A preliminary phylogenetic analysis, both manual and computer based, has indicated that in order for the nominative subgenus to be monophyletic several intermediate forms between *Euorthocladius* and *Orthocladius* s. str. have to be included in the first, and that the subgenus *Symposiocladius* should be

enlarged. Accordingly species such as *Orthocladius frigidus* (Zetterstedt) which was removed from *Euorthocladius* and placed in *Orthocladius* s. str. by Soponis (1987) again should be placed in *Euorthocladius* together with some as yet undescribed species. Some species such as *O. annectens* Sæther and *O. holsatus* Goetghebuer resemble *O. (Symposiocladius) lignicola* (Kieffer) for instance in having nearly identical male hypopygia and larvae with lateral setal brushes and were assigned to the subgenus *Symposiocladius* in Sæther et al. (2000).

Cranston (1983) erected the genus *Symposiocladius* for the species *Orthocladius lignicola* Kieffer primarily based upon the characteristic immature stages with the larva mining submerged wood. However, as the imagines of *O. lignicola* do not differ significantly from several species of *Orthocladius* s. str., Cranston and Oliver (1988) and Cranston et al. (1989) decided to regard *Symposiocladius* merely as a subgenus of *Orthocladius*. One of the reasons for erecting a new genus was the presence of abdominal setal brushes in the larvae. However, as mentioned by Fagnani and Soponis (1988) and Moller Pillot (1984) also *O. annectens* Sæther and *O. holsatus* Goetghebuer have these setal brushes and conspicuous large Lauterborn organs, and the hypopygia of these species are nearly inseparable from that of *O. lignicola*. Furthermore, as shown by Cranston and Oliver (1988) some populations of *O. lignicola* have simple l_4 setae.

The present paper attempts to give a preliminary definition of the subgenus *Symposiocladius*.

Methods and Terminology

The general terminology follows Sæther (1980). In the figures of the male genitalia the dorsal view is shown to the left, the ventral aspect and apodeme to the right. The measurements are given as ranges followed by a mean when four or more measurements are made, followed by the number measured in parentheses (*n*). The holotypes of the new species are deposited at the Museum of Zoology, Department of Zoology, University of Bergen, Norway (ZMBN). Other material is returned to Florida A&M University (FAM), The Swedish National Museum (SNM), or the collection of Dr. Peter Langton, Coleraine, Londonderry, Northern Ireland (PL) or deposited at the Zoologische Staatssammlung, Munich (ZSM), R. M. Bohart Museum of Entomology, Davis, California (RMB); and the Museum of Zoology, University of Bergen, Bergen (ZMBN).

Orthocladius subgen. *Symposiocladius* Cranston

Orthocladius subgen. *Symposiocladius* Cranston 1983: 419.

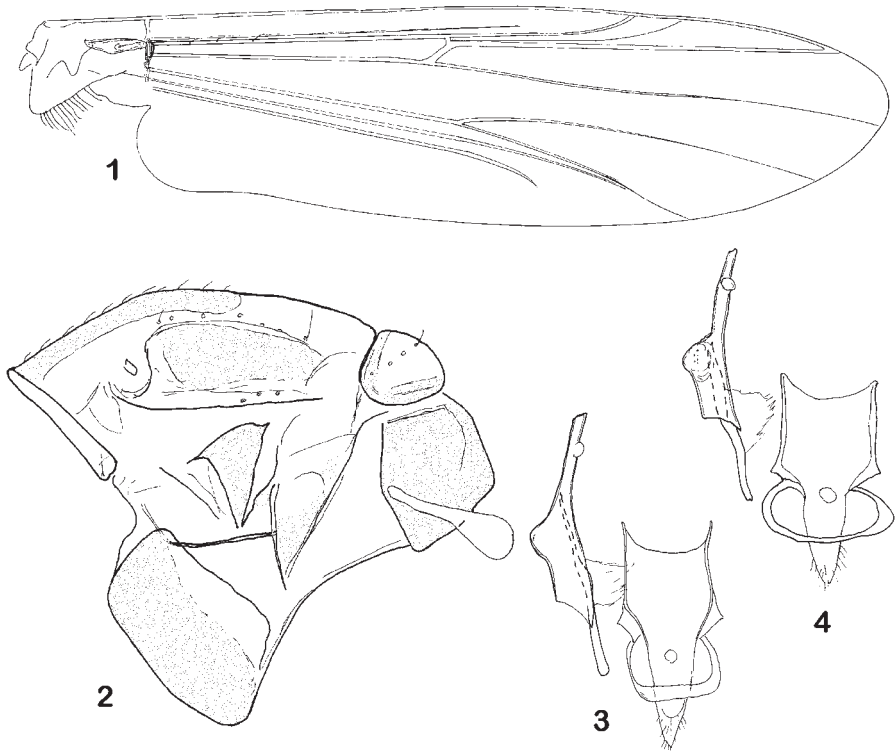
Type species: Orthocladius (Symposiocladius) lignicola Kieffer.

Diagnostic characters: The male imagines are separable from other *Orthocladius* v. d. Wulp by the combination of no virga, anal point triangular with pointed apex, collar-like superior volsella, and inferior volsella with ventral part not extended prominently below dorsal part. The female genitalia do not appear separable from

those of *Orthocladius* s. str. The pupa lacks chitinous rings on tergites I–III and chitinous threads on anal lobe, and either have circular spine patch set off from surrounding shagreen medially on tergites IV–VI, anal lobe drawn into long narrow process with innermost terminal spur claw-like; or pedes spurii B present on segment III combined with no spurs or chitinous threads on anal lobe; or conspicuous pedes spurii B on segment II but no pedes spurii B on III combined with spine-like spurs on anal lobe and dark reticulated apophyses. The larva differs from other subgenera by having robust, circular Lauterborn organs, often body segments 4–9 with lateral seta l_4 developed as setal brush, often vestigial premandibular brush, and pecten galearis often present.

Imago

Small to moderately large species, wing length 1.1–2.9 mm. Thorax with brown to blackish brown vittae and other markings as shown in Fig. 2 and with the ground colour varying from pale to nearly as dark as markings.



Figures 1–4. *Orthocladius* (*Symposiocladius*) spp., male imagines: (1) wing of *O. (S.) schnelli* sp. n.; (2) thorax of *O. (S.) schnelli* sp. n.; (3) tentorium, stipes and cibarial pump of *O. (S.) schnelli* sp. n.; (4) tentorium, stipes and cibarial pump of *O. (S.) bilyji* sp. n.

Eye bare, reniform, with small or no dorsomedian elongation. Antenna with 13 flagellomeres in male, 5 in female; male antenna fully plumed; groove beginning on flagellomere 4; sensilla chaetica present on flagellomere 2, 3 and 13; apex without straight apical seta in male, with or without in female; AR 1.0–2.0. Palpomeres normal, but ultimate palpomere often short; palpomere 3 with 1–3 short lanceolate sensilla clavata. Temporals reduced in number to numerous. Tentorium and stipes normally developed. Cibarial pump with anterior margin deeply concave, cornua moderately (Fig. 4) to strongly (Fig. 3) developed. Clypeus with several setae.

Anteprenotal lobes with several lateral anteprenotals. Acrostichals starting close to anteprenotum, dorsocentrals few and uniserial to numerous and bi-triserial; few prealars; supraalars absent or occasionally present. Scutellum with setae transversely uni-biserial.

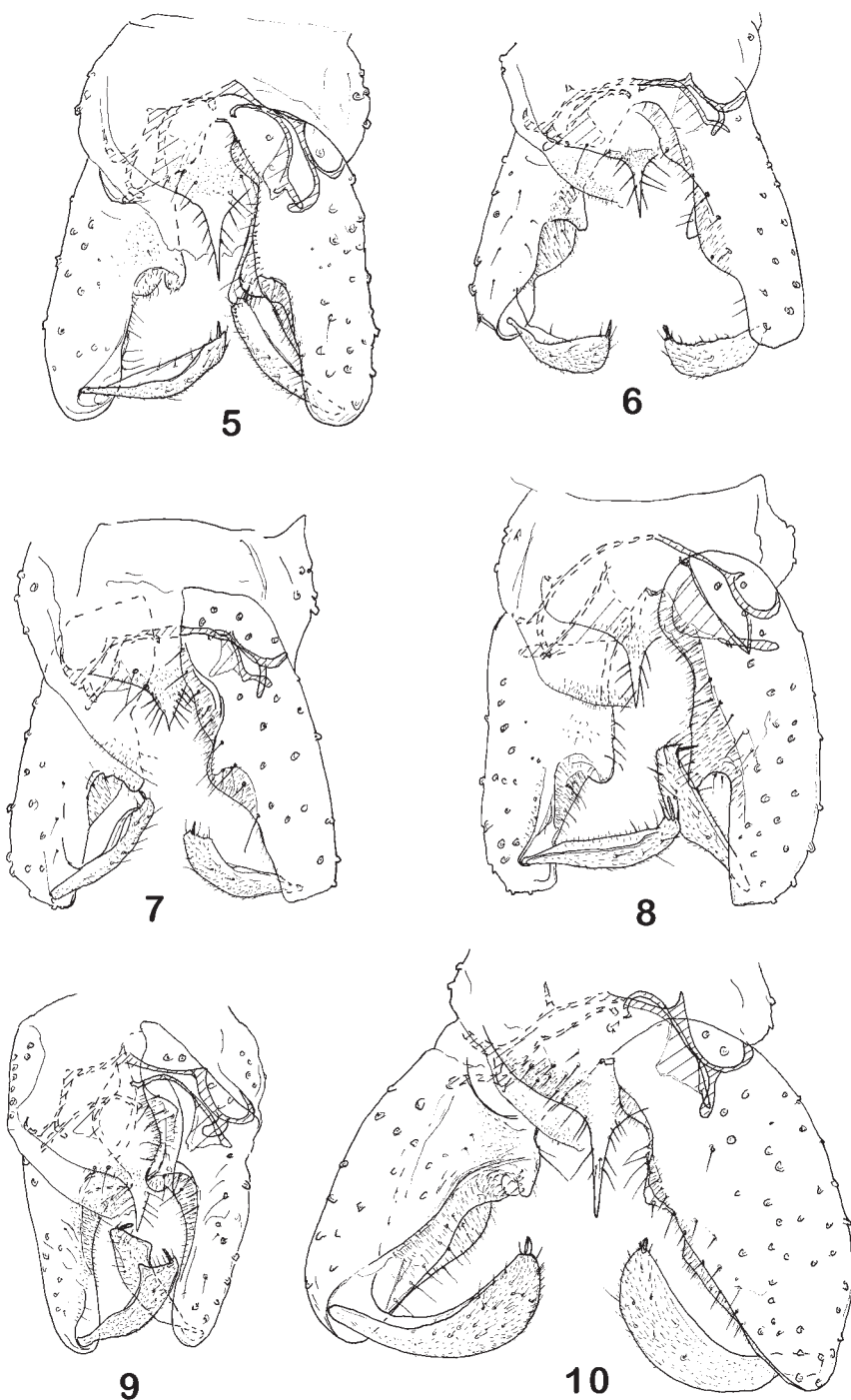
Wing membrane with fine punctation; anal lobe well developed, right-angled to slightly projecting (Fig. 1); costa not or slightly extended; R_{2+3} running in the middle between R_1 and R_{4+5} , ending close to R_{4+5} ; R_{4+5} ending above or distal to end of M_{3+4} , costa ending distal to end of M_{3+4} ; $VR_{1.04}$ –1.25; Cu_1 slightly sinuous; postcubitus ending far distal to cubital fork, anal vein ending below or slightly distal to cubital fork. Brachiolum with 1 seta, R with a few setae; R_1 , R_{4+5} and costal extension of male occasionally with 1 non-marginal seta, in female R_1 and R_{4+5} with setae; other veins bare. Squama with 7–24 setae. Sensilla campaniformia about 10–12 basally on brachiolum, about 8–10 apically on brachiolum, three below setae on brachiolum; one present basally on subcosta, and one basally on R_1 .

Front leg ratio 0.54–0.68. Tibial spurs and hind tibial comb normal. Tarsal pseudospurs present on ta_1 of mid and hind legs, and ta_2 of mid and often hind leg. Pulvilli absent. Sensilla chaetica 0–9 on ta_1 of midleg, 0–4 on hind leg in male; 2–58 on ta_1 of each middle and hind leg in female.

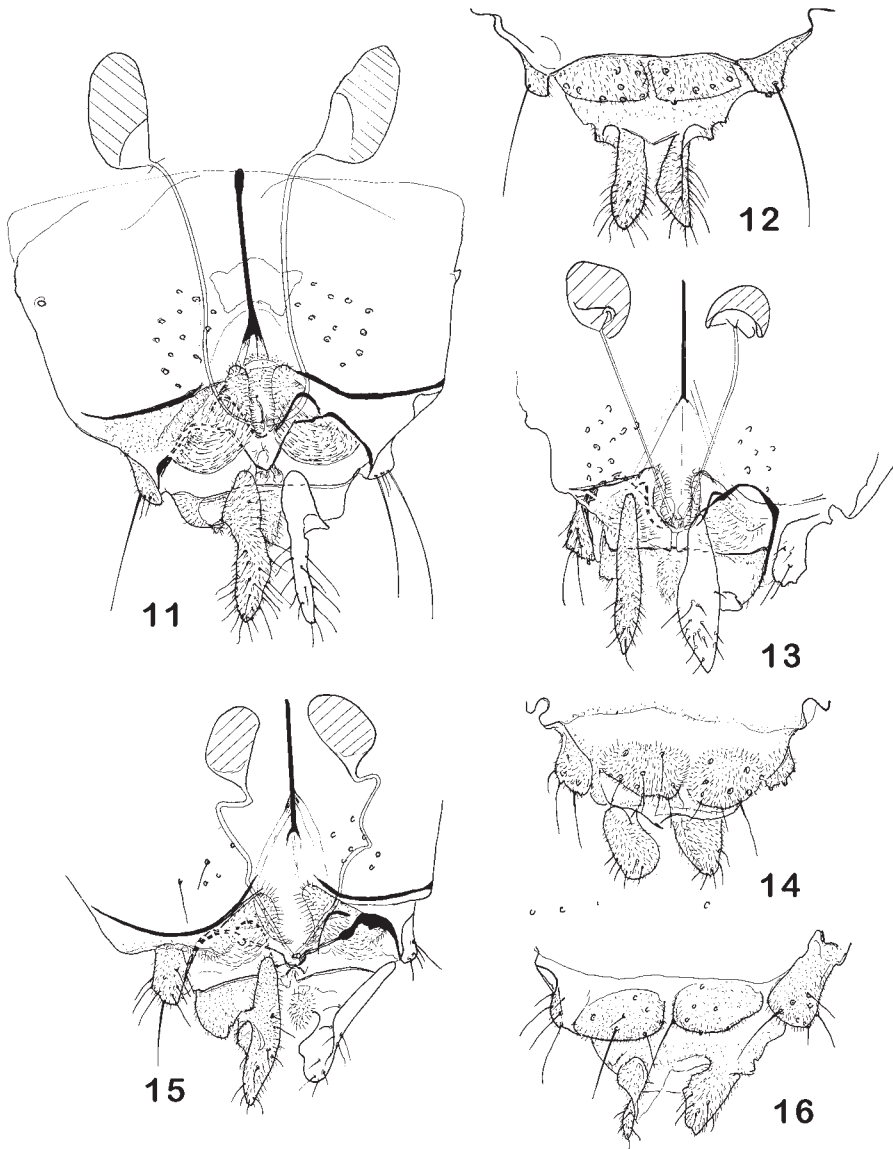
Tergites and sternites sparsely haired with a transverse band of few setae, a few median setae and few lateral setae.

Male anal point triangularly pointed, with several setae and a few to numerous setae at base on tergite IX (Figs. 5–10); laterosternite IX with few to several setae. Sternapodeme slightly curved, oral projections weak or, in one species, strongly developed. Phallapodeme usually curved and widened apically, aedeagal lobe well developed. Virga absent. Gonocoxite well developed; superior volsella collar-like; inferior volsella well developed, with ventral part not extended prominently below dorsal part. Gonostylus with low and long to more triangular apical or preapical crista dorsalis, megaseta normal.

Female genitalia (Figs. 11–35) with evenly curved gonocoxapodemes not meeting or only indicated anterior of vagina. Gonocoxite small to well developed, with few to numerous setae. Tergite IX strongly divided with several setae. Segment X normal. Postgenital plate weak, indistinct, bluntly triangular. Cercus large. Gonapophysis VIII divided into large, brush-like ventrolateral lobe covering part of dorsomesal lobe; and smaller to equally large dorsomesal lobe with oral rounded projection. Rami indistinct, barely sclerotised. Apodeme of apodeme lobe distinct. Coxosternapodeme strong laterally, moderately strong to weak and indistinct medially, evenly curved or

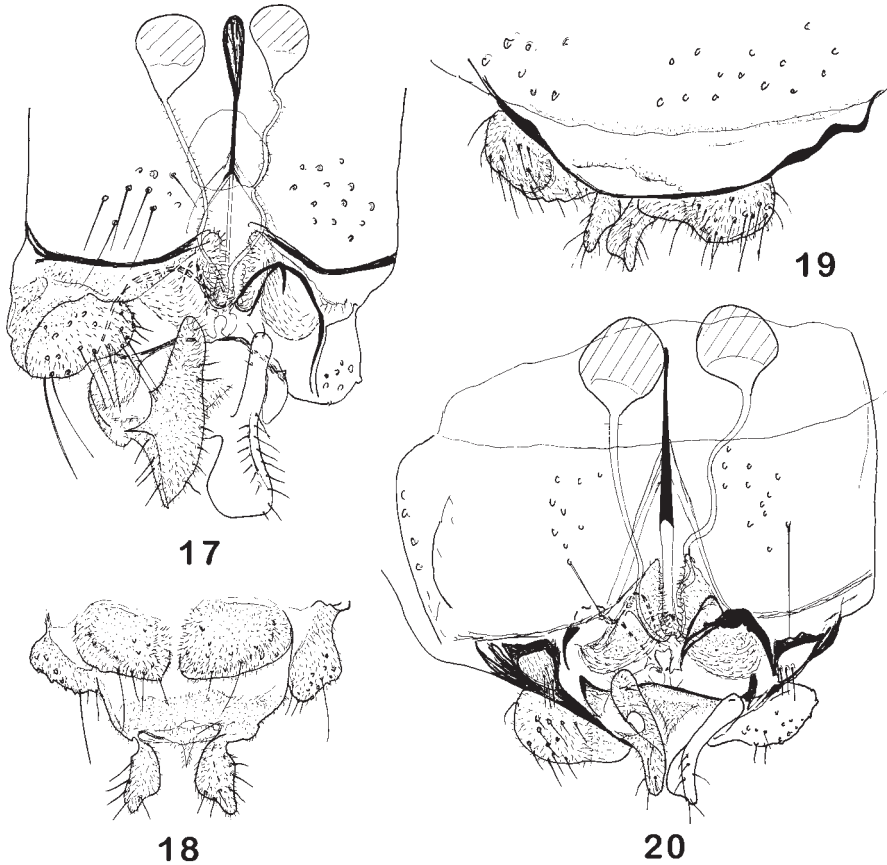


Figures 5–10. *Orthocladius* (*Symposiocladius*) spp., male hypopygium: (5) *O. (S.) lignicola* Kieffer; (6) *O. (S.) annectens* Sæther; (7) *O. (S.) schnelli* sp. n.; (8) *O. (S.) holsatus* Goetghebuer; (9) *O. (S.) halvorseni* sp. n.; (10) *O. (S.) bilyji* sp. n.



Figures 11–16. *Orthocladus* (*Symposiocladius*) spp., female genitalia, ventral and dorsal view: (11, 12) *O. (S.) lignicola* Kieffer; (13, 14) *O. (S.) holsatus* Goetghebuer; (15, 16) *O. (S.) schnelli* sp. n.

with anterior right-angled bend. Seminal capsules pear-shaped, darkly sclerotized for most of their length; without distinct neck. Spermathecal ducts nearly straight, slightly meandering, or with anterior bend but no loop, and separate openings. Labia bare.

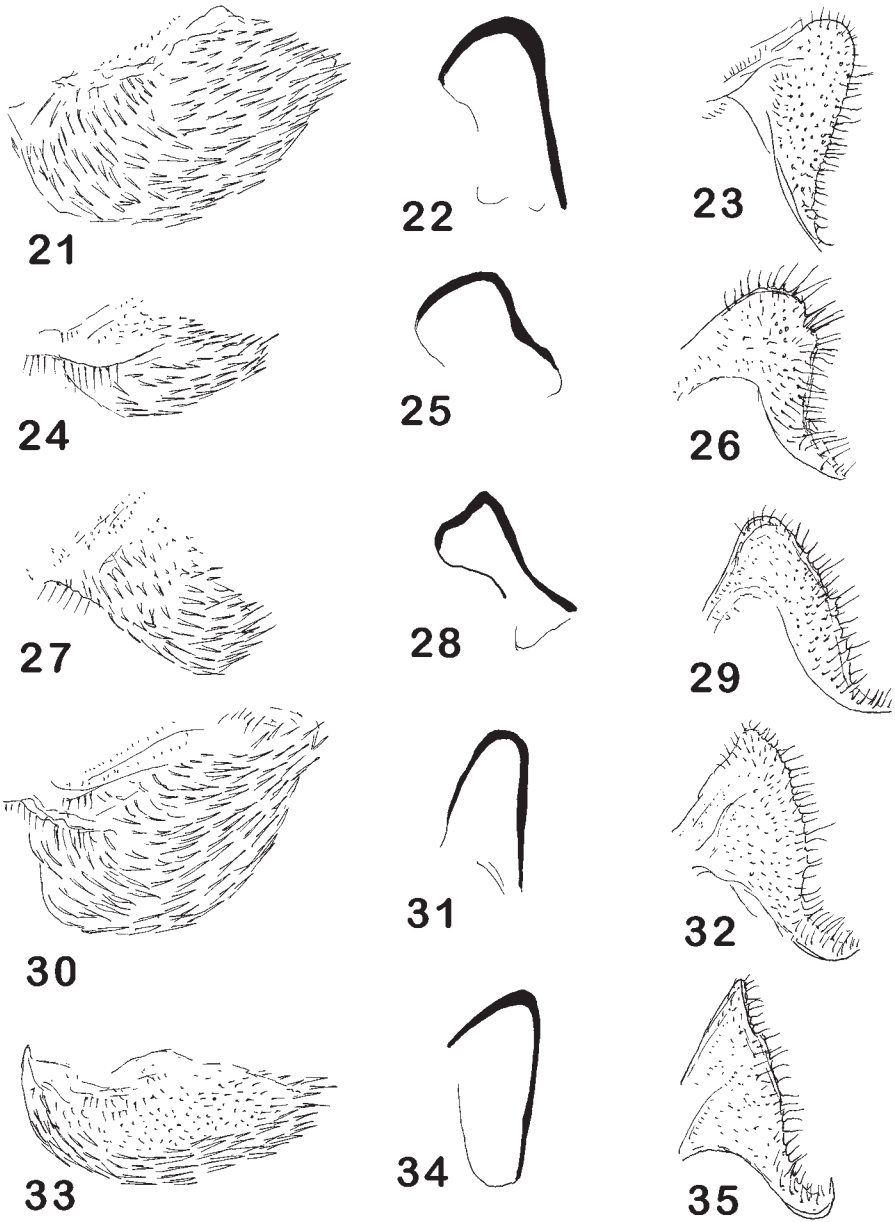


Figures 17–20. *Orthocladius* (*Symposiocladius*) spp., female genitalia, ventral and dorsal view: (17, 18) *O. (S.) halvorseni* sp. n.; (19, 20) *O. (S.) bilyji* sp. n.

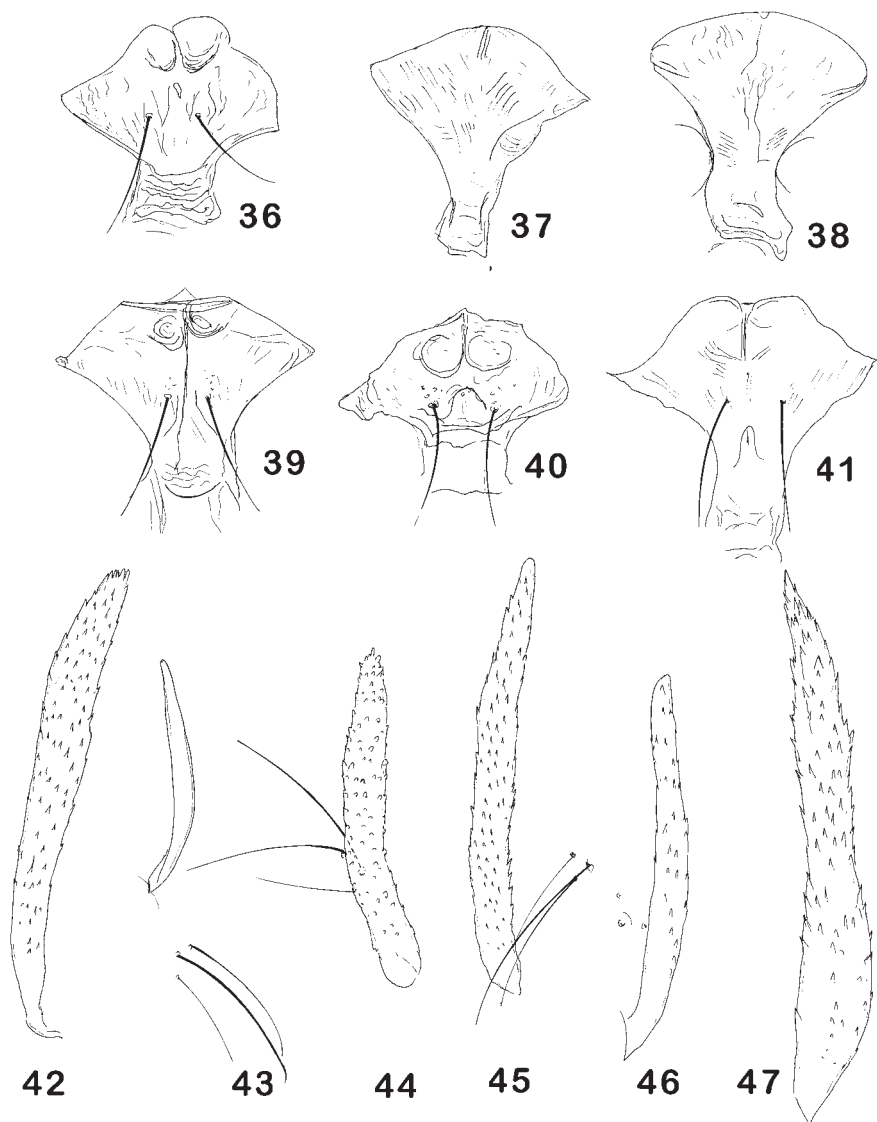
Pupa

Moderately sized pupae, 2.4–4.9 mm long. Exuviae transparent to pale greyish yellow. Frontal warts present or absent (Figs. 36–41). Frontal setae well developed, on small tubercles, absent or vestigial. Frontal apotome slightly wrinkled to rugulose. Thoracic horn (Figs. 42–47) digitiform, bare to covered with weak spinules. Wing sheath smooth, without pearls or nose. Three precorneals, 4 anteprenotals, at least one postorbital, and 4 dorsocentrals present.

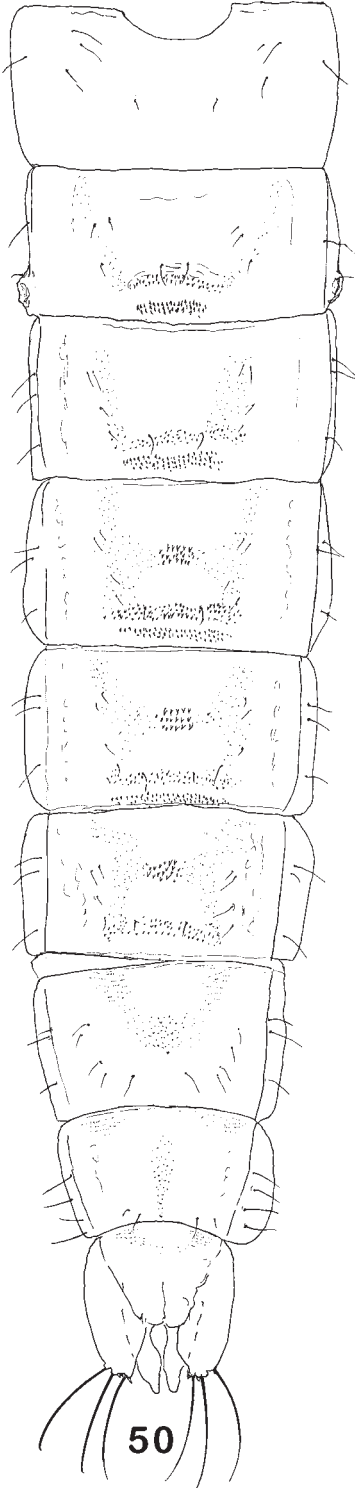
Tergite I bare; II with weak anteriomedian shagreen followed by clear band and stronger posteromedian shagreen. Tergites III–V with anterior shagreen or spine patch followed by a spinule-free transverse band, stronger posterior band of spinules, another spinule-free band and 4–7 rows of anteriorly directed spinules posterior on tergites or more usually on conjunctives. Tergites VII and VIII (Figs. 48, 50, 58, 59) may have similar, but weaker shagreen pattern to III–V without the conjunctival



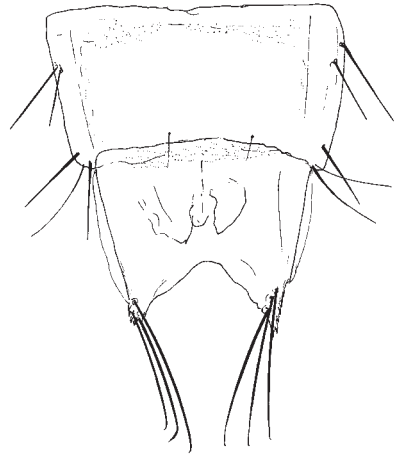
Figures 21–35. *Orthocladius* (*Symposiocladius*) spp., female genitalia, ventrolateral, apodeme and dorsomesal lobes: (21–23) *O. (S.) lignicola* Kieffer; (24–26) *O. (S.) schnelli* sp. n.; (27–29) *O. (S.) holsatus* Goetghebuer; (30–32) *O. (S.) halvorseni* sp. n.; (33–35) *O. (S.) bilyji* sp. n.



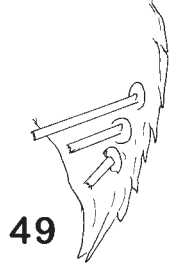
Figures 36–47. *Orthocladius* (*Symposiocladius*) spp., pupa: (36–41) Frontal apotome: (36) *O. (S.) lignicola* Kieffer, (37) *O. (S.) annectens* Sæther, (38) *O. (S.) schnelli* sp. n. (39) *O. (S.) holsatus* Goetghebuer, (40) *O. (S.) halvorseni* sp. n., (41) *O. (S.) bilyji* sp. n. (42–47) Thoracic horn: (42) *O. (S.) lignicola* Kieffer, (43) *O. (S.) annectens* Sæther, (44) *O. (S.) schnelli* sp. n. (45) *O. (S.) holsatus* Goetghebuer, (46) *O. (S.) halvorseni* sp. n., (47) *O. (S.) bilyji* sp. n.



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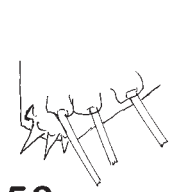
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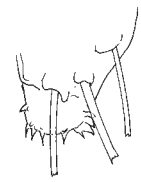
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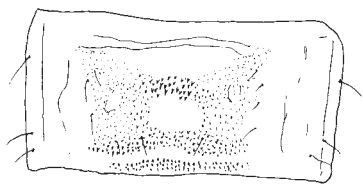
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spinules or tergite VIII may have anterior shagreen only. Tergite IX bare or with weak anterior shagreen. Sternites I and IX bare; other sternites mostly with weak antero-medial shagreen. Tergite II caudal hooklets in 3–4 rows. Pedes spurii A present on IV–VII. Pedes spurii B weak to prominent on segment II and often on III.

Segment I with 1 L seta, II–VI each with 3 hair-like L setae; VII with 4 L setae; VIII with 4–5 L setae.

Anal lobe (Figs. 48–53, 55, 58, 59) well developed, drawn into long narrow process with innermost terminal spur claw-like, with a few triangular, pointed spurs consisting of taeniate extensions of the cuticle, or without taeniate extensions; macrosetae long and subequal. Genital sac of male extending beyond anal lobe.

Larva

Medium sized larvae, up to 6.3 mm long.

Antenna (Figs. 66–70) with 5 segments, antennal ratio 1.5–2.7. Basal antennal segment with ring organ situated near base, blade shorter than flagellum. Lauterborn organs prominent, appearing circular, at least as long as third segment.

S I bifid. Other S setae simple. Labral lamellae absent. Chaetae simple. Pecten epipharyngis (Figs. 61–63) of 3 simple, fully separated scales, scales close together or scales fused to single scale. Premandible (Figs. 60–63) simple, possibly always with vestigial brush consisting of weak points. Pecten galearis (Figs. 64, 65) often present.

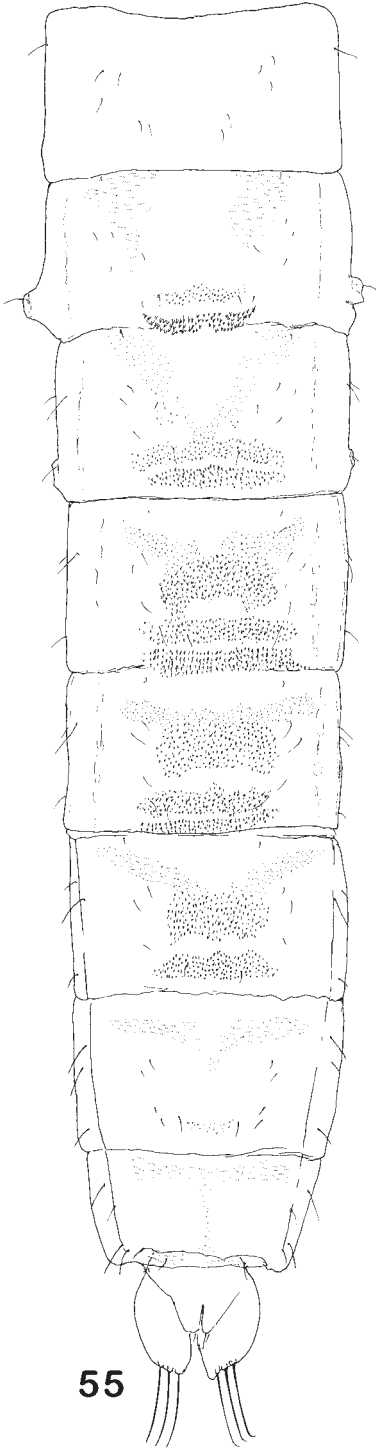
Mandible (Figs. 71–75) with apical tooth shorter or longer [in *O. (S.) holsatus*] than combined width of 3 inner teeth; fourth false tooth joined to mola. Seta interna of 6–8 branches fused at base, branches smooth or finely serrated apically.

Mentum (Figs. 77–80) either with single elongate median tooth and 2 pairs of basal lateral teeth, triangular with median tooth not clearly separated from first lateral of 6 teeth; or with rounded median tooth about as broad as the first 5 combined of 6 pairs of gradually smaller lateral teeth. Ventromental plates narrow, connected to outer margin of median or first lateral teeth. Setae submenti situated slightly below base of mentum.

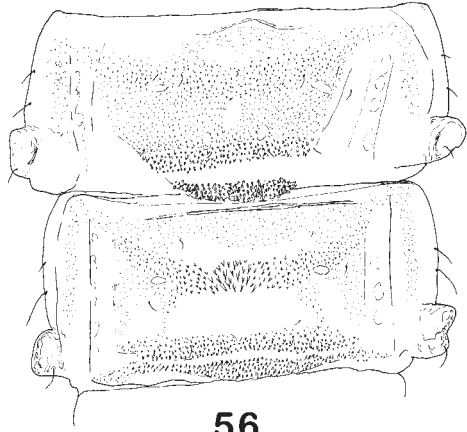
Maxillae with pecten galearis weak, vestigial or perhaps occasionally absent.

Shorter claws of anterior parapods with teeth, longer claws apparently smooth. Seta l_4 on abdominal segments mostly developed as setal tufts consisting of up to 30 hairs, occasionally long and simple. Procercus higher than wide, with 6–7 anal setae. Supraanal setae less than 1/4 as long as anal setae. Anal tubules at most slightly longer than posterior parapods.

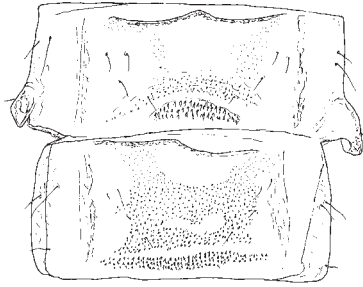
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 Figures 48–54. *Orthocladius (Symposiocladius)* spp., pupa: (48) tergites VIII and IX of *O. (S.) lignicola* Kieffer; (49) apex of anal lobe of *O. (S.) lignicola* Kieffer; (50) tergites of *O. (S.) schnelli* sp. n.; (51) apex of anal lobe of *O. (S.) schnelli* sp. n.; (52, 53) apex of anal lobe of *O. (S.) annectens* Sæther from Florida and Ontario; (54) tergite IV of *O. (S.) annectens* Sæther.



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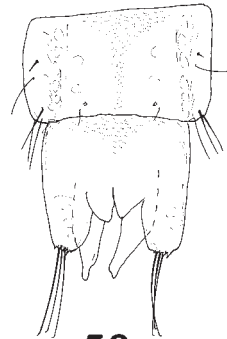
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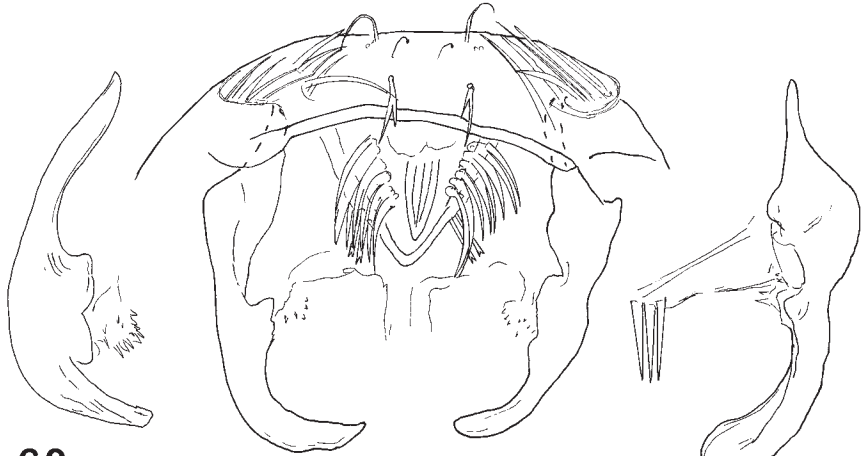
Systematics

The subgenus exhibits several potential synapomorphies, but only one may be unique, some are not present in all members and several consist in features that are difficult to observe although potentially important. Likely synapomorphies present in all members of the subgenus are the absence of a virga in the males and the conspicuous large circular Lauterborn organs of the larvae. Other species of *Orthocladius* may have large Lauterborn organs, but they do not appear circular (Epler, 2001). The split l_4 setae of the larval abdomen was one of the characters originally defining the subgenus. As mentioned above, Cranston and Oliver (1988) found that some populations of *O. (S.) lignicola* have simple l_4 setae and one of the new species described here, *O. (S.) halvorseni*, has simple setae. However, split l_4 setae in *Orthocladius* occur only within *Symposiocladius*. Also the presence of a vestigial premandibular brush may be limited to the subgenus although not observed in all species. The brush when present within the subgenus consists of a few weak points and often is not observable except on perfectly positioned and prepared specimens. A pecten galearis is well developed in *O. (S.) halvorseni*, very weak in *O. (S.) schnelli*, and apparently even weaker in *O. (S.) annectens*. Neither a vestigial premandibular brush nor a pecten galearis were observed on the available material of *O. (S.) lignicola* and *O. (S.) holsatus*, but the material is insufficient for a more secure judgement about presence or absence. Within *Orthocladius* a pecten galearis otherwise is observed only in the subgenus *Pogonocladius*.

It is not possible to give a finite definition of the subgenus until the full genus has been re-examined and analysed. There are, for instance, some species such as *O. (Orthocladius) oliveri* Sponis which could be included based on the lack of a virga combined with a collar-like superior volsella of the male hypopygium. However, the ventral part of the inferior volsella extends prominently below the dorsal part, unlike any of the other included species. Also, the larva does not appear to have particularly large Lauterborn organs and the l_4 setae of the abdomen apparently are simple. One of the new species included here, *O. (S.) bilyji* sp. n. differs from the other included species by among other having numerous setae basal of the anal point, few setae on the laterosternite, strong oral projections of the transverse sternapodeme, strongly curved gonostylus, and a female with reduced gonocoxite IX. The male in other details conforms to the diagnosis and the pupa appears similar to that of some types of *O. (S.) lignicola*.

Within the subgenus *O. (S.) annectens* and *O. (S.) schnelli* obviously are sister species and nearly identical as imagines. The absent or vestigial frontal setae, the absence of frontal warts and the triangular mentum of the larvae may be synapomorphies. However, the same features are found in *Orthocladius (O.) dentifer* Brundin

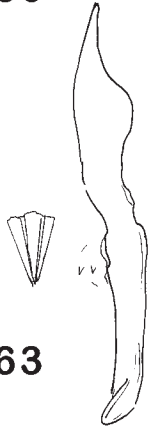
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 Figures 55–59. *Orthocladius (Symposiocladius)* spp., pupa: (55) tergites of *O. (S.) halvorseni* sp. n.; (56) tergites II and III of *O. (S.) holsatus* Goetghebuer; (57) tergites II and III of *O. (S.) bilyji* sp. n.; (58) tergites VIII and IX of *O. (S.) bilyji* sp. n.; (59) apex of anal lobe of *O. (S.) bilyji* sp. n.



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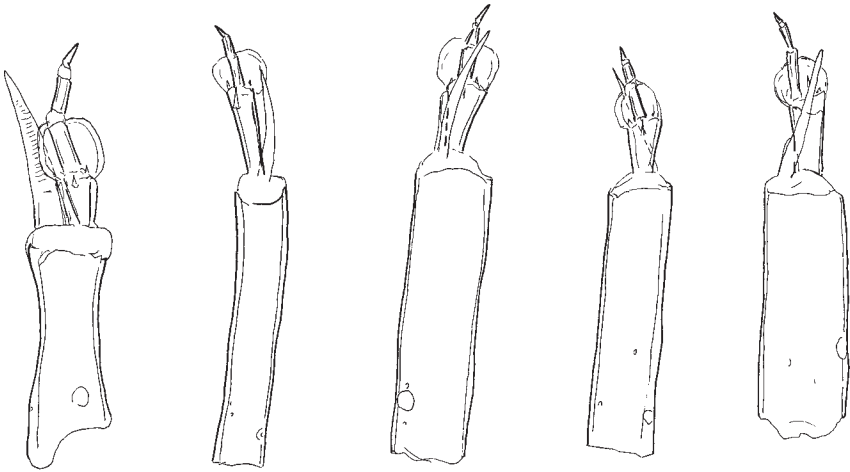


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which except for the presence of a virga has a male hypopygium very similar to *O. halvorseni* sp. n. It is possible that also *Orthocladius dentifer* should be included in the subgenus. This, however, will have to await a phylogenetic analysis of the full genus including all species. Several species of *Orthocladius*, including *O. (S.) holsatus*, in addition to *O. (S.) annectens* and *O. (S.) schnellii* have a median spine patch, but the patch is not set off from the surrounding coarse shagreen (Langton & Cranston, 1991; Rossaro & Casalegno, 2001). In *O. (S.) annectens*, *O. (S.) schnellii* and *O. (S.) holsatus* the ventrolateral lobe of gonapophysis VIII is about the same size as the dorsomesal lobe, while it is larger in the limited number of other sufficiently known species of *Symposiocladius* and *Orthocladius* s. str.

Presence of pedes spurii B both on segments II and III is found in *O. (S.) halvorseni* sp. n., *O. (S.) holsatus* and *O. (S.) lunzensis* Dettinger-Klemm. Also *Orthocladius (O.) mallochi* Kieffer and *Orthocladius (O.) carlatus* (Roback) have pedes spurii B on segment III. Both these species, however, have males with a well developed pointed superior volsella and a virga. The long apical tooth of the mandible in *O. (S.) holsatus* and *O. (S.) lunzensis* appears unique.

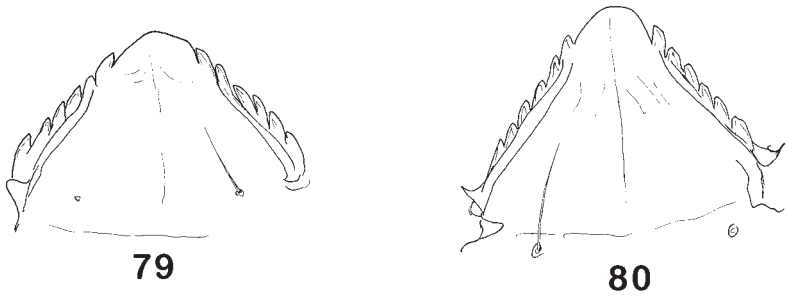
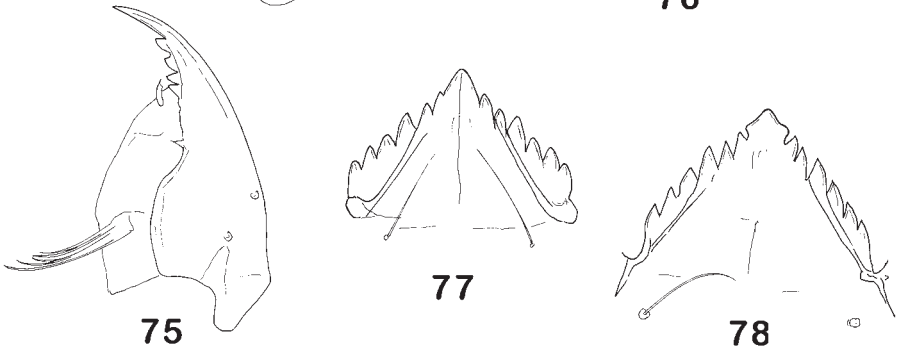
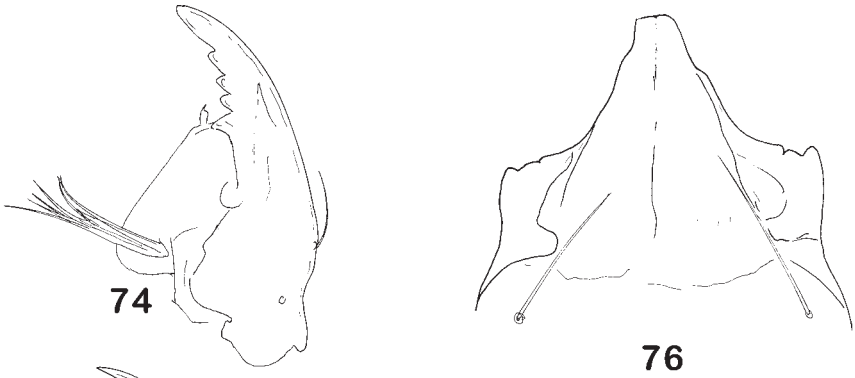
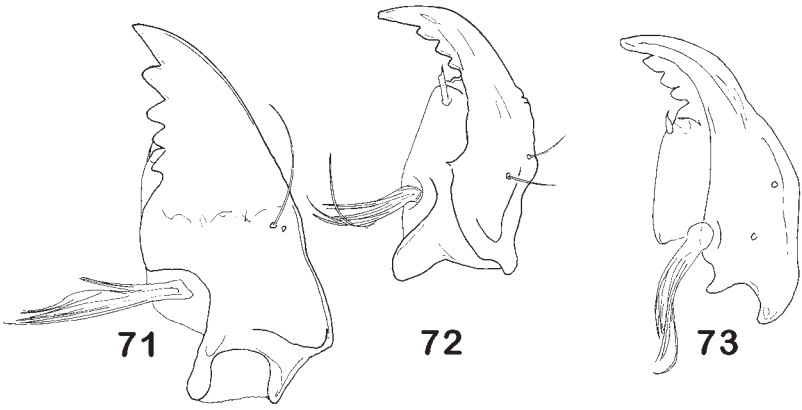
O. (S.) lignicola and *O. (S.) bilyji* both have 5 L setae on segment VIII all long in *O. (S.) lignicola*, the first reduced and the four posterior long in *O. (S.) bilyji*. According to Söponis (1977) there are 3–4 L setae on segment VIII, while Langton and Cranston (1991) and Rossaro and Casalegno (2001) operate with 4–5 L setae. This probably is a result of whether one of the setae is regarded as a far laterally displaced D seta or as an L seta. Long L setae on segment VIII may be a synapomorphy for *O. (S.) lignicola* and *O. (S.) bilyji* although *O. (O.) ruffoi* Rossaro & Prato also has long and strong L setae.

As it will appear from the above the subgenus mostly is defined by a mosaic of synapomorphies and underlying synapomorphies with only the size and shape of the larval Lauterborn organ appearing as a uniquely derived synapomorphy. However, the male hypopygia of the included species are hardly separable except for the gonostyli of *O. (S.) halvorseni* and *O. (S.) bilyji*.

Key to Male Imagines of *Orthocladius (Symposiocladius)*

1. Dorsocentrals 25–31, bi-triserial, AR about 1.9–2.0, about 12–14 setae basal of anal point on tergite IX, gonostylus widest near apex *O. (S.) smolandicus* Brundin
- Dorsocentrals 4–23, uni-biserial, AR 1.0–1.8; 0–14 or 24–40 setae basal of anal point on tergite IX, gonostylus widest near apex or near apical half to third 2
2. Thorax with about 23 dorsocentrals, 10 prealars, and 2 supraalars, LR₁ about 0.54; gonostylus widest in middle, crista dorsalis small and apical *O. (S.) lunzensis* Dettinger-Klemm

←
 Figures 60–70. *Orthocladius (Symposiocladius)* spp. (60–65) Larvae: (60) premandible *O. (S.) annectens* Sæther; (61) labrum, epipharyngeal area and premandible of *O. (S.) schnellii* sp. n.; (62) epipharyngeal pecten and premandible of *O. (S.) holsatus* Goetghebuer; (63) maxilla, dorsal view of *O. (S.) schnellii* sp. n.; (65) pecten galearis of *O. (S.) halvorseni* sp. n. (66–70) Antenna: (66) *O. (S.) lignicola* Kieffer, (67) *O. (S.) annectens* Sæther, (68) *O. (S.) schnellii* sp. n. (69) *O. (S.) holsatus* Goetghebuer, (70) *O. (S.) halvorseni* sp. n.



- Thorax with 4–18 dorsocentrals, 3–8 prealars and no supraalars, LR₁ 0.59–0.68; gonostylus widest in middle or near apex, crista dorsalis long and usually low 3
- 3. Gonostylus with triangular inner projection one third from apex *O. (S.) halvorseni* sp. n.
- Gonostylus without inner projection, widest near apex or in middle 4
- 4. Tergite IX with 24–40 setae basal of anal point; gonostylus curved, widest at drawn out apex *O. (S.) bilyji* sp. n.
- Tergite IX with 0–14 setae basal of anal point; gonostylus not curved, widest at apex or near middle 5
- 5. Palpomeres long and narrow, third palpomere about 1.5 times as long as fourth palpomere; R with 6–13 setae *O. (S.) lignicola* Kieffer
- Palpomeres not long and narrow, third palpomere at most slightly longer than fourth palpomere; R with 2–6 setae 6
- 6. Tergite IX with 6–14 setae basal of anal point; thorax with 7–14 anteprenotals, 11–18 dorsocentrals and 5–7 prealars; phallapodeme nearly straight apically *O. (S.) holsatus* Goetghebuer
- Tergite IX with 0–4 setae basal of anal point; thorax with 1–5 anteprenotals, 4–17 dorsocentrals and 3–8 prealars; phallapodeme distinctly curved apically 7
- 7. Gonostylus widest near middle, rounded without outer corner *O. (S.) annectens* Sæther
- Gonostylus widest near apex, often club-shaped or with outer corner *O. (S.) schnelli* sp. n.

Key to Female Imagines of *Orthocladius* (*Symposiocladius*)

- 1. Wing with 23–38 setae on R₄₊₅, 14–26 on R and 10–18 setae on R₁ *O. (S.) lignicola* Kieffer
- Wing with 4–19 setae on R₄₊₅, 2–20 on R and 3–19 setae on R₁ 2
- 2. Ultimate flagellomere with preapical seta, ta₁ of mid and hind legs each with 8–58 sensilla chaetica 3
- Ultimate flagellomere without preapical seta, ta₁ of mid and hind legs each with 2–8 sensilla chaetica 5
- 3. Ta₁ of mid and hind legs each with 8–20 sensilla chaetica, R₄₊₅, with 13–19 setae, ventrolateral lobe of gonapophysis VIII larger than dorsomesal lobe *O. (S.) halvorseni* sp. n.
- Ta₁ of mid and hind legs each with 42–58 sensilla chaetica, R₄₊₅, with 5–14 setae, ventrolateral lobe of gonapophysis VIII subequal to dorsomesal lobe 4
- 4. Ta₁ of mid and hind legs each with about 58 sensilla chaetica; R₄₊₅, with about 14 setae, squama with about 22 setae; gonocoxite with 6 long and 16 short setae *O. (S.) lunzensis* Dettinger-Klemm
- Ta₁ of mid and hind legs each with 42–49 sensilla chaetica; R₄₊₅, with 5–11 setae, squama with 12–15 setae; gonocoxite with 4–7 long and 7–9 short setae *O. (S.) holsatus* Goetghebuer
- 5. Tergite IX conspicuous, extending posteriorly, strongly divided, with altogether 50–56 setae; gonocoxite IX small, not visible in dorsal view, with 6–7 short setae; wing length 2.0–2.1 mm *O. (S.) bilyji* sp. n.
- Tergite IX less conspicuous, with 13–22 setae; gonocoxite IX well developed, with 8–14 setae, some of them long; wing length 1.1–1.9 mm 6
- 6. Wing length 1.1–1.4 mm; gonocoxite with about 4 long and 4 short setae; Nearctic *O. (S.) annectens* Sæther
- Wing length 1.6–1.9 mm; gonocoxite with 5–10 long and 4–5 short setae; Palaearctic *O. (S.) schnelli* sp. n.

◀
 Figures 71–80. *Orthocladius* (*Symposiocladius*) spp, larvae: (71–75) Mandible: (71) *O. (S.) lignicola* Kieffer, (72) *O. (S.) schnelli* sp. n., (73) *O. (S.) annectens* Sæther, (74) *O. (S.) halvorseni* sp. n., (75) *O. (S.) holsatus* Goetghebuer. (76–80) Mentum: (76) *O. (S.) lignicola* Kieffer, (77) *O. (S.) annectens* Sæther, (78) *O. (S.) schnelli* sp. n. (79) *O. (S.) holsatus* Goetghebuer, (80) *O. (S.) halvorseni* sp. n.

Key to Pupae of *Orthocladius* (*Symposiocladius*)

1. Tergites with IV–VI with circular spine patch medially, frontal setae absent or vestigial, anal lobe with spurs 2
- Tergites with IV–VI without medial circular spine patch or patch not set off from surrounding shagreen spinules, frontal setae well developed except occasionally reduced in *O. (S.) lignicola*, anal lobe with or without spurs 3
2. Thoracic horn bare or at most with very weak spinules, shagreen on tergites strong or sparse and relatively weak with spine patches not well set off from surrounding spinules. *O. (S.) annectens* Sæther
- Thoracic horn covered with strong scale-like spinules, shagreen on tergites very weak with spine patches well set off from surrounding spinules *O. (S.) schnelli* sp. n.
3. Pedes spurii B at most on segment II only, weak to prominent; segment VIII with 5L setae; anal lobe with spine-like spurs 4
- Pedes spurii B on segments II and III; segment VIII with 4L setae; anal lobe without spurs 5
4. Pedes spurii B prominent, anal lobe with 1–2 triangular spurs; segment VIII with 5L setae of which anterior one is very short *O. (S.) bilyji* sp. n.
- Pedes spurii B weak or absent, anal lobe drawn into long narrow process with innermost terminal spur claw-like or occasionally with several triangular, pointed spurs; segment VIII with 5 long L setae *O. (S.) lignicola* Kieffer
5. Pedes spurii B not large, much weaker on segment III than on segment II; anteriomedian shagreen not very strong *O. (S.) halvorseni* sp. n.
- Both pedes spurii B prominent, nearly the same size on segment III as on segment II; anteriomedian shagreen consisting of strong spinules 6
6. Length of anal macrosetae/length of anal lobe 0.47–0.55 (male) and 0.55 (female); genital sac of male long, clearly surpassing apex of anal lobe *O. (S.) holsatus* Goetghebuer
- Length of anal macrosetae/length of anal lobe 0.38 (male) and 0.43–0.47 (female); genital sac of male short, not clearly surpassing apex of anal lobe *O. (S.) lunzensis* Dettinger-Klemm

Key to Larvae of *Orthocladius* (*Symposiocladius*)

1. Mentum with single broad, elongate tooth and 2 pairs of basal lateral teeth; all S setae simple *O. (S.) lignicola* Kieffer
- Mentum with one median and 6 pairs of lateral teeth, S I bifid 2
2. Mentum triangular with median tooth relatively narrow and not clearly separated from first lateral teeth; scales of pecten epipharyngis fully fused 3
- Mentum convex, median tooth broad, clearly separated from first lateral teeth; pecten epipharyngis consisting of separate scales 4
3. Median tooth of mentum narrowly triangular, about as high as basally wide; Nearctic *O. (S.) annectens* Sæther
- Median tooth of mentum broadly triangular, clearly lower than basally wide; Palaearctic *O. (S.) schnelli* sp. n.
4. Antenna 6-segmented (always?), antennal blade clearly surpassing terminal flagellomere; anal tubules long, about 1.5 times as long as posterior parapods *O. (S.) lunzensis* Dettinger-Klemm
- Antenna 5-segmented, antennal blade about as long as combined length of flagellomeres 2–4; anal tubules much shorter than posterior parapods 5
5. Apical tooth of mandible longer than combined width of 3 inner teeth, at least some l_4 setae of abdomen split *O. (S.) holsatus* Goetghebuer
- Apical tooth of mandible shorter than combined width of 3 inner teeth, all l_4 setae long and simple *O. (S.) halvorseni* sp. n.

***Orthocladius* (*Symposiocladius*) *lignicola* Kieffer** (Figs. 5, 11, 12, 21–23, 36, 42, 48, 49, 66, 71, 76)

Orthocladius lignicola Kieffer in Potthast, 1915: 273.

Symposiocladius lignicola (Kieffer) Cranston 1983: 419; Cranston et al. 1983: 199; Coffman et al. 1986: 209; Langton 1991: 182.

Orthocladius (*Orthocladius*) *tryoni* Sopenis, 1977:100.

Orthocladius (*Symposiocladius*) *lignicola* Kieffer, Cranston et al. 1989: 147.

Orthoclaudiinae gen? *acutilabis* Konstantinov, 1948: 335, unavailable.
Orthoclaudiinae gen. ?1 *xylophila* Botnariuc et Cure, 1956: 266, unavailable.

Material examined

CANADA: Manitoba, Lake Winnipeg, 20-Mile Creek, 2 ♂ paratypes of *O. (O.) tryoni*, 26 viii & 1 ix 1971, S. Flam, Nina Hooper, E. Johnson & M. Roberts (ZMBN); Quebec, Sutton River, 1 mi. north of Abercorn, 1 ♂, 1 ♀, 1 pupal exuviae, 2 larval exuviae. USA: South Dakota, Lewis & Clarke Lake, periphyton, 5 v 1971, 1 ♂ paratype, P. L. Hudson.

Diagnostic characters

The male imago is separable from the other species of the subgenus by having long and narrow palpomeres with third palpomere about 1.5 times as long as fourth palpomere, 6–17 dorsocentrals, R with 6–13 setae and gonostylus without inner projection and widest in the middle. The female has 23–38 setae on wing vein R₄₊₅. The pupa is distinguished by having weak or absent pedes spurii B on segment II; anal lobe drawn into long narrow process with innermost terminal spur claw-like or, in some populations with several triangular, pointed spurs; and 5 long and strong L setae on segment VIII. The mentum of the larva with an elongate broad median tooth and 2 pairs of small lateral teeth separate it from all other chironomids.

Male imago

The male is well described by Cranston (1983) and Soponis (1977, as *O. tryoni*), female, pupa and larva by Cranston (1983). See also Cranston and Oliver (1988).

Remarks

According to Cranston and Oliver (1988) *O. (S.) lignicola* contains larval specimens both with I₄ single and specimens with more than 20 branches in I₄. The specimens with single I₄ from Berry Creek, Oregon, are associated with pupae with several pointed triangular spurs as in *O. (S.) schnelli*, *O. (S.) annectens* and *O. (S.) bilyji* sp. n. Although it thus appears likely that the specimens from Berry Creek could belong to a different species, Cranston & Oliver also found intermediate specimens and both types together.

Ecology and distribution

The species is known from most European countries ranging from Norway and Finland to Portugal and Bulgaria, but has not been recorded from the European parts of Russia, Greece or the former Yugoslavia, but is found in Siberia (Ashe & Cranston, 1990). In Canada it is known from Yukon and British Columbia to Quebec; in USA from Oregon and California to Minnesota and Pennsylvania to Florida and Texas (Oliver et al., 1990; Caldwell et al., 1997; Epler, 2002; Spies, 1999).

The species is mining submerged wood apparently preferring alder (*Alnus* spp.) and hazel (*Corylus avellaria*) in the Palaearctic and maple (*Acer* spp.) in the Nearctic (Cranston, 1983; Cranston & Oliver, 1988).

***Orthocladius (Symposiocladius) annectens* Sæther (Figs. 6, 37, 43, 52–54, 60, 67, 73, 77)**

Orthocladius (Orthocladius) annectens Sæther, 1969: 61; Soptonis, 1977: 23.

Hydrobaenus sp. 2, Roback, 1957: 80.

Not *Orthocladius (Orthocladius) annectens*, Schnell, 1988: 2 (= *O. (S.) schnelli* sp. n.).

Material examined

USA: Florida, Clay Co., Peter's Creek, 4 ♂ 2 ♀ reared from larvae 1 iv 1966, 7 ii 1966, 16 xii 1966, 22 × 1967, 27 i 1968, 6 iii 1968, W.M. Jr. & E.C. Beck; Florida, Walton Co. Eagle Creek, i.1 mi. east of Okaloosa Co. line on St. Hwy. 20, 1 ♂ 2 ♀ reared from larvae, 4 v 1980, J.H. Epler; Florida, Santa Rosa Co. Blackwater Basin, Riley's Creek, 18 × 1974, W.M. Beck Jr. (all FAM). CANADA: Ontario, Killarney Park, outlet of Burke Lake, 3 pupal exuviae, 24 v 1997, G.A. Halvorsen (ZMBN)

Diagnostic characters

The male imago is separable from the other species of the subgenus by having tergite IX with 0–4 setae basal of anal point, thorax with 1–5 anteprenotals, 4–17 dorsocentrals and gonostylus widest near middle and rounded without outer corner. The female has no preapical seta on ultimate flagellomere, ta_1 of mid and hind legs each have 2–3 sensilla chaetica, the wing is 1.1–1.4 mm long, and the gonocoxite has about 4 long and 4 short setae. The pupa is distinguished by combining circular spine patch medially on tergites IV–VI with a bare thoracic horn. The larva differs from *O. (S.) schnelli* sp. n. by having a narrower median tooth of mentum.

Male imago ($n = 4–5$ except when otherwise stated)

Total length 2.43–2.97 mm (3). Wing length 1.14–1.56, 1.38 mm. Total length/wing length 1.75–2.03 (3). Wing length/length of profemur 2.58–2.95, 2.73. Coloration brown with blackish brown vittae, lower 2/3 of preepisternum, median anepisternum II, margins of scutellum and postnotum blackish brown. Halteres golden.

Head. AR 1.27–1.46, 1.35. Ultimate flagellomere 425–543, 492 μ m long. Temporal setae 9–13 (3); including 0–6, 3 inner verticals; 2–4, 4 outer verticals; and 2–3 (3) postorbitals. Clypeus with 3–7, 5 setae. Cibarial pump, tentorium and stipes as in *O. (S.) schnelli* (Fig. 3). Tentorium 129–173, 150 μ m long; 26–38, 32 μ m wide. Stipes 101–131, 115 μ m long; 45–49 μ m (2) wide. Palpomere lengths (in μ m): 23–30, 26; 30–45, 41; 56–79, 71; 56–75, 66; 113–154 (3).

Thorax. Anteprenotum with 2–4 (2) setae. Dorsocentrals 4–6, 5; acrostichals 7 (2); prealars 3; no supraalars. Scutellum with 4–6, 4 setae.

Wing. VR 1.10–1.23, 1.15. Anal lobe slightly projecting. Costal extension 11–23, 18 μ m long. R with 3–4, 4 setae. Squama with 8–13, 10 setae.

Legs. Spur of front tibia 41–64, 51 μ m long; spurs of middle tibia 19–26, 22 and 15–23, 20 μ m long; of hind tibia 46–56, 50 and 19–26, 21 μ m long. Width at apex of front tibia 26–34, 30 μ m; of middle tibia 26–38, 33 μ m; of hind tibia 30–41, 36 μ m. Pseudospurs present on ta_1 of mid and hind leg, on ta_2 of mid leg; 19–26, 23 μ m long. Sensilla chaetica 1 at 0.08–0.11 on ta_1 of mid leg; 2–4, 3 at 0.10–0.16 to 0.12–0.19 on ta_1 of hind leg. Lengths (in μ m) and proportions of legs:

	fe	ti	ta ₁	ta ₂	ta ₃	ta ₄
p ₁	387–572, 509	501–680, 614	321–454, 404	227–345, 295	151–246, 201	104–156, 133
p ₂	369–572, 500	416–619, 536	198–293, 254	123–198, 166	95–151, 123	52–85, 73
p ₃	397–624, 538	501–737, 643	288–435, 351	170–265, 215	123–175, 154	57–95, 81
	ta ₅	LR	BV	SV	BR	
p ₁	66–85, 78	0.64–0.67, 0.66	2.05–2.21, 2.16	2.74–2.79, 2.76	2.0–2.4 (2)	
p ₂	57–85, 73	0.45–0.49, 0.47	2.85–3.12, 2.99	3.95–4.32, 4.08	2.9–3.6, 3.2	
p ₃	66–90, 81	0.55–0.60, 0.57	2.84–3.02, 2.91	3.09–3.33, 3.21	4.0	

Hypopygium (Fig. 6). Tergite IX with 6–12, 10 setae of which all except 0–4 are on anal point; laterosternite IX with 3–5, 4 setae. Phallapodeme 45–73, 64 µm long; transverse sternapodeme 49–79, 67 µm long. Gonocoxite 120–195, 169 µm long. Gonostylus 60–88, 77 µm long; rounded without outer corner, widest medially; crista dorsalis long and low, but gently rounded and widest preapically, reaching basal third, in some views not distinguishable; megaseta 9–11, 10 µm long. HR 2.00–2.34, 2.21; HV 2.93–3.76 (3).

Female imago ($n = 2-4$ except when otherwise stated)

Total length 2.25 mm (1) mm. Wing length 1.17–1.38 mm. Total length/wing length 1.92 (1). Wing length/length of profemur 2.82–3.04. Coloration about as in male, but more pale.

Head. Antenna with 5 flagellomeres, without preapical seta on ultimate flagellomere. AR 0.54–0.61. Temporal setae 5–8 including 0–3 inner verticals, 1–2 outer verticals, and 3–4 postorbital. Clypeus with 6–9, 7 setae. Flagellomere lengths (in µm): 49–54, 26–30, 26–34, 30–34, 75. Palpomere lengths (in µm): 23–28, 34–38, 49–64, 41–60, 83–114.

Thorax. Anteprenotum with 3–4 setae. Dorsocentrals 5–7, 6; acrostichals about 10; prealars 3; no supraalars. Scutellum with 2–4 setae.

Wing. VR 1.16–1.20. Anal lobe slightly projecting. Costal extension 23–38 µm long. R with 4–8 setae, R₁ with 3–5, R₄₊₅ with 4–5, costal extension with 0–1 setae. Squama with 8–12 setae.

Legs. Spur of front tibia 26–30 µm long, spurs of middle tibia 23 and 19 µm long, of hind tibia 38–64 and 19 µm long. Width at apex of front and middle tibia each 30 µm, of hind tibia 36–38 µm. Pseudospurs present on ta₁ of mid and hind leg, on ta₂ of mid leg and occasionally on ta₂ of hind leg, about 19 µm long. Sensilla chaetica apparently 2–3 at 0.10–0.22 of mid leg, about 2 on hind leg. Length (in µm) and proportions of legs:

	fe	ti	ta ₁	ta ₂	ta ₃	ta ₄
p ₁	406–454	473–520	302–350	243–227	137–161	85–95
p ₂	397–435	425–501	198–236	113–132	76–90	47–57
p ₃	425–454	491–572	274–284	161	104–113	57
	ta ₅	LR	BV	SV	BR	
p ₁	61–71	0.63–0.67	2.32–2.39	2.78–2.91	2.0–2.2	
p ₂	57–61	0.47	3.25–3.48	3.96–4.14	2.4	
p ₃	61–66	0.56–0.57	3.05–3.11	3.27–3.34	4.4 (1)	

Abdomen. Number of setae on tergite VIII 11. Sternite VIII with 10 central plus 2 far lateral to each side.

Genitalia. Gonocoxite with 8 setae of which 4 are shorter and weaker. Tergite IX clearly divided, with altogether 14–15 setae. Cercus 94–116 µm long. Seminal capsules pear-shaped, 56–71, 63 µm long; 45–60 µm wide. Notum 94–120 µm long.

Pupa ($n = 9-10$ except when otherwise stated)

Total length 2.41–3.76, 3.27 mm. Exuviae pale greyish brown.

Cephalothorax: Frontal setae (Fig. 37) 0–6, 1 µm long. Thoracic horn (Fig. 43) 86–150, 126 µm long, 15–23, 18 µm wide, 5.3–9.5, 6.9 times as long as wide, 0.52–0.78, 0.65 times as long as anal lobe. Anterior precorneal (Pc₁) 53–83, 69 µm (7) long; Pc₂ 75–109, 92 µm (7) long; Pc₃ 41–60, 48 µm (7) long. Anterior dorso-central (Dc₁) strong, 53–79, 63 µm long; Dc₂ weak, 34–68, 38 µm long; Dc₃ strong, 45–79, 57 µm long; Dc₄ moderately strong, 26–60, 41 µm long. Distances (in µm): Dc₁–Dc₂ 23–60, 39; Dc₂–Dc₃ 36–71, 50; Dc₃–Dc₄ 15–38, 22.

Abdomen. Tergite III with 0–5, 2 slightly stronger median spinules; tergites IV–VI with median circular spine patches; tergite IV (Fig. 54) with 16–38, 21 spines in patch; V with 15–40, 25 spines; VI with 18–44, 21 spines; one aberrant specimen lacks spine patch on tergite VI. Tergites II–VI each with 3–4 posterior rows of short spines. Integuments II/IV–V/VI each with 4 rows of anteriorly directed spines. Tergite I without shagreen; tergite II with sparse median shagreen; III–VI with strong to weakly developed shagreen with at least some stronger spinules around spine patches; VII–IX with median spinules. Sternite I bare; sternites II–V each with very weak anterior and lateral shagreen, VI with a few posterior weak spinules; VII–IX bare. Tergite II with 39–50, 45 caudal hooklets. Pedes spurii A present on sternites IV–VII. Pedes spurii B on tergite II only, low to well developed.

Anal lobe 210–289, 252 µm long. Anal macrosetae 150–203, 180 µm long. Apex (Figs. 52, 53) with 2–10, 5 spines of which 2–5 strong; longest spine 11–23, 15 µm long.

Fourth instar larva ($n = 8-10$ except when otherwise stated)

Total length 2.65–3.59, 3.03 mm (4). Head 0.36–0.41, 0.38 mm long. Postmentum 174–199, 188 µm long. Head capsule pale brown with brownish mentum, apical half of mandible and postoccipital margin.

Head. Antenna as in Fig. 67. Length of antennal segments (in µm): 59–69, 63; 14–17, 16; 6–7, 7; 5–7, 6; 5–6, 5. AR 0.1.69–2.00, 1.89. Basal antennal segment 13–15, 14 µm wide; blade 20–26, 24 µm long; accessory blade 12–17, 14 µm (6) long; Second antennal segment with 7–9, 7 µm long preapical style. Lauterborn organs 7–9, 8 µm long. Pecten epipharyngis consisting of three fused spines [i.e., of *Cricotopus* (*Isocladis*) type]. Labrum and epipharyngeal area as in *O. (S.) schnelli* (Fig. 61). Pecten galearis weak. Premandible (Fig. 60) 69–81, 77 µm long; with brush consisting of points. Mandible (Fig. 73) 142–161, 149 µm long. Mentum (Fig. 77) 114–133,

121 wide; width of median tooth 15–19, 18 µm (8). Lengths of L setae 1–4 on segment VIII (in µm) as: 45–75, 55; 45–71, 54; 38–90, 70; 64–98, 83.

Abdomen. Lateral setal brushes each consisting of 5–7 (3) setae; lengths of setae 56–83 µm (2). Procercus 19–24, 21 µm high; 15–23, 18 µm wide; anal setae 450–638, 552 µm long. Supraanal seta 49 µm (1) long. Posterior parapods 124 µm (1) long. Anal tubules digitiform, 139 µm (1) long, 23 µm (1) wide at base.

Remarks

Most of the pupal exuviae from Florida are smaller and with weaker shagreen. However, there always appear to be at least a few strong spinules around the spine patches making the patches not as clearly set off as in *O. (S.) schnelli*. The larvae appear to have a more pale head capsule than in *O. (S.) schnelli* and there may be some larvae without lateral setal brushes, but this is not clear on these larval exuviae.

Distribution

The species has been collected in Canada from the Northwest Territories and British Columbia to Ontario; in USA from Minnesota, New York, New Jersey and Pennsylvania south to Mississippi and Florida (Oliver et al., 1990).

Orthocladius (Symposiocladius) schnelli sp. n. (Figs. 1–3, 7, 15, 16, 24–26, 38, 44, 50, 51, 61, 68, 72, 78)

Orthocladius (Symposiocladius) annectens, Schnell, 1988: 2, in list, not *O. annectens* Sæther.

Type locality. NORWAY: Hordaland, Bergen, Frotveitvatn.

Type material. Holotype ♂, NORWAY: Hordaland, Bergen, Lake Frotveitvatn, 2 v 1989, Ø. A. Schnell (ZMBN Type No. 387). Paratypes: NORWAY: 1 pupal exuviae, as holotype except 25 viii 1987, drift in outlet stream, H. Sægrov & Ø.A. Schnell. Hordaland, Vaksdal, Ekse River, weir basin: 1 ♂, 2 ♀ reared from larva, 13–14 v 1985; 2 pupae reared from larva 6–9 vi 1985; 1 ♂ reared from larva, 1 mature pupa, 8 vii 1985; 1 mature pupa, 24 vii 1985; 1 ♂, 3 ♀ and mature ♂ pupa reared from larva, 25–29 viii 1985; 2 ♂ reared from pupa, 1 ♀ reared from larva, 1 pupa reared from larva, 1 mature pupa, 1 larva, 20 vi 1986; 8 pupal exuviae, 15 vii 1986; 1 ♂ reared from larva, 1 ♀ reared from larva, 3 ♂ reared from pupa, 6 ♂, 4 pupae reared from larva, 2 mature pupae, 8 pupal exuviae, 6 larvae, 24 viii 1986; 3 ♂, 6 pupae, 28 viii 1986; 7 larvae, 1–2 × 1986; 1 ♂ reared from larva, 25 viii 1988; all Ø. A. Schnell. Finnmark, Kautokeino, Nappuljåkka: 2 pupal exuviae, 22 vi 1987, J. Moldsvær & R.T. Larsen. Vest Agder, Audnedal, Barstøl at bridge: 6 pupal exuviae, 26 v 1988, Ø. A. Schnell. Aust Agder, Åmli, Tovdalselva, Sta. 4–2: 1 ♂, 4 ix 1996, G.A. Halvorsen.

Etymology. Named after the collector of most of the type specimens who first pointed out the presence of setal brushes, premandibular brush and the larval pecten epipharyngis of the *Isocladius* type.

Diagnostic characters

The male imago differs from *O. (S.) annectens* by having gonostylus widest near apex and often club-shaped or with outer corner. The female differs from *O. (S.) annectens* by having ta₁ of hind leg with 5–8 sensilla chaetica, wing 1.6–1.9 mm long, and gonocoxite with 5–10 long and 4–5 short setae. The pupa is distinguished by combining circular spine patch medially on tergites IV–VI with thoracic horn with numerous scale-like spinules. The larva differs from *O. (S.) annectens* by having a differently shaped wider median tooth of mentum.

Male imago ($n = 10$ except when otherwise stated)

Total length 2.79–3.57, 3.28 mm. Wing length 1.55–2.07, 1.93 mm. Total length/wing length 1.58–1.80, 1.70. Wing length/length of profemur 2.93–3.25, 3.10. Coloration brown with blackish brown vittae, lower 2/3 of preepisternum, median anepisternum II, margins of scutellum and postnotum blackish brown. Halteres golden.

Head. AR 1.24–1.45, 1.33. Ultimate flagellomere 482–595, 551 μm long. Temporal setae 9–15, 12; including 2–9, 5 inner verticals; 1–5, 3 outer verticals; and 3–5, 3 postorbitals. Clypeus with 2–7, 5 setae. Tentorium, stipes and cibarial pump as in Fig. 3. Tentorium 128–173, 157 μm long; 28–41, 35 μm wide. Stipes 124–158, 139 μm long; 26–45, 38 μm (4) wide. Palpomere lengths (in μm): 30–41, 33; 45–53, 49; 79–101, 92; 79–98, 91; 120–154, 134.

Thorax (Fig. 2). Anteprenotum with 1–3, 2 setae. Dorsocentrals 5–10, 7; acrostichals 6–12, 8; prealars 3–5, 3; no supraalars. Scutellum with 4–11, 7 setae.

Wing (Fig. 1). VR 1.12–1.21, 1.17. Anal lobe slightly projecting. Costal extension 19–53, 31 μm long. R with 2–6, 3 setae. Squama with 9–15, 11 setae.

Legs. Spur of front tibia 49–60, 54 μm long; spurs of middle tibia 23–28, 25 and 19–26, 23 μm long; of hind tibia 53–64, 61 and 19–23, 22 μm long. Width at apex of front tibia 30–38, 35 μm ; of middle tibia 34–41, 38 μm ; of hind tibia 39–49, 46 μm . Pseudospurs present on ta_1 of mid and hind leg, on ta_2 of mid leg and occasionally on ta_2 of hind leg; 19–26, 23 μm long. Sensilla chaetica 0–2, 1 (9) at 0.06–0.14 on ta_1 of mid leg; 1–2, 1 at 0.09–0.17 on ta_1 of hind leg. Length (in μm) and proportions of legs:

	fe	ti	ta_1	ta_2	ta_3	ta_4
p_1	529–662, 621	671–813, 775	406–520, 486	288–406, 324	198–255, 238	113–161, 147
p_2	539–671, 635	605–777, 710	265–331, 315	170–217, 204	123–161, 154	66–95, 88
p_3	572–709, 672	690–855, 813	378–482, 458	227–293, 263	170–217, 197	85–113, 105
	ta_5	LR	BV	SV	BR	
p_1	95–123, 112	0.61–0.65, 0.63	2.06–2.33, 2.21	2.78–2.95, 2.87	2.4–3.6, 2.8 (8)	
p_2	85–113, 108	0.43–0.46, 0.44	2.82–3.17, 3.01	4.17–4.50, 4.26	2.5–5.0, 3.6 (9)	
p_3	104–132, 122	0.54–0.61, 0.56	2.70–2.96, 2.81	2.96–3.37, 3.24	3.8–6.0, 4.9	

Hypopygium (Fig. 7). Tergite IX with 11–15, 13 setae of which all except 2–4 are on anal point; laterosternite IX with 4–8, 6 setae. Phallapodeme 68–83, 73 μm long; transverse sternapodeme 73–86, 80 μm long. Gonocoxite 184–223, 213 μm long. Gonostylus 79–101, 94 μm long; often with outer corner, often club-shaped, widest near apex; crista dorsalis long and low, reaching basal third, in some views not distinguishable; megaseta 9–15, 11 μm long. HR 2.20–2.33, 2.24; HV 3.10–3.69, 3.41.

Female imago ($n = 8$ –9 except when otherwise stated)

Total length 2.45–3.40, 2.78 mm (7). Wing length 1.57–1.92, 1.75 mm. Total length/wing length 1.45–1.78, 1.59 (7). Wing length/length of profemur 3.23–3.42, 3.30. Coloration about as in male, but more pale.

Head. Antenna with 5 flagellomeres, without preapical seta on ultimate flagellomere. AR 0.56–0.82, 0.67 (10). Temporal setae 5–7, 6; including 3–4, 3 inner ver-

ticals; 0–1, 1 outer vertical; and 1–3, 2 postorbitals. Clypeus with 3–9, 6 setae. Flagellomere lengths (in μm , $n = 10$): 49–77, 61; 30–56, 37; 34–45, 39; 36–41, 39; 101–128, 112. Palpomere lengths (in μm , $n = 7$): 26–41, 34; 30–45, 41; 75–98, 85; 75–105, 87; 120–143, 133.

Thorax. Anteprepronotum with 3–5, 4 setae. Dorsocentrals 5–9, 7 (10); acrostichals 10–16, 12; prealars 3–5, 4; no supraalars. Scutellum with 4–8, 6 setae.

Wing. VR 1.15–1.25, 1.20. Anal lobe slightly projecting. Costal extension 23–45, 34 μm long. R with 6–12, 8 setae; R_1 with 3–6, 5; R_{4+5} with 4–9, 6; and costal extension with 0–2, 1 non-marginal setae. Squama with 7–14, 10 setae.

Legs. Spur of front tibia 31–49, 41 μm (7) long; spurs of middle tibia 23–30, 26 and 19–26, 23 μm long; of hind tibia 45–56, 52 and 19–26, 23 μm long. Width at apex of front tibia 34–41, 37 μm (7); of middle tibia 34–41, 38 μm ; of hind tibia 41–53, 46 μm . Pseudospurs present on ta_1 of mid and hind leg and on ta_2 of mid leg; 18–30, 23 μm long. Sensilla chaetica 2–4, 3 at 0.07–0.12, 0.09 to 0.11–0.40, 0.18 (7) of mid leg; 5–8, 6 (7) at 0.08–0.11, 0.10 to 0.21–0.40, 0.26 (6) on hind leg. Length (in μm) and proportions of legs ($n = 7$ for tibia of front leg, 6 for tarsi and ratios of front leg):

	fe	ti	ta_1	ta_2	ta_3	ta_4
p_1	482–588, 536	576–718, 653	350–444, 403	246–331, 284	161–198, 180	95–123, 111
p_2	501–605, 552	529–647, 610	227–293, 266	151–180, 164	109–132, 122	57– 85, 73
p_3	520–605, 567	633–765, 696	340–406, 393	189–236, 214	142–165, 154	66– 95, 74
	ta_5	LR	BV	SV	BR	
p_1	85–104, 95	0.56–0.62, 0.61	2.28–2.51, 2.41	2.87–3.20, 3.00	2.0–2.3, 2.1 (5)	
p_2	66–104, 91	0.42–0.46, 0.44	3.02–3.35, 3.18	4.23–4.54, 4.39	1.8–2.9, 2.4 (6)	
p_3	70–109, 101	0.53–0.55, 0.54	2.84–3.06, 2.96	3.29–3.47, 3.38	2.5–3.3, 2.8	

Abdomen. Number of setae on each of tergites VIII 7–19, 12 (10). Sternite VIII with 8–14, 10 (10) central plus 0–4, 2 far lateral to each side.

Genitalia (Figs. 15, 16, $n = 10$). Gonocoxite with 9–14, 12 setae of which 4–5, 4 are shorter. Tergite IX clearly divided, with altogether 13–22, 17 setae. Ventrolateral lobe of gonapophysis VIII (Fig. 24) subequal in size to dorsomesal lobe (Fig. 26). Cercus 120–158, 130 μm long. Seminal capsules pear-shaped, 68–90, 76 μm long; 49–56, 52 μm wide; sclerotized in anterior 49–60, 55 μm . Notum 94–131, 119 μm long.

Pupa ($n = 10$ –11 except when otherwise stated)

Total length 3.21–3.78, 3.52 mm. Exuviae pale greyish brown.

Cephalothorax: Frontal setae (Fig. 38) 0–30, 7 μm long. Thoracic horn (Fig. 44) covered with scale-like spinules; 188–240, 210 μm long; 23–38, 29 μm wide; 5.0–9.3, 7.3 times as long as wide; 0.74–0.90, 0.84 (8) times as long as anal lobe. Anterior precorneal (Pc_1) 75–139, 103 μm long; Pc_2 94–135, 121 μm long; Pc_3 38–75, 52 μm long. Anterior dorsocentral (Dc_1) strong, 56–79, 69 μm long; Dc_2 weak, 26–64, 41 μm long; Dc_3 strong, 60–79, 74 μm long; Dc_4 weak or strong, 30–64, 51 μm long. Distances (in μm): Dc_1 – Dc_2 15–68, 38; Dc_2 – Dc_3 26–83, 63; Dc_3 – Dc_4 19–45, 28.

Abdomen (Fig. 50). Tergites IV–VI with median circular spine patches; tergite IV with 11–20, 16 spines in patch; V with 12–26, 18 spines; VI with 12–29, 22 spines. Tergites II–VI each with 3–5 posterior rows of short spines. Integuments II/IV–V/VI each with 4–5 rows of anteriorly directed spines. Tergite I without shagreen, II–VI all with very weak shagreen, most extensive on IV–V, VII with a few weak anterior spinules, VIII and IX bare or with a few very weak anterior spinules. Sternite I bare; sternites II–V each with very weak anterior and lateral shagreen, VI with a few posterior weak spinules; VII–IX bare. Tergite II with 50–63, 59 caudal hooklets. Pedes spurii A present on sternites IV–VI or VII. Pedes spurii B on tergite II only, low. Lengths of L setae 1–4 on segment VIII (in μm) as: 45–94, 75; 68–98, 80; 68–116, 96; 68–116, 98.

Anal lobe 263–311, 280 μm long. Anal macrosetae 225–263, 251 μm (9) long. One specimen with only 2 macrosetae. Apex (Fig. 51) with 2–6, 3 spines; when 6, 3 very small.

Fourth instar larva ($n = 10\text{--}11$ except when otherwise stated)

Total length 3.31–4.25, 3.70 mm (4). Head 0.41–0.48, 0.46 mm long. Postmentum 195–221, 213 μm long. Head capsule brown with brownish black mentum, apical half of mandible and postoccipital margin.

Head. Antenna as in Fig. 68. Length of antennal segments (in μm): 55–73, 65; 14–19, 17; 5–8, 7; 5–6, 5; 2–5, 4. AR 1.71–2.00, 1.90. Basal antennal segment 15–19, 17 μm wide; blade 19–25, 21 μm long; accessory blade 12–18, 15 μm (8) long; Second antennal segment with 6–8, 7 μm long preapical style. Lauterborn organs 7–9, 8 μm long. Pecten epipharyngis consisting of three fused spines [i.e., of *Cricotopus* (*Isocladis*) type]. Labrum and epipharyngeal area as in Fig. 61. Premandible (Fig. 61) 76–82, 79 μm long; with brush consisting of often indistinct points. Pecten galearis (Fig. 64) present but weak. Mandible (Fig. 72) 137–161, 149 μm long. Mentum (Fig. 78) 114–133, 123 wide; width of median tooth 19–24, 20 μm (8).

Abdomen. Lateral setal brushes each consisting of 6–9 setae; lengths of setae 105–300, 152 μm (8). Procercus 19–38, 25 μm (7) high, plus one abnormal specimen 68 μm high; 23–30, 25 μm wide, abnormal specimen 53 μm wide; anal setae 544–638, 572 μm (8) long. Supraanal seta 49–98 μm (3) long, 0.09–0.18 (3) times as long as anal setae. Anal tubules not measurable.

Remarks

The differences found between the imagines of *O. (S.) schnelli* and *O. (S.) annectens* are slight and may not hold on a larger material. The median tooth of the larval mentum is quite different in the two species. However, on specimens with worn teeth, this difference is no longer clear.

Ecology and distribution

The species has been collected by from lakes and rivers all over Norway (Schnell, 1988; Schnell & Aagaard, 1996).

Orthocladius (Symposiocladius) holsatus Goetghebuer (Figs. 8, 13, 14, 27–29, 39, 45, 56, 62, 69, 75, 79)

Orthocladius holsatus Goetghebuer, 1937: 509.

Cricotopus holsatus (Goetghebuer): Moller Pilot (1984: 65), larva.

Orthocladius holsatus Goetghebuer: Langton (1991: 190); Langton & Cranston (1991: 246), pro parte.

Not *Orthocladius smolandicus* Brundin sensu Soponis (1977: 94) (= *O. (S.) holsatus*).

Diagnostic characters

The male imago is separable from the other species of the subgenus, by having gonostylus widest near apex and with low and elongate crista dorsalis; tergite IX with 6–14 setae basal of anal point; thorax with 7–14 antepronotals, 11–18 dorsocentrals, 5–7 prealars and no supraalars; and phallapodeme nearly straight apically. The female has metatarsi of mid and hind legs each with 42–49 sensilla chaetica; R₄₊₅, with 5–11 setae, squama with 12–15 setae; and gonocoxite with 4–7 long and 7–9 short setae. The pupa is distinguished by having well developed pedes spurii B both on segment II and III as in *O. (S.) lunzensis* but with anal macrosetae/length of anal lobe as 0.47–0.55 (male) and 0.55 (female) and the genital sac clearly surpassing apex of the anal lobe. The broad median tooth of the mentum combined with an apical tooth of mandible longer than combined width of the three inner teeth and at least some l₄ setae of abdomen separate the species from other members of the subgenus except *O. (S.) lunzensis* which has a 6-segmented antenna with the antennal blade surpassing the flagellum and long anal tubules.

Remarks

All stages and both sexes are redescribed in detail by Dettinger-Klemm (2000). It can be added that the larval premandible has indication of a brush and that pecten galearis is absent or perhaps vestigial. One possible additional record is: NORWAY: Hordaland, Bergen, Lake Frotveitvatn, drift in outlet, 1 pupal exuviae, 25 viii 1987, Ø. A. Schnell (ZMBN). This exuviae, illustrated in Fig. 56, however, is larger, darker and with stronger shagreen than in the specimens described by Dettinger-Klemm (2001) and re-examined here.

Distribution

The species is widespread in Europe, but several records need re-examination in view of the very similar closely related species.

Orthocladius (Symposiocladius) lunzensis Dettinger-Klemm

Orthocladius (Symposiocladius) lunzensis Dettinger-Klemm, 2000: 58.

Paratrachocladius holsatus (Goetghebuer) sensu Thienemann (1942: 201); Thienemann (1954: 124, 127).

Diagnostic characters

The male imago is separable from the other species of the subgenus, by having gonostylus widest in the middle and crista dorsalis small and apical; thorax with about 23 dorsocentrals, 10 prealars, and 2 supraalars. The female has metatarsi of mid and hind

legs each with about 58 sensilla chaetica, R_{4+5} , with about 14 setae, squama with about 22 setae, and gonocoxite with 6 long and 16 short setae. The pupa is distinguished by having well developed pedes spurii B both on segment II and III as in *O. (S). holsatus* but with length of anal macrosetae/length of anal lobe as 0.38 (male) and 0.43–0.47 (female) and genital sac of male not clearly surpassing apex of anal lobe. The six-segmented antenna with the antennal blade surpassing the flagellum and long anal tubules separate the species from *O. (S). holsatus*.

Remarks

The species is described in all stages and both sexes by Dettinger-Klemm (2000).

Distribution

The species is known from Austria.

Orthocladius (Symposiocladius) smolandicus Brundin

Orthocladius (Orthocladius) smolandicus Brundin, 1947: 22; Brundin, 1956:106.

Orthocladius (Orthocladius) holsatus, Langton & Cranston, 1991: 246, pro parte.

Not *Orthocladius (Orthocladius) smolandicus*, Sopotis 1977: 23 (= *O. (S.) holsatus*).

Material examined. SWEDEN: Småland, Lake Innaren, Björkholmen, syntype ♂, 23–26 vii 1945, L. Brundin (SNM); 1 ♂, H. Määr, no other date.

Diagnostic characters

The male imago is separable from the other species of the subgenus by having 25–31 dorsocentrals in 2–3 rows and squama with 19–24 setae.

Male imago ($n = 1-2$)

Total length about 4.4 mm. Wing length 2.16–2.39 mm. Total length/wing length 1.83. Wing length/length of profemur 2.58–2.95. Coloration brown with blackish brown vittae, lower 2/3 of preepisternum, median anepisternum II, margins of scutellum and postnotum blackish brown. Halteres golden.

Head. AR 1.96–2.00. Ultimate flagellomere 685–718 μm long. Temporal setae 11, including 5 inner verticals, 3 outer verticals and 3 postorbitals. Clypeus with about 10 to 21 setae. Tentorium 169–206 μm long, 41–43 μm wide. Stipes 135–150 μm long. Palpomere lengths (in μm): 38, 64–71, 101–113, 109–124, 143.

Thorax. Anteprepronotum with at least some setae. Dorsocentrals 31 in 2–3 rows (Brundin, 1956: 106, mentions 24–30 setae). Other setae not observable.

Wing. VR 1.15. Anal lobe strongly projecting. Costal extension 26 μm long. R with 5–6 setae. Squama with 19–24 setae.

Legs. Spur of front tibia 83–90 μm long, spurs of middle tibia both 38 μm long, of hind tibia 60 and 30 μm long. Width at apex of front tibia 26–34, 30 μm ; of middle tibia 26–38, 33 μm ; of hind tibia 30–41, 36 μm . Pseudospurs present on ta_1 of mid and hind leg and ta_2 of mid leg, 26–30 μm long. Sensilla chaetica 6–9 at

0.08–0.20 of mid leg, apparently absent on hind leg. Length (in μm) and proportions of legs:

	fe	ti	ta ₁	ta ₂	ta ₃	ta ₄
p ₁	803–841	1021–1068	680–718	463–473	284–293	189
p ₂	860–907	954–1068	435–463	250–265	189–208	132–137
p ₃	841–945	1040–1229	567–647	331–369	246–265	123–170
	ta ₅	LR	BV	SV	BR	
p ₁	118–128	0.67	2.33–2.47	2.66–2.68	2.0–2.3	
p ₂	113–118	0.43–0.46	3.17–3.35	4.17–4.26	2.7–3.1	
p ₃	142	0.53–0.56	2.91–2.99	3.32–3.36	3.1	

Hypopygium (Brundin, 1947: fig. 43). Tergite IX with at least 14 setae on anal point and about 12 basal of anal point; laterosternite IX with 8 setae. Anal point 64 μm long. Phallapodeme and transverse sternapodeme not measurable. Gonocoxite 270 μm long. Gonostylus 118 μm long, widest near apex; crista dorsalis long and low, but gently rounded and widest preapically, reaching basal half, megaseta not measurable. HR 2.29.

Remarks

The specimens are in a bad shape, the syntype lacking the hypopygium, and drawings are not possible.

Distribution

The species has been collected at lakes in Sweden.

Orthocladius (Symposiocladius) halvorseni sp. n. (Figs. 9, 17, 18, 30–32, 40, 46, 55, 63, 69, 74, 80)

Type locality. NORWAY: Hordaland, Vaksdal, Ekse.

Type material. Holotype mature ♂ pupa, NORWAY: Hordaland, Vaksdal, Ekse, 9 xi 1978, G. A. Halvorsen (ZMBN Type No. 388). Paratypes: NORWAY: mature ♂ pupa, mature ♀ pupa, 3 ♀, as holotype.

Etymology. Named after the collector of the type specimens.

Diagnostic characters

The male imago is separable from the other species of the subgenus by having a gonostylus with triangular inner projection one third from apex. The female has a preapical seta on ultimate flagellomere, ta₁ of mid and hind legs each with 8–20 sensilla chaetica and R₄₊₅, with 13–19 setae. The pupa is distinguished by having pedes spurii on both segments II and III, but with those on segment III reduced. The larva differs from that of *O. (S.) holsatus* by having long, simple l₄ setae.

Male imago ($n = 1-2$, mature pupae)

Total length about 3.1–4.2 mm. Coloration brown with blackish brown vittae, lower 2/3 of preepisternum, median anepisternum II, margins of scutellum and postnotum blackish brown. Halteres golden.

Head. AR 1.53–1.69. Ultimate flagellomere 206–266 μm long. Clypeus with 16 setae.

Thorax. Anteprenotum with 6–10 setae. Dorsocentrals 8–10, acrostichals 16, prealars 4, no supraalars. Scutellum with 6–10 setae.

Wing. Squama with 13–16 setae.

Hypopygium (Fig. 9). Tergite IX with 13–14 setae of which 8–10 are on anal point, laterosternite IX with 10–11 setae. Phallapodeme 71–86 μm long, transverse sternapodeme 83–101 μm long. Gonocoxite 229–278 μm long. Gonostylus 101–114 μm long, with inner, triangular projection at about 2/3; crista dorsalis low, starting at apex and following triangular projection; megaseta 11 μm long. HR 2.26–2.43, HV about 3.1–3.6.

Female imago ($n = 3\text{--}4$ except when otherwise stated)

Total length 3.81–4.30, 4.09 mm. Wing length 2.32–2.70 mm. Total length/wing length 1.46–1.78. Wing length/length of profemur 3.22–3.41. Coloration as in male.

Head. Antenna with 5 flagellomeres, with 60–71, 66 μm long preapical seta on ultimate flagellomere. AR 0.66–0.71. Flagellomere lengths (in μm): 38–45, 41–60, 94–109, 98–116, 150–206. Temporal setae 8–9, 9; including 1–2, 2 inner verticals; 5–7, 6 outer verticals; and 1–2, 1 postorbital. Clypeus with 16–19 setae. Palpomere lengths (in μm): 38–45, 41–60, 94–109, 98–116, 150–206.

Thorax. Anteprenotum with 8–9, 8 setae. Dorsocentrals 7–13, 10; acrostichals 13–18; prealars 4; no supraalars. Scutellum with 8–10, 9 setae.

Wing. VR 1.08–1.09. Anal lobe well developed. Costal extension 56–68 μm long. R with 11–13 setae, R_1 with 8–12, R_{4+5} with 13–19, costal extension with 0–2 setae. Squama with 17 setae.

Legs. Spur of front tibia 49 μm long, spurs of middle tibia 30–38 and 26–30 μm long, of hind tibia 64–75 and 26–30 μm long. Width at apex of front tibia 41–49 μm , of middle tibia 45–53 μm , of hind tibia 53–60 μm . Pseudospurs present on ta_1 of mid and hind leg, on ta_2 of mid leg and occasionally on ta_2 of hind leg, 26–30 μm long on ta_1 and of ta_2 of mid leg, 15 μm long when present on ta_2 of hind leg. Sensilla chaetica 8–20 at 0.07–0.29 on ta_1 of mid leg, 11–18 at 0.07–0.28 on ta_1 of hind leg. Length (in μm) and proportions of legs:

	fe	ti	ta_1	ta_2	ta_3	ta_4
p_1	765–907	898–1040	586–671	387–435	265–298	180–194
p_2	765–888	808–936	369–435	217–246	165–198	109–123
p_3	841–893	945–1077	529–605	312–345	246–265	146–161
	ta_5	LR	BV	SV	BR	
p_1	104–113	0.64–0.65	2.35–2.40	2.76–2.81	1.9–2.0	
p_2	90–104	0.46	3.22–3.34	4.20–4.27	1.9–2.4	
p_3	109–118	0.54–0.56	2.70–2.80	3.26–3.45	2.4–2.9	

Abdomen. Number of setae on tergite VIII 20–22. Sternite VIII with 24–26, 25 central plus 2 far lateral to each side.

Genitalia (Fig. 17, 18). Gonocoxite with 20–22, 21 setae of which 5–6, 6 are shorter and weaker. Tergite IX clearly divided, with altogether 20–26, 22 setae. Ventrolateral lobe (Fig. 30) larger than dorsomesal lobe (Fig. 32). Cercus 128–184, 163 μm long. Seminal capsules pear-shaped, 56–75, 68 μm long; 45–56, 52 μm wide; sclerotized in anterior 30–41 μm . Notum 120–150, 140 μm long.

Pupa ($n = 5$ except when otherwise stated)

Total length 4.16–4.97, 4.59 mm (4). Exuviae pale greyish brown with anal lobe nearly transparent.

Cephalothorax. Frontal warts prominent. Frontal setae (Fig. 40) 143–169, 155 μm (4) long. Thoracic horn (Fig. 46) with projection about 1/3 from base in 2 of 5 specimens; 225–308, 270 μm long; 26–45, 30 μm wide; 6.1–11.1, 9.3 times as long as wide; 1.25–1.49, 1.36 times as long as anal lobe. Anterior precorneal (Pc_1) 150–188, 165 μm long; Pc_2 131–169, 146 μm long; Pc_3 86–150, 115 μm long. Anterior dorso-central (Dc_1) strong, 56–75, 66 μm long; Dc_2 weak, 45–75, 56 μm long; Dc_3 strong, 64–86, 80 μm long; Dc_4 weak or strong, 56–75, 67 μm long. Distances (in μm): Dc_1 – Dc_2 23–83, 51; Dc_2 – Dc_3 26–60, 44; Dc_3 – Dc_4 17–45, 28.

Abdomen (Fig. 55). Tergite I bare; tergite II with anterior group shagreen and posteromedian spinules; tergite III with sparse anterior shagreen, followed by bare transverse band, then band of stronger spinules followed by bare band and 5–7 rows of anteriorly directed spines posterior on tergite and on conjunctives III/IV; tergites IV and V as III, but anterior shagreen stronger and more extensive and posterior anteriorly directed spinules more clearly on the conjunctives; tergite VI as preceding tergites, but without spinules on conjunctives; tergites VII–IX with weak anterior group shagreen. Sternite I and IX bare, sternites II–VIII each with weak anterior group shagreen, sternites III–VI with additional posteromedian shagreen. Tergite II with 60–116, 96 caudal hooklets. Pedes spurii A strong on sternites IV–VI, weak on VII. Pedes spurii B well developed on tergite II, weak on tergite III. Lengths of L setae 1–4 on segment VIII (in μm) as: 49–83, 66; 49–75, 62; 49–75, 62; 75–120, 98 (4).

Anal lobe 263–345, 304 μm (4) long. Anal macrosetae 180–206, 198 μm long. Apex bare. Male genital sac overreaching lobe by 94 μm (1).

Fourth instar larva ($n = 6$ except when otherwise stated)

Total length not measurable. Head 0.48–0.54, 0.52 mm long. Postmentum 255–274, 261 μm long. Head capsule brown with brownish black mentum, apical half of mandible and postoccipital margin.

Head. Antenna as in Fig. 70. Length of antennal segments (in μm): 54–64, 57; 15–17, 16; 8–9, 8; 6–8, 7; 5–6, 5. AR 1.50–1.66, 1.58. Basal antennal segment 14–19, 17 μm wide; blade 24–31, 27 μm (5) long; accessory blade 14–15 μm (3) long; Second antennal segment with 8–9 μm (2) long preapical style. Lauterborn organs 811, 9 μm (4) long. Epipharyngeal pecten (Fig. 62) consists of 3 well-separated spines. Pecten galearis (Fig. 65) relatively distinct. Premandible (Fig. 62) 83–101, 92 μm long;

vestigial brush indicated by a few points. Mandible (Fig. 74) 146–178, 165 μm long. Mentum (Fig. 80) 135–152, 145 wide; width of median tooth 32–36, 34 μm .

Abdomen. Seta l_4 simple about 130–150 μm long. Procercus 34–38, 36 μm high; 26–34, 29 μm wide; anal setae 705–788, 757 μm long. Supraanal seta about 95–115 μm (2) long, about 0.12–0.15 (2) times as long as anal setae. Anal tubules digitiform about 30 μm (1) wide.

Remarks

Although the larvae have single l_4 setae the species otherwise appears very similar to *O. (S.) holsatus*. Cranston and Oliver (1988) showed that some populations also of *O. (S.) lignicola* may have simple l_4 setae. The male, except for the absence of a virga, is very similar to *Orthocladus dentifer* Brundin. The pupa of *O. dentifer*, however, lacks frontal setae.

Ecology and distribution

The species is known from the type locality only, a river in Western Norway.

Orthocladus (Symptocladus) bilyji sp. n. (Figs. 4, 10, 19, 20, 33–35, 41, 47, 57–59)

Type locality. CANADA: Ontario, Oakville, Fourteen Mile Creek.

Type material. Holotype ♂, CANADA: Ontario, Oakville, Fourteen Mile Creek, S. of Upper Middle Rd., 1 v 2002, reared 3 v 2002, B. Bilyj (ZMBN Type No. 389). Paratypes: 14 ♂, 2 ♀, as holotype except net sweep 19 iv 2002.

Etymology. Named after the collector of the type specimens.

Diagnostic characters

The male imago is separable from the other species of the subgenus by having 24–40 setae basal of anal point; fifth palpomere less than 1.1–1.5 times as long as fourth; oral projections strongly developed; and gonostylus curved, widest at drawn out apex. The female imago is easily distinguished from other species of the subgenus by the prominent tergite IX with altogether 50–56 setae and the small gonocoxite IX with 6–7 short setae. The pupa is distinguished by the prominent pedes spurii B on segment II with no pedes spurii on III, combined with no circular spine patches on tergites and spine-like spurs on the anal lobe.

Male imago ($n = 10$ except when otherwise stated)

Total length 3.37–3.89, 3.66 mm. Wing length 1.80–2.23, 2.03 mm. Total length/wing length 1.75–1.88, 1.81. Wing length/length of profemur 2.21–2.61, 2.48. Coloration dark brown with blackish brown vittae, lower 2/3 of preepisternum, median anepisternum II, margins of scutellum and postnotum blackish brown.

Head. AR 1.06–1.34, 1.17. Ultimate flagellomere 454–520, 485 μm long. Temporal setae 12–17, 14; including 4–6, 5 inner verticals; 5–9, 6 outer verticals; and 2–5,

3 postorbitals. Clypeus with 10–15, 12 setae. Tentorium, stipes and cibarial pump as in Fig. 4, cornua less prominent than in other species. Tentorium 158–188, 177 μm long; 34–41, 38 μm wide. Stipes 135–189, 152 μm long; 34–64, 50 μm wide. Palpomere lengths (in μm): 38–49, 41; 49–60, 57; 83–109, 92; 75–94, 83; 90–113, 103.

Thorax. Anteprepronotum with 5–8, 7 setae. Dorsocentrals 9–15, 12; acrostichals 12–16, 14; prealars 5–7, 6; no supraalars. Scutellum with 8–14, 10 setae.

Wing. VR 1.04–1.11, 1.08. Anal lobe strongly projecting. Costal extension 0–23, 12 μm long. R with 6–12, 9 setae; R_1 with 0–1, 0; R_{4+5} with 0–1, 1 seta; costal extension with 0–1, 0 non-marginal setae. Squama with 8–21, 16 setae.

Legs. Spur of front tibia 60–69, 63 μm long; spurs of middle tibia 34–41, 38 and 30–38, 34 μm long; of hind tibia 60–75, 69 and 30–41, 37 μm long. Width at apex of front tibia 49–56, 54 μm ; of middle tibia 49–60, 53 μm ; of hind tibia 51–68, 63 μm . Pseudospurs present on ta_1 of mid and hind leg, and ta_2 of mid and usually hind leg; 19–30 μm long. Sensilla chaetica 3–6, 4 at 0.07–0.12, 0.09 to 0.17–0.30, 0.20 on ta_1 of mid leg; 0–3, 0 at 0.15–0.33 (1) on ta_1 of hind leg. Length (in μm) and proportions of legs:

	fe	ti	ta_1	ta_2	ta_3	ta_4
p_1	737– 917, 818	841–1030, 925	510–614, 569	321–387, 357	151–170, 161	151–170, 161
p_2	747– 912, 819	765– 945, 845	340–411, 381	189–227, 209	142–170, 153	95–123, 108
p_3	832–1030, 914	888–1077, 971	444–562, 500	232–293, 263	189–222, 208	113–151, 125
	ta_5	LR	BV	SV	BR	
p_1	104–113, 110	0.59–0.63, 0.61	2.57–2.74, 2.63	2.95–3.28, 3.08	1.7–2.1, 2.0	
p_2	95–109, 103	0.44–0.47, 0.45	3.38–3.84, 3.58	4.19–4.52, 4.38	1.7–2.0, 1.9	
p_3	99–113, 109	0.50–0.53, 0.52	3.27–3.53, 3.37	3.64–3.89, 3.77	2.0–3.1, 2.6	

Hypopygium (Fig. 10). Tergite IX with 36–54, 43 setae of which 10–17, 13 are on anal point; laterosternite IX with 3 setae. Phallapodeme 105–128, 120 μm long; transverse sternapodeme 86–109, 97 μm long. Gonocoxite 255–298, 266 μm long. Gonostylus 143–165, 155 μm long; curved, with rounded outer corner, widest near drawn out apex; crista dorsalis not distinguishable; megaseta 13–15, 14 μm long. HR 1.67–1.83, 1.78; HV 2.21–2.53, 2.36.

Female imago ($n = 2$)

Total length 2.98–3.02 mm. Wing length 2.08–2.19 mm. Total length/wing length 1.36–1.45. Wing length/length of profemur 3.38–3.40. Coloration about as in male, but more pale.

Head. Antenna with 5 flagellomeres, without preapical seta on ultimate flagellomere. AR 0.68–0.76. Temporal setae 8 including 3 inner verticals, 2 outer verticals, and 3 postorbital. Clypeus with 12–13 setae. Flagellomere lengths (in μm): 83–90, 41–47, 41–45, 41, 150–158. Palpomere lengths (in μm): 41, 53, 75–79, 75–105, 98. Coronal suture complete (104–120 μm long).

Thorax. Anteprepronotum with 8–9 setae. Dorsocentrals 11–12, acrostichals 14–16 prealars; no supraalars. Scutellum with 10 setae.

Wing. VR 1.05–1.10. Anal lobe slightly projecting. Costal extension 19–23 μm long. R with 8–13 setae, R_1 with 4–6, R_{4+5} with 4–11, costal extension with 0–1 setae. Squama with 17 setae.

Legs. Spur of front tibia 51 μm long, spurs of middle tibia 36–38 and 34 μm long, of hind tibia 58–64 and 23–34 μm long. Width at apex of front tibia 51 μm , of middle tibia 47–51 μm , of hind tibia 56 μm . Pseudospurs present on ta_1 of mid and hind leg, on ta_2 of mid leg and occasionally on ta_2 of hind leg, about 26 μm long. Sensilla chaetica 7–8 at 0.08 to 0.21–0.30 of mid leg, 3–7 at 0.10–0.12 to 0.18–0.38 of hind leg. Length (in μm) and proportions of legs:

	fe	ti	ta_1	ta_2	ta_3	ta_4
p_1	614–643	756–761	435–444	246	161	95–104
p_2	690	728–737	331	146–170	113	76–80
p_3	784–794	879–898	458–473	236–246	170–180	85–90
	ta_5	LR	BV	SV	BR	
p_1	90–104	0.58	2.98–3.08	3.10–3.22	1.4–2.3	
p_2	85–90	0.45	3.88–4.16	4.29–4.31	1.9–2.1	
p_3	85–99	0.52–0.53	3.52–3.68	3.58–3.63	2.0	

Abdomen. Number of setae on tergite VIII 39–44. Sternite VIII with 21–24 central plus 3 far lateral to each side.

Genitalia (Figs. 19, 20). Gonocoxite small, with 6–7 short setae. Tergite IX prominent, strongly divided, with altogether 50–56 setae. Ventrolateral lobe of gonapophysis VIII (Fig. 33) with triangular microtrichia limited to posterior margin. Cercus 116–124 μm long. Seminal capsules ovoid, 90–98 μm long, dark sclerotized in anterior 75 μm , 51–79 μm wide. Notum 146–154 μm long.

Pupa ($n = 1$)

Total length 4.14 mm. Exuviae pale with dark brown apophyses.

Cephalothorax: Frontal setae (Fig. 47) 158 μm long. Thoracic horn (Fig. 47) 356 μm long, 56 μm wide, 6.33 times as long as wide, 1.67 times as long as anal lobe. Anterior precorneal (Pc_1) 158 μm long, Pc_2 131 μm long, Pc_3 113 μm long. Anterior dorsocentral (Dc_1) strong, 83 μm long; Dc_2 weak, 86 μm long; Dc_3 strong, 68 μm long; Dc_4 weak, 56 μm long. Distances (in μm): Dc_1 – Dc_2 56, Dc_2 – Dc_3 71, Dc_3 – Dc_4 15.

Abdomen. Tergite I bare, T II with weak median shagreen, T III–VI with coarse median shagreen, T VII–IX with weak median shagreen (Figs. 57, 58). Integuments III/IV–V/VI each with 4–5 rows of anteriorly directed spines. Apophyses with reticulations. Sternites I–IV bare; sternite V with a few posteromedian shagreen spinules, S VI with posteromedian shagreen; S VII–IX bare. Tergite II with 40 caudal hooklets. Pedes spurii A present on sternites IV–VII. Pedes spurii B on tergite II only, very conspicuous. Lengths of L setae 1–5 on segment VIII (in μm) as: 15, 150, 150, 120, 133.

Anal lobe 308 μm long, apex (Fig. 59) with 1–2 spines, 19–26 μm long. Anal macrosetae 214 μm long. Male genital sac apparently overreaching anal lobe by about 110 μm .

Remarks

The imagines, particularly the females, are the most easily distinguishable species of the subgenus. The pupa, however, resembles several species of *Orthocladius* with posterior spines including the *O. (S.) lignicola* from Berry Creek, Oregon, described by Cranston and Oliver (1988).

Ecology and distribution

The species is known only from the type locality, a stream in Ontario, Canada.

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