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**LA THÈSE A ÉTÉ
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A REVISION OF THE NEARCTIC SPECIES OF

ORTHOCLADIUS (ORTHOCLADIUS) VAN DER WULP (KIEFFER)

(DIPTERA:CHIRONOMIDAE)

by

ANNELLE R. SOPONIS, M. Sc.

A thesis submitted to the Faculty of
Graduate Studies in partial fulfilment
of the requirements for the degree of
Doctor of Philosophy

Carleton University

Ottawa, Ontario

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ABSTRACT

The nearctic subgenus Orthocladius (Orthocladius) is revised; keys to species for males, females, pupae and larvae are given; variations and correlations of characters in the adult male are analyzed; and keys to the subgenera and diagnoses of the subgenera of Orthocladius for males, females, pupae, and larvae are provided. Redescriptions of 17 previously-known species and descriptions of 10 new species are presented. The new species are: O. charensis, O. clarkei, O. cooki, O. hazensis, O. knuthi, O. oliveri, O. paradeopratus, O. robacki, O. subletti, and O. tryoni. Orthocladius paradoreus (Roback) is considered a synonym of O. obumbratus Johannsen; O. nanseni Kieffer and O. sordens Johannsen are considered as nomina dubia; O. bifasciatus Malloch and O. clepsydrus Coquillett are placed in incertae sedis; O. decoratus (Holmgren) and O. currani Sublette are reviewed but not assigned to a subgenus. Lectotypes are designated for O. lapponicus Goethghebuer, O. obumbratus Johannsen and O. trigonolabis Edwards. The holotype of O. oblidens is figured and described.

The results of this study indicate that species identification in Orthocladius (Orthocladius) must rely primarily on the structures of male genitalia, supported by characters found in the larva and pupa. An attempt is made to choose suitable terms for structures used in chironomid taxonomy.

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INTRODUCTION

Adults of the subgenus Orthocladius (Orthocladius) are small to medium-sized, dark chironomids. Many species in North America emerge in early spring, though a few species are collected in summer and fall. The larvae of most species have a green body, while a few are white, with a yellow head capsule; the larvae live in tubes. Larvae are usually found associated with plants in cold waters of lakes, streams, and rivers, although records from Florida suggest that certain species have adapted to warmer waters.

Prior to the present study, twenty species of Orthocladius (Orthocladius) were recorded from North America, and identifications were made by referring to scattered descriptions (Brundin 1956; Roback 1957a; Sublette 1966, 1967a, 1967b, 1970; Saether 1969) which were not always adequate. No key to all twenty species had ever been available, and identifications of immature stages and adult females were next to impossible.

Many species occurring in North America have been placed in the genus Orthocladius by Sublette and Sublette (1965). These names were not assigned to subgenera, and further studies are needed before this can be accomplished for all species.

The primary object of this study was to work out the taxonomy of Orthocladius (Orthocladius) occurring in North America. It has long been recognized (Malloch 1915; Edwards 1929) that the adults of Orthocladius are so similar morphologically in different species that assignment of specimens to a particular species is sometimes difficult. Therefore, sixty-five characters of the adult male were analyzed to obtain insight into variation of adult

structures. The mean, range, and variance for each character are given in a table following the species description of the adult male. These data should be considered in identifying the species. An analysis of the variations and correlations based on these data is also given.

As pointed out by Brundin (1956), a study based on the pupae and larvae, as well as the adults, should provide a more accurate classification of chironomids. Therefore, with this in mind, characters of the immature stages were investigated.

In the course of this study, it has become increasingly evident that the terminology of various structures used in the chironomid taxonomy has been confused, two or more terms having been applied to one and the same structure. An attempt is therefore made to choose the most suitable terms for structures, by referring to the morphological works by Saether (1971), Hansen (1973), and others.

The results of this work indicate that species identification in Orthocladius (Orthocladius) must rely primarily on the structure of the male genitalia, supported by characters found in the larval and pupal stages. Keys to species in all known stages are given for Orthocladius (Orthocladius). In this subgenus, twenty-eight species are recognized as valid, and twenty-seven species are described and figured. Of these, ten species are new, and two species are recorded for the first time in North America. One species is synonymized (O. paradoreus (Roback)), two species are considered as nomina dubia (O. nanseni Kieffer, O. sordens Johannsen), and two species are placed in incertae sedis (O.

bifasciatus Malloch, O. clepsydrus Coquillett). Two species previously placed in the subgenus Orthocladus are reviewed (O. decoratus (Holmgren), O. currani Sublette), but can not be definitely assigned until the type material and additional North American material are examined. Lectotypes are designated for three species (O. lapponicus Goethghebuer, O. obumbratus Johannsen, and O. trigonolabis Edwards). An application is being made to the International Commission on Zoological Nomenclature for the acceptance of Orthocladus oblidens (Walker) as the type species of the genus Orthocladus. The holotype of Orthocladus oblidens (Walker) is described and figured.

The separation of the subgenus Orthocladus from other members of the genus is sometimes difficult, and no keys to the subgenera occurring in North America are available. Therefore, keys to the subgenera and diagnoses of the subgenera of Orthocladus are given in all stages.

I feel more studies on the world fauna of Orthocladus (Orthocladus) are necessary before one may obtain definite ideas about their phylogeny and zoogeography. At the present time, records of Orthocladus (Orthocladus) in parts of the world, other than North America and Europe, are scarce (Freeman 1956; Hardy 1960).

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MATERIAL AND METHODS

General

This study was based on an examination of approximately 2000 specimens, mostly adult males, representing 27 species of the subgenus Orthocladius (Orthocladius). The subgenus, as treated here, comprises those species occurring in North America north of Mexico, and Greenland.

Many specimens were borrowed from various museums and individuals, as indicated in the acknowledgments; others were collected in the field by the author. Borrowed specimens were either pinned, preserved in alcohol, or slide-mounted. Specimens collected in the field were preserved in 70% ethanol (ETOH). Specimens not on slides were slide-mounted by the author in the procedure outlined below. Type material was mounted in Canada balsam by M.E. Roussel employing a modification of the technique developed by Leo Forster, outlined in Saether (1969).

Adults in swarms were collected at dusk. Adults in copula were captured either in swarms or by searching for them on a substrate, often the top of a car. Pupal exuviae were collected by washing accumulated floating debris through a Thienemann sieve. Larvae and pupae, as well as some adults, were collected by placing Brundin nets in rivers and streams.

Live larvae were collected by washing aquatic vegetation through a Thienemann sieve. Rearing of fourth instar larvae to adults was about 50% successful. The larvae were placed in individual rearing vials which were kept cool with running tap water; the vials were checked daily for emergence. After the adult

emerged, it was allowed to mature for a period of 24 hours, or until the body became hardened and the antennae (male) became plumose. The specimens were then preserved in 70% ETOH.

Specimens selected for study were mounted on slides. This was carried out under 15x magnification. An adult midge was placed in a drop of distilled water on a depression slide, and dissected in the following manner: wings, head, and abdomen were cut off with a scalpel; 3 legs on the left side were pulled off by applying a watchmaker's forceps to the coxae; pedicels and flagellomeres were rolled off from the scape with a fine needle. The wings, legs, and antennae were placed directly into 95% ETOH. The rest of the body was placed into 10% KOH solution, and heated for 2 minutes or until the specimen was cleared. Heated parts were then placed into a bath of each of the following for a period of 2-5 minutes, or until the desired effect was reached: distilled water, glacial acetic acid, and 95% ETOH. All parts were mounted directly from 95% ETOH into a drop of euparal on the labelled slide, and then covered with a coverslip (#0). To prevent the collapse of fragile specimens, the parts were placed into a mixture of 95% ETOH and euparal prior to mounting in euparal. The appearance of the finished slide is given in Fig. 1. Slides were dried in an oven at $45^{\circ}\text{C} \pm 10^{\circ}\text{C}$ for a period of 2 weeks before counts and measurements were taken.

Pupae were mounted according to the same procedure as that for adults. The cephalothorax was cut off from the abdomen with a scalpel, and mounted laterally. The abdomen was mounted with the dorsal side up. Undissected pupal exuviae were mounted directly

from 95% ETOH into euparal, and placed with the dorsal side up.

Larvae were mounted directly from 95% ETOH. The head was cut off from the body with a scalpel, and placed with the ventral side up. The body was mounted laterally. Sometimes it was necessary to clear the larval body in hot 10% KOH solution, and the procedure followed that used for the adults. Larval exuviae were mounted with the ventral side up.

The importance of good slide-making cannot be over-emphasized. In adults of O. (Orthocladus), the recognition of many species relies on genitalic features. It is very difficult to identify the specimens in which the genitalia is badly distorted. To overcome the dorsoventral compression that occurs during slide making, the genitalia should be allowed to dry in a drop of mounting medium for several hours before the coverslip is added. Examples of variations produced in the male genitalia due to slide making, are provided in Figs. 34, 41, 47.

Descriptions of several slide making techniques for chironomids are available (Schlee 1966, Wirth and Marston 1968, Hellenthal (in prep.), Hansen 1973). An advantage of using euparal is that it dries quickly, and there are relatively few steps involved in the procedure. The advantage of using Canada balsam is that there is minimal collapse of fragile specimens, and the slide has a long life. Chironomids mounted in euparal have lasted 10 years in good condition in the Canadian National Collection (D.R. Oliver, pers. comm.).

Figures were drawn from slide-mounted specimens with the aid of a Wild drawing tube, adapted to fit the Nikon compound

microscope. Steroscan micrographs were taken by the Carleton University Jeol U-3 scanning electron microscope. Specimens preserved in alcohol were washed in several baths of 95% ETOH, air dried, and secured to a brass plug with Scotch Ruban double face tape. Specimens were then coated with a layer of gold and carbon (400-500 Å thick) in a vacuum evaporator, and then photographed by use of the SEM. For histological examination of the thorax in O. oliveri, both preserved specimens from 70% ETOH and fresh specimens fixed in 2.5% gluteraldehyde were dehydrated with ETOH, passed through 2 changes of propylene oxide, and embedded in plastic (Spurr 1969). Semi-thin (0.5-1.5 μ) sections were cut on an ultramicrotome using glass knives. The sections were dried onto glass slides, stained with methylene blue (1% in 1% aqueous borax) and mounted in immersion oil.

For the analysis of variation and correlation, a total of sixty-five characters were studied in more than five hundred adult males. The mean, variance, and correlation coefficient were calculated by the standard computer program of the Statistical Research Service (Agriculture Canada).

Measurements and Ratios

Most of the methods of measuring characters and of calculating ratios published in Schlee (1966) and Saether (1969) are used in this work.

In my experience, it is better to measure the maximum length of each leg segment (Hansen 1973) than measuring the median axis (Schlee 1966). In order to measure the median axis of the leg segment, the investigator is faced with the problem of determining

where the median axis lies. This is time consuming, and it increases the chance of interpretation. Measurements should be taken quickly to avoid interpretation, as pointed out by Lindeberg (1967, p. 51).

To avoid error as much as possible, I measured a maximum of ten slides per day. All measurements and counts were taken consistently in the same manner and in as short a time as possible. All measurements and counts are my own. It is not surprising that my values differ slightly from those of other authors for the same specimen, since no two people measure exactly the same.

Measurements and counts given for adults, pupae and larvae represent those taken on the right side of the specimen (unless damaged). Total counts are given for such unpaired structures as the clypeus. Counts for the abdominal setae and muscle marks represent those taken on a single pupal specimen, although comparisons were made with other specimens.

All measurements were made on a Nikon model S-Ke II compound microscope, and converted to microns* with the aid of a calibrated ocular micrometer. The magnification under which each particular measurement was taken is indicated in parentheses with the description of the measurement given below. Counts were made generally at magnifications of 200x for adults and pupae, and 1000x for larvae. Wing punctation was determined at 200x. Measurements and ratios were calculated by a standard computer program of the Statistical Research Service (Agriculture Canada) for large samples. Values for individual specimens not calculated there were calculated by the author at least twice on an Olivetti-Underwood 24 electric calculator or Wang electric table calculator.

*microns = μ

Measurements

Adults.

Body size: sum of thoracic and abdominal lengths (40x);

Figs. 2-4

Eye width: interocular distance (200x); Figs. 6, 7

Palpal lengths: length of each segment (200x); Figs. 6, 7

Antennal lengths: length of each flagellomere (female, 200x; Fig. 9); total lengths of flagellomeres 1 to 12 and length of 13 (male, 100x; Fig. 8)

Wing length: distance from arculus to tip (40x); Fig. 14a

Wing width: widest distance between margins (40x); Fig. 14a

Leg lengths: median axis length of each segment (40x); Fig. 15a

Anapleural suture length: maximum length (100x); Fig. 2

Gonocoxite length: maximum length (100x); Fig. 19

Gonostylus length: maximum length (100x); Fig. 19

Pupal Exuviae.

Body length: sum of cephalothoracic and abdominal lengths (20x); Figs. 79, 92

Thoracic horn length: maximum length (100x); Fig. 80a

Anal lobe length: length from anterior margin to tip, not including spurs (100x); Fig. 92

Anal seta length: maximum length (100x)

Larvae.

Antennal lengths: maximum length of each segment (1000x); Fig. 111d

Labial plate width: widest distance between 6th laterals (1000x); Fig. 110

Ratios

Adults.

A.R.-antennal ratio (Edwards 1929): length of last flagellomere/
total length of flagellomeres 1-12 (male) or flagellomeres
1-4 (female)

V.R.-venarum ratio (Fittkau 1954): length of arculus to
r-m/length of arculus to fCu

L/W.R.-wing length to wing width ratio: length of wing/width
of wing

L.R.-leg ratio (Edwards 1929): length of first tarsal
segment/length of tibia

B.V.-(Beinverhältnis) (Pagast 1947): total length of femur,
tibia, and first tarsal segment/total length of tarsal
segments 2 to 5

S.V.-(Beinverhältnis) (Pagast 1947): total length of femur
and tibia/length of first tarsal segment

H.R.-hypopygium ratio (Saether 1967): length of gonocoxite/
length of gonostylus

H.V.-hypopygium value (Saether 1967): length of body/length
of gonostylus x 10

Pupal Exuviae.

A.L.R.-anal lobe ratio: length of longest anal seta/length
of anal lobe

Larvae.

A.R.-antennal ratio (Fittkau 1962 as modified by Schlee 1966):
length of basal segment/total length of terminal segments:

STRUCTURE AND TERMINOLOGY

MALES

Color. The adult males of O. (Orthocladius) are uniformly black, brown, and occasionally yellow. Many discussions regarding the value of color as a taxonomic character for chironomids have appeared in the literature (Edwards 1929, Townes 1945, Oliver 1959, Fittkau 1962, Moeller 1964, 1966, Schlee 1966, Hashimoto 1968, Hirvenoja 1973). In general, color is not considered as a diagnostic character, although patterns are distinctive for certain groups (cf. Hirvenoja 1973). The color of an adult chironomid depends on its age, sex, preservation, geographical origin, and seasonal emergence, as well as the environmental conditions during its development. Pinned material retains its color, but alcohol and cleared material becomes lighter (Schlee 1966). Early dipterists included a detailed account of color in their species descriptions, based, with few exceptions, on pinned adults. The color description given in this work was based on preserved or slide-mounted material.

The taxonomic value of the scutal stripes (Freeman 1955, fig. 2), whether or not they merge posteriorly, was discussed by Edwards (1929, p. 183). According to him, this character varies not only with the sex and age of the individual, but it also varies seasonally and individually in many species of chironomids. He pointed out that pinned specimens with a lightly sclerotized thorax may appear to have scutal stripes because of the underlying thoracic muscles. Freeman (1955, p. 16) noted that the scutal stripes were subject to color variation, both in shade and the degree of fusion

in dark colored species. Hansen (1973) noted that cleared adults of Diamesa often have no scutal stripes. These findings agree with my observations on males of O. (Orthocladius).

Antennae. The antenna of a chironomid, as pointed out by Hansen (1973, p. 22), consists of three true segments: the scape, pedicel, and a multiannulated flagellum (Fig. 8). Males of O. (Orthocladius) typically have a flagellum which is composed of thirteen flagellomeres.

Head. The eyes are bare, i.e. they lack microtrichia or other setae between the ommatidia. The two groups of cephalic setae that were studied here are the clypeal setae and the temporal setae. The clypeus is rectangular and setae are always present. The temporal setae (Fig. 6) occur on the vertex* of the head, and extend from the midline of the head around to the back of the eye. Saether (1971) and Hansen (1973) divided the temporal setae into three groups: the inner verticals, the outer verticals, and the postorbitals (= postoculars). Hansen distinguished the inner verticals from the outer verticals in some Diamesa by the more robust development of the outer verticals. The outer verticals are more robustly developed than the inner verticals in O. (Orthocladius); however, the setae are often absent in slide mounted material, and I have not found a satisfactory criterion (cf. Saether 1971) for the separation of these two groups of vertical setae. Therefore, I have included both groups of setae in the counts of the vertical setae.

*vertex: the area above the levels of the antennal sockets and the foramen magnum.

The postorbital setae are situated behind the eye, and are separated by a distinct gap from the vertical setae. In some species, the gap is not large, so that this distinction is sometimes difficult to make. However, I have been able to count the postorbital setae in most specimens without difficulty. Hirvenoja (1973) was unable to separate the vertical setae from the postorbital setae in the Cricotopus-group, in which no gap occurs between these two types of setae. He regarded the postorbital setae only as those located behind the eye. He suggested that this character is probably sexually dimorphic, as I have found.

Early dipterists, with the exception of Malloch (1915) and Tokunaga (1936) considered the palps of chironomids as 4-segmented. However, recent workers (Saether 1971, Hansen 1973, Hirvenoja 1973) have recognized five palpal segments. The first palpal segment of O. (Orthocladius) is clearly delimited from the second (Fig. 6), and palpal segments 2 to 4 are typically armed with robust setae. The proportion of one palpal segment to another is variable within and between species (Freeman 1955), and this tendency generally holds true in O. (Orthocladius). The proportion of palpal segment three to four is a reliable species character for adults of O. tryoni.

Thorax. The terminology of the thoracic structures follows that of Saether (1971) and Hansen (1973).

I have considered five setal groups of the thorax (Fig. 11) which include the lateral anteprenotals, acrostichals, dorsocentrals, prealars, and scutellars. Males of O. (Orthocladius) have a small group of lateral anteprenotals on the lateral part of each anteprenotal lobe. The acrostichal setae (Dorsomediane Borsten of

Brundin 1956) are located on the midline of the scutum, and anteriorly begin within the area immediately behind the antepnotum. They are always present except in O. appersoni. The acrostichals are weakly to robustly developed, and often lost in handling the specimens, so that in many instances I have had to count the sockets from which the setae arise. The dorsocentral setae (Dorsolaterale Borsten of Brundin 1956) are weakly to robustly developed, and lie lateral to the acrostichals, just posterior to the humeral pit. The dorsocentrals are usually uniserial in arrangement, except in O. smolandicus, in which they are biserial to multiserial. The prealar setae lie dorsal and anterior to the wing base. The prealars include one anterior seta and a posterior group of three to five setae, separated by a gap from the former. The number or arrangement of the prealars do not provide species characters. Occasionally I have seen a single seta on the sternum II in a few isolated individuals, and this has been reported in Diamesa (Hansen 1973, p. 56). The scutellar setae occur in a uniserial or biserial arrangement on the median part of the scutellum. Within the genus Orthocladus, I have arbitrarily distinguished these arrangements of setae: uniserial, if less than three setae are out of line with each other (Fig. 10a); biserial, if at least three setae are out of line with each other (Fig. 10b); multiserial, if at least three rows of setae can be distinguished (Fig. 10c).

A mesonotal pit (Figs. 5a, 11) occurs in some species of O. (Orthocladus), and this structure is discussed in detail under O. oliveri.

Wings. The terminology of the wing veins follows the

Comstock-Needham system used by Edwards (1929) and Brundin (1956) (Fig. 12).

In males of Orthocladius, some importance has been placed on the extension (production) of the costal vein beyond the apex of the vein R4+5. I have divided the area of extension into three states: not extended (Fig. 14c), slightly extended (Fig. 14d), and well extended (Fig. 14b). This character varies within the species as well as in the two wings of the same individual. Therefore, this character is not reliable in O. (Orthocladius).

The shape of the anal lobe of the wing has been used by chironomid workers, and I find that this is a reliable species character. Edwards (1929, p. 284) characterized six different shapes for the anal lobe: produced, right-angled, rounded, obtuse, obsolete, and absent. The anal lobe in all males of O. (Orthocladius) is rounded. I consider the anal lobe produced if it is curved towards the wing base (Figs. 14f, g), and not produced if it is curved towards the wing apex (Fig. 14e).

Males have setae on the stem vein (remigium of Hansen 1973) and the R vein of the wing. Setae occur consistently on vein R4+5 in males of O. charensis, and less frequently in males of O. knuthi. The squama always has a setal fringe, and two campaniform sensilla (stigmatal sensilla of Saether 1971) are present, one on the R vein and the other on crossvein r-m near vein R2+3 (Fig. 12).

In O. (Orthocladius), the wings are bare, i.e. no macrotrichia occurs. The wings are scarcely to moderately punctate, due to the presence of microtrichia. The punctation of

the wings has been used as a specific and generic character in chironomid taxonomy. Edwards (1929) thought that the microtrichia were absent in his Group C (= O. (Orthocladius)). However, Brundin (1956, p. 16) pointed out that all Orthocladiinae have microtrichia on the wings. The size of the dots on the wings are, in fact, the pores (sockets) of the microtrichia, and Brundin suggested that the size of the pores are directly correlated with the size of the microtrichia. Edwards (1929, p. 336) recognized four colors of the wing that are produced through reflection of the microsculpture of the wing in pinned adults of Spaniotoma (Orthocladius),

The color of the halteres has been used in distinguishing the species of O. (Orthocladius). In pinned specimens, the halteres of some species appear to be brown or black (cf. O. nigrinus). However, on slide-mounted specimens, the halteres appear to be golden with a fine cover of microtrichia. I have used slide-mounted material, and therefore I have been unable to use this character. Hansen (1973) reported that the color of the halteres in males of Diamesa appears to be quite variable.

Legs. The fore tibia bears a single long spur (Fig. 15a); the mid leg bears two shorter spurs of subequal length (except for the spurs in O. trigonolabis, Figs. 15d, e); the hind tibia bears a comb and two spurs, the outer one about twice as long as the inner one (Fig. 15c). Spines are absent on the tarsi of the fore leg, and a pair of spines are found on the first and/or second tarsal segments of the mid and hind legs (except in O. hellenthalii). Pulvilli are absent, the empodium is slender and fringed, and the claws have toothed apices.

Hypopygium. The terminology of the genitalia follows that of Saether (1971) and Hansen (1973).

The males have a haired anal point and a characteristically shaped basal lobe of the gonocoxite (Fig. 16b). The basal lobe is, in turn, divided into the dorsal (Basallobus of Hirvenoja 1973) and the ventral parts (laterale Paramere, Anhang 2? of Hirvenoja 1973). The shape of the dorsal part is of diagnostic importance for separation of species in O. (Orthocladius). I have used the following words to describe the different shapes: long and narrow (Fig. 46), noselike (Figs. 31, 36), square (Fig. 40), and pinched (Fig. 38). At the basal median part of the gonocoxite there is a pair of freely hanging haired lobes (intermediate Paramere, Anhang 1? of Hirvenoja 1973) which are either collarlike (Fig. 16a) or triangular in shape (Fig. 19). I call these lobes simply the basal median lobes, since the homology of this structure is not clear (pers. comm. D.M. Wood). I have used the shape of the median margins (Fig. 29) as a specific character.

I propose to use the term virga* (Snodgrass, 1935, p. 322: defined as a terminal unallic spine, usually arising from the endophallus) for the group of spines attached to the distal end of the endophallus (penis cavity? of Saether 1969, fig. 9c, 9p). In O. (Orthocladius), the virga occurs in most species, but not in all. In O. nigritus and O. cooki the virga may be absent in some

*Tuxen (1970, p. 357) recorded the virga for the orders Dictyoptera, Plecoptera, Dermaptera, Lepidoptera, Siphonaptera, Pthiraptera, and Heteroptera. The virga probably arose independently in many orders, and hence it is probably not homologous throughout the class Insecta (pers. comm. R. Matsuda).

individuals. When the endophallus is everted (Figs. 18, 19), the virga can be seen as a cluster of spines. When the endophallus is in a resting position (the usual condition in slides), the virga is located dorsal and posterior to the basal median lobes of the gonocoxite (Fig. 16). Sometimes the virga is found out of position (Fig. 45), and often the virga is reduced in size. The virga occurs in two distinct arrangements: spines are well spaced within the cluster (Figs. 45-56), or the spines are compactly arranged within the cluster (Figs. 30-32).

The gonostylus is a simple structure with a single apical tooth (peg). I have followed Brundin's (1956) terminology for naming the various surfaces of the gonostylus (Fig. 17), i.e. inner area, dorsal edge, ventral edge, and dorsal side. The males of O. trigonolabis (Figs. 16, 33) and O. dentifer (Fig. 30) have a protuberance or bump on the gonostylus.

I have figured the struts of the hypopygium (Figs. 16, 19) but I have been unable to use them as a specific character, although Schlee (1968a) used the struts successfully for males of Corynoneura. The dorsal strut has been referred to as the sternapodeme (Saether 1971; Hansen 1973), or the Bogenspanne (Schlee 1968a), and the ventral strut has been called the phallapodeme (Saether 1971; Hansen 1973).

FEMALES

Structure and terminology are as in the male, except for the following structures:

Color. In some species, the female is lighter than the male.

Antennae. The flagellum consists of five flagellomeres, and there is no strong apical seta on the last flagellomere (Fig. 9). A pair of sensory setae occur at the apex of the first four flagellomeres, and many occur on the last flagellomere. Edwards (1929, p. 183) pointed out that these setae are thin, hollow, membranous extensions of the cuticle, and they are not articulated at the base as are other setae. These setae are difficult to see, and are sometimes lost.

Head. The compound eyes are larger than those in the male, and their dorsal margins are widely separated and are not extended medially (Fig. 9). Fewer temporal setae are present in the female; consequently, the delimitation of the postorbital setae is difficult to recognize. When postorbital setae are present in the male of the species, they are usually present also in the female.

Thorax. The female has a more robust thorax than the male.

Wings. The wing (Fig. 13) is broader and sometimes longer than that of the male. The veins are thicker and darker than the corresponding veins in the male, and the space between the veins M and Cu is larger. Setation is more complete in the female, occurring on veins R, R₁, R₄₊₅, and the stem vein. The anal lobe is similar in all species. It is straight proximally, then slightly rounded distally, and it is not produced. The setae lining the margin of the anal lobe begin in the middle of the lobe.

Legs. The claws end in a single sharp point.

Genitalia. The terminology of the genitalia follows that of Reiss (1971).

There are a pair of dark brown, pear-shaped spermathecae, and each has a short, straight spermathecal duct (Fig. 57). Tergite IX consists of two parts (hemitergites), each part is usually narrow and bandlike (Figs. 57, 63), and in a few species, it is wide and platelike (Fig. 61). Species characters are found in the shape and setation of the lateral sternite IX. The cerci are similar in shape throughout the species, and the size appears to vary with the size and species of the individual.

PUPAL EXUVIAE

The terminology of the pupal structures follows that of Hirvenoja (1973).

Color. The exuviae are golden or brown. The results of several investigations (Krüger 1938, Walker 1956, Lindeberg 1967) have revealed that seasonal variations of color occur within a species, and that temperature and water quality are two of the ecological factors that affect the color. In examining museum specimens, the possibility of color change due to microbial breakdown (cf. Coffman 1973) should be taken into consideration.

Cephalothorax. The thoracic horn (respiratory apparatus) occurs in a variety of tubelike forms (Fig. 90). They are usually covered with spines, although they are bare in a few species. Two different types of spines are found on the thoracic horn; they are either flat and scalelike (Figs. 91a, b), or small and pointed (Figs. 91c, d). Only one type of spines occurs within the same species except for O. lapponicus (Fig. 90j), in which the two types occur together. The spines occur in varying densities, depending on the species and the condition of the exuviae. The size of the

thoracic horn is a species character. In slide-mounted and SEM prepared material, the thoracic horn is often collapsed.

The region of the cephalothorax along the eclosion line (Dorchenfelder of Fittkau 1962) can be smooth, wrinkled (Fig. 79), or bumpy (Figs. 91f, 93). This region shows variation in form from the anterior to the posterior region.

The presence or absence of the frontal setae (Fig. 79), and the degree of development are species characters. The dorsocentral setae most commonly occur in two groups, each group consisting of two setae each. The arrangement or degree of development of the dorsocentrals is not a species character. The number of cephalothoracic setae is constant, with the exception of the postorbitals and prealars, throughout the species of O. (Orthocladius). The cephalothoracic setae are robustly developed in pupae of O. appersoni.

Abdomen. The terminology of the abdominal setae follows that of Pagast (1947).

Fittkau (1962, p. 50) found no variation in the number of dorsal setae of segments III to VI in the Tanypodinae. Hirvenoja (1973) found the most variation in the ventral setae, and in the dorsal and lateral setae of segment VIII in the Cricotopus-group. Typically, the pupae of O. (Orthocladius) have five lateral setae on segment VIII.

The muscle marks (Fensterflecken of Thienemann 1944, Muskelmale of Hirvenoja 1973) occur in two groups on the tergites: an oralmedian pair (OMM), and an analmedian pair (AMM) (Fig. 92). The muscle marks are difficult to see on lightly chitinized specimens,

and they vary individually in number and size. Often the muscle marks merge together.

The pattern of spines on the tergites of the pupal exuviae have traditionally been referred to in the literature as "shagreen". The definition of shagreen in Webster's dictionary is: "1. an untanned leather covered with small rounded granulations ... 2. the rough skin of various sharks and rays when covered with small close-set tubercles". This term shagreen, when it refers to spines, therefore is misapplied. I call these spines simply the "spine patterns". The spine patterns of the tergites are important for species recognition in O. (Orthocladius). A characteristic feature of the spine patterns is the presence of a rectangular patch of anteriorly-directed spines along the posterior margins of tergites III to V (Figs. 92, 100). Tergite II bears a distinct patch of recurved spines along the posterior margin (Figs. 91g, 92), and there are three to five rows of spines present in the patch. It is possible that the shape of the individual spines may prove to be a species character (Fig. 91e).

There have been several reports in the literature concerning the variation that occurs in the tergal spine patterns of chironomid pupal exuviae, and these apply to O. (Orthocladius). Walker (1956) found, within and between species of Psectrocladius, variations in the number of spines present on the posteromedial spine patches (Spitzenplatten) of the tergites. This variation was not always the same in different populations of the same species, and he attributed this variation to sexual and seasonal dimorphism. He concluded that it is unlikely that we can distinguish between

two species by counting the spines of the patch in several exuviae. Reiss (1965) found that in Paratanytarsus dimorphus Reiss, the summer forms possess more spines than spring forms from the same habitat. Lindeberg (1967) found sexual dimorphism in the area covered by the spines, and the development of the latter on tergites of pupae of Tanytarsus sp.

Two kinds of *Pedes spurii* (falsefeet) occur, A and B (Zavřel 1942). *Pedes spurii* A occur on the posterolateral corners of the sternites as whorls of spines (Fig. 96). These structures occur consistently on sternites IV to VII in the specimens I have examined. *Pedes spurii* B appear as small, bare, membraneous extensions of the tergite (Fig. 92). They occur on segment II in all pupae, and in certain species they occur on segment III as well (Fig. 91h).

The anal lobe of segment IX bears three long terminal setae, and small chitinous spurs may be present in the vicinity of the anal setae (Fig. 92). Swim hairs are never present. In pupae of O. charensis, thin chitinous threads occur on the outer margin of the anal lobes (Fig. 107). Although it is often difficult to determine the shape of the anal lobe in the pupal exuviae, the shape varies from narrow to heart-shaped between species. Hirvenoja (1973) found that the shape of segment IX in pupal exuviae of the Cricotopus-group varies greatly in the different taxa.

Lindeberg (1967) has reviewed the sexually dimorphic characters of pupae of the Chironominae. These differences occur in body size, numbers of swim hairs on the anal lobe, area covered

and development of spine patterns, and distension of the wing sheaths. I have not studied sexual dimorphism in the pupae.

LARVAE (4th INSTAR)

The terminology of the larval structures follows that of Zavřel (1941).

Color. The larvae are usually green, sometimes white, and they have a light yellow head capsule. The occipital margin and mouth parts of the head capsule are dark brown to black.

Head. The eyespots (Fig. 122c) are bipartite and composed of a small, reniform anterior spot and a larger, round posterior spot. Eyespots are not present in larval exuviae since they are retained in the adult (Hirvonoja 1973, fig. 2).

The larvae have a 13-toothed labial plate (hypochilum of Mozley 1970) that is either convex (Fig. 131b) or triangular (Fig. 140b) in shape. The median tooth is usually broader than the first laterals, and it is extended anteriorly beyond the other teeth. The paralabial plates are extended from the third lateral tooth to the sixth, and in some species they are extended posteriorly as long, prominent structures (Fig. 142a).

The mandible has four true teeth and one false tooth, and its outer margin is either smooth (Fig. 132a) or crenulate (Fig. 136b). On the mandible occur a hyaline sensory seta (subdental seta of Mozley 1970) and a brush (interior seta of Mozley 1970). The brush consists of 6 to 8 setae, and 2 of these setae are distinctly shorter than the others, which are long and serrated.

The epipharyngeal area (Fig. 112a) has a U-shaped ungula

(U-sclerite of Mozley 1970) which bears 2 pairs of chaetulae basales and 4 to 8 pairs of chaetulae laterales. The epipharyngeal area also has 3 to 4 pairs of spinules, a pecten composed of 3 teeth, many lateral setae, and a premandible. The premandible has a simple apex, except in the larvae of O. oliveri, where it is bifid (Fig. 117a).

There are five pairs of labral setae: the bifurcate SI, the robust and long SII, the slender SLII, and the peglike SIV and SV (Figs. 108a, b; 113a). In larval exuviae, the SV are often difficult to see because of their small size and location. The torma bears a pair of long, robust setae. Mozley (1970) called these setae the premandibular setae. However, they clearly arise from the torma (Fig. 108d). The antenna is typically 5-segmented, except in O. charensis, where it is 4-segmented. The tip of the terminal segment bears a minute sensillum (Fig. 108c), which Mozley (1970, fig. 5) figured for a species of Trissocladius. The accessory seta of the antenna (accessory stylus of Mozley 1970; Nebenstift of Strenzke 1960) is bowling pin-shaped (Fig. 111d). The sensory seta ("fb" seta of Mozley 1970; Sinnesborste of Strenzke 1960) is always present. The development of the Lauterborn organs, whether weak or robust, is a species character. The blade (main antennal seta of Mozley 1970) of the antenna is grooved (Fig. 117b), as first illustrated in a species of Clunio by Strenzke (1960, fig. 25). However, the grooves are not as clearly defined in larvae of O. (Orthocladius) as they are in larger larvae of chironomids.

Body Segments. The larva has 13 postcephalic segments

which bear several appendages and processes: a single pair of prolegs on segment I; a pair of posterior prolegs (posterior parapods of Mozley 1970), four anal gills (anal papillae of Mozley 1970), and a pair of procerci (preanal papillae of Mozley 1970) on segment XIII. Each procercus bears 6 to 8 long terminal setae and 2 short lateral setae.

TAXONOMY

Historical Review of the European Literature

The genus Orthocladius has been treated as a heterogeneous group, resulting in a rich European literature on "Orthocladius". Van der Wulp (1874) erected the genus Orthocladius on the basis of ten native species of Netherlands without designating a species as the type (see Nomenclatorial Problems). The generic diagnosis for Orthocladius was based on the characters which comprised bare wings, uni-colored legs, foretarsus shorter than tibia of the fore leg, and the straight or little curved Cu 2 vein of the wing. The earliest described species were O. rubicundus (Meigen 1818), O. oblidens (Walker 1856), and O. decoratus (Holmgren 1869), published under the generic name Chironomus. None of these species were included in Orthocladius by van der Wulp (1874, 1877).

In the next few years, the name Orthocladius appeared in lists (Lundbeck 1898; Theobald 1892; Verrall 1901), a catalogue (Kertész 1902), new species descriptions (Kieffer 1899), and faunal works with new species descriptions (Lundström 1910, 1916).

Kieffer (1906a) revised the genus Orthocladius to include four subgenera (Orthocladius, Trichocladius, Psectrocladius, and Dactyloccladius) based on characters which comprised bare or hairy eyes, the presence or absence of pulvilli, leg and body lengths, and the size and shape of the empodium. He included characters for the larvae and pupae of Orthocladius. Kieffer (1906a) designated Orthocladius sordidellus Zetterstedt as the type of the subgenus Orthocladius (see Nomenclatorial Problems). In a later paper, Kieffer (1906c) designated the type species of the other

subgenera.

In the next few decades, Kieffer described many new species of Orthocladus without figures (1915, 1921a, 1923a, 1923b, 1924a, 1924b, 1925a, 1925b, 1926, 1929); with figures (1906b, 1912, 1921c; Kieffer and Thienemann 1906); in keys without figures (1909, 1911); in keys with figures (1919a, 1922); and made passing notes on known species in short papers (1919b; Kieffer and Thienemann 1908/1909).

Edwards studied the adults of Orthocladus from northern Europe, and he provided distribution records (1923, 1935a, 1937), and lists with descriptions and figures (1922, 1924). In his classic monograph, Edwards (1929) proposed a classification for Orthocladus under the generic name Spaniotoma (see Nomenclatorial Problems). Edwards (1929) treated Kieffer's (1906a) subgenera of Orthocladus as subgenera of Spaniotoma, except for Dactylocladius, which Edwards placed as Group D of S. (Orthocladus). The subgenus S. (Orthocladus) consisted of six groups, of which Orthocladus (s. str.) was Group C. The Group C of Edwards (1929) contain species recognized today as belonging to the four subgenera of Orthocladus.

In 1932 Goethghebuer published a large faunal study in which he treated Orthocladus as a genus consisting of five subgenera (Chaetocladus, Orthocladus (s. str.), Heterotanytarsus, Dactylocladius, and Pseudorthocladus). His diagnosis for Orthocladus (s. str.) followed that used for Group C by Edwards (1929). Goethghebuer published new species descriptions of Orthocladus in short papers (1931a, 1934a, 1934b, 1934c, 1937,

1938, 1940, 1941a, 1941b, 1941c, 1942, 1948; Goethghebuer and David 1939); in thirteen short notes (1931b-1949); and in a note (1936). Goethghebuer also gave distributional records for known species (1950; Goethghebuer and Lindroth 1931). Later Goethghebuer (1942), in his treatment of the palearctic Orthoclaadiinae, included seven subgenera in the genus Orthocladus (Chasmatonotus, Chaetocladus, Eudactylocladus, Pseudorthocladus, Ivetenia, Orthocladus, and Amblyocladus). He synonymized Dactylocladus with Orthocladus (s. str.). Goethghebuer (1942) recognized 127 species in Orthocladus (s. str.), and he included short notes and figures for some species. His diagnosis for Orthocladus (s. str.) follows his 1932 paper.

Orthocladus (Orthocladus) was later mentioned in lists (Gigja 1945; Kloet and Hincke 1945), in a short paper with descriptions of new species (Marcuzzi 1949), and in a key (Coe 1950).

During the same period, many dipterists were studying the immature stages of Orthocladus. Potthast (1915) published the first major work on the immature stages of Orthocladus under the name Orthocladus-Dactylocladus saxicola group, in which he provided larval and pupal descriptions of five species. Thienemann (1916, 1919, 1944, 1958) and his school (Thienemann and Harnisch 1933; Thienemann and Kruger 1937; Zavřel 1942) made similar studies, and these resulted in a classification for Orthocladus different from that based on the adults. Thienemann (1935) erected the subgenera Euorthocladus, Eudactylocladus, and Rheorthocladus, and separated them on the characters that comprised the color of the head capsule, size of the Lauterborn organs, the number of

teeth on the labial plate, and the shape and size of the labral setae of the larvae, and the spine patterns and shape of the thoracic horn of the pupae. Later, Thienemann (1936b, 1944) raised these subgenera to generic status. This classification did not agree with the classification based on the adults by Kieffer (1906a), Edwards (1929), and Goethghebuer (1932, 1942). Many of Thienemann's works were habitat studies which provided ecological information for various European species (1916, 1919, 1936, 1937, 1941, 1958).

Edwards (1937) provided the first example of a "pupal species" when, failing to separate the adult of Orthocladius abiskoensis from the adult of O. rubicundus, he used pupal characters in separating these two species. Brundin (1956, p. 103) cited this example of incongruity between the classification based on adults and that on immature stages of Orthocladius, and he concluded that the status of O. abiskoensis remains uncertain.

Thienemann (1944) published the first comprehensive key to the immature stages of Orthocladius species. Chervnoskii (1949) provided a key to the larvae of Orthocladius species occurring in Russia, and gave short descriptions and ecological notes. Pankratova (1970) published a key to larvae and pupae of Orthocladius species, and synonymized many of the species proposed by Chervnoskii (1949). More recently, Bryce and Hobart (1972) published a key to the larvae of British chironomids which included several species of Rheorthocladius (Orthocladius).

Hennig (1950) dealt with the larvae and pupae of Orthocladius, based on the literature then available, i.e. he relied

heavily on the work of Thienemann (1944).

Thienemann (1954), in his compendium on chironomids, presented the ecological information known for the genera Orthocladius, Rheorthocladius, Euorthocladius, Eudactylocladius, and Dactylocladius.

Brundin (1947) included the genera Orthocladius, Dactylocladius, and Eudactylocladius in his study of the adult chironomids of Sweden. He described three new species of Orthocladius, and included in this genus some species now recognized as members of the subgenera Pogonocladius and Euorthocladius. Later, Brundin (1949) found the immature and adult stages of Orthocladius species in and around Swedish lakes. In his comprehensive work on the systematics of the Orthoclaadiinae, Brundin (1956) included the subgenera Orthocladius (s. str.), Eudactylocladius, and Euorthocladius within the genus Orthocladius, and erected a new subgenus Pogonocladius. He separated the adult stages of Orthocladius species on the basis of the structure and setation of the antepronotum, the arrangement of the scutellar setae, the shape of the antenna, the structure of the hypopygium, the shape of the anal lobe of the wing, and the presence or absence of the fore tarsal beard. Brundin (1956) described one new species and recorded eleven species of Orthocladius (Orthocladius) from Sweden.

Recently, the name Orthocladius (Orthocladius) has been mentioned in a checklist (Fittkau et al 1967), and in ecological works (Oliver 1962; Reiss 1968; Saether 1968; Ertolva 1970; Fahy 1973; Weiderholm 1974a, b).

Historical Review of the North American Literature

In North America Orthocladus (Orthocladus) attracted the attention of early dipterists in state faunal surveys. Johannsen (1905) described two new species from New York, Orthocladus sordens and O. obumbratus. He provided a key to species, separating adults primarily on the basis of color and size. Malloch (1915) described two new species from Illinois, Orthocladus nigritus and O. lacteipennis (= mallochii), and included a description of O. obumbratus. He treated Orthocladus as a large genus with six subgenera (Orthocladus, Trichocladus, Psectrocladius, Trissocladus, Dactyloccladius, and Diploccladius) following Kieffer (1906a, 1908b). Malloch probably understood Orthocladus (Orthocladus) as a bare eyed, bare winged, dark orthoclad with indistinct pulvilli. Malloch pointed out (p. 521) the variation problem within Orthocladus (Orthocladus).

In the next few decades many references referring to the above species of Orthocladus appeared in local faunal lists (Winn and Beaulieu 1915; Cole and Lovett 1921; Leonard 1928; Petch and Maltais 1932); a museum list (Frison 1927); and in a short paper with a key (Johannsen 1947). Johannsen (1937) published a study on the immature stages of Orthocladus (Orthocladus) under the name Spaniotoma (Rheorthocladus). He included Thienemann's subgenera (Euorthocladus, Eudactyloccladius, and Rheorthocladus) in the genus Orthocladus, and provided a key to the larvae, pupae, and adults of Orthocladus obumbratus and the European species O. saxicola Kieffer and O. oblidens (Walker).

Arctic and northern species of Orthocladus (Orthocladus)

soon interested European and North American dipterists. Malloch (1923) recorded O. obumbratus from the Pribiloff Islands; Kieffer (1926) described the new species O. nanseni from arctic North America; Remy (1928) recorded O. decoratus from Greenland; Edwards (1933) recorded O. oblidens from Hudson Straits; Goethghebuer (1933) described the new species O. groenlandensis and recorded O. decoratus from eastern Greenland. Andersen (1937) brought together all the species of arctic Orthocladius in his key to the adults. He followed Goethghebuer's (1932) classification of the genus which included five subgenera (Chaetocladius, Orthocladius, Heterotanytarsus, Dactylocladius, and Pseudorthocladius). Andersen's key was based heavily on the literature then available. Consequently, many of the 18 species of Orthocladius (s. str.) recognized by Andersen belong to the other three subgenera of Orthocladius recognized today. Henriksen (1939) recorded 19 species of Orthocladius from eastern Greenland, following the classification of Goethghebuer (1932). Of these, I consider three species as belonging to O. (Orthocladius). More recently, Oliver (1962) compared the northern distribution of Orthocladius decoratus with that of O. trigonolabis and other northern species. Oliver (1963) recorded Orthocladius decoratus from Ellesmere Island, and later Oliver and Danks (1972) made an ecological study of this population. Welch (1973) conducted a detailed ecological investigation on two species of O. (Orthocladius) in an arctic lake.

Johannsen (1952) provided a key to the adults of O. (Orthocladius) occurring in Connecticut under the name Hydrobaenus

(Hydrobaenus). Johannsen (1952) retained the seven subgenera of Edwards (1929), and the subgeneric characters he used for Orthocladius follow that used by Edwards (1929) and Goethghebuer (1932, 1942).

Roback (1957a) described three new species of O. (Orthocladius) from Pennsylvania under the name Hydrobaenus group Rheorthocladius, and provided a key to species and ecological information. His concept of species was based both on immature and adult characters, and combined the classifications of Goethghebuer (1942), Johannsen (1952), and Hennig (1950).

Sublette and Sublette (1965) catalogued the North American species of Orthocladius. This list was greatly modified by the subsequent museum works of Sublette (1966, 1967a, 1967b, 1970). Sublette redescribed the type specimens originally described by Johannsen, Malloch, and Coquillett; placed O. bifasciatus Malloch in incertae sedis; and described the new species Orthocladius currani from misidentified type material. Sublette (1966, 1967b, 1970) also provided a table comparing adult characters for similar species of Orthocladius (Orthocladius).

Cole (1969) included Orthocladius, as well as Hydrobaenus, Camptocladius, and Spaniotoma, in the genus Hydrobaenus Fries. He listed the western localities of species of Orthocladius (Orthocladius) taken from the literature.

Hamilton, Saether and Oliver (1969) provided an outline of the classification of Chironomidae, which included Orthocladius (Orthocladius), based on the major European and North American literature as well as on the observation of reared specimens.

They combined the characters of larvae, pupae and adults, and their approach largely agreed with the adult classification of Brundin (1956).

Saether (1969) described four new species of O. (Orthocladius) from Canada, following the classification of Hamilton, Saether, and Oliver (1969). He recorded O. obumbratus from Alberta.

More recently the name Orthocladius (Orthocladius) has appeared in the North American literature in ecological surveys (Saether 1970; Spence and Hynes 1971), a detailed ecological investigation (Coffman 1973), and a state faunal survey (Hudson 1971).

In addition to the literature cited above, references to the North American genus Orthocladius have appeared in various catalogues (Aldrich 1905; Smith 1910; Curran 1934), local faunal lists (Henriksen and Lundbeck 1917; Britton 1920; Brimley 1938), a report (Malloch 1919), short papers with descriptions (Johannsen 1942; Roback 1959; Oliver 1970), a type list (Coquillett 1910), state faunal reports (Wirth and Stone 1956; Iovino 1966), and ecological investigations (Miller 1941; Oliver 1968; Iovino and Miner 1970; Danks and Oliver 1972; Dendy 1971).

Nomenclatorial Problems

There have been three major nomenclatorial problems that affected the name Orthocladius in the years following the erection of the genus by van der Wulp (1874).

Edwards (1929) examined the closely related genera then recognized (Diplocladius, Limnophyes, Eukiefferiella, Smittia,

Trichocladius, Psectrocladius, Orthocladius), and had difficulty finding clearcut characters to separate them. Edwards concluded that these genera should be reunited as subgenera under Spaniotoma Philippi (1865), the oldest generic name which represented this group. Edwards admitted that the type species Spaniotoma bivittata could possibly prove to be a member of Psectrocladius, or of the vitripennis group of Cricotopus. Later, Edwards (1932) concluded that the type species Spaniotoma bivittata was closely related to either Psectrocladius turfaceus Kieffer or to Dactylocladius curtistylus Goethghebuer.

Goethghebuer (1932, p. 1) stated that he did not understand why Edwards suppressed the name Orthocladius, and pointed out that the type specimen of Spaniotoma was a problem.

Brundin (1956) convincingly argued that Spaniotoma Philippi should be considered a nomen nudum*. The diagnosis by Philippi was based on the females of two species from Chile. Brundin interpreted from the diagnosis that Philippi considered Spaniotoma as a gall gnat genus. Philippi's description and illustration of Spaniotoma bivittata show that at the time of the description, he had some light colored specimens of Orthoclaadiinae before him. Brundin also pointed out that the Cu2 vein is curved in Psectrocladius turfaceus and Dactylocladius curtistylus, whereas Philippi's drawing shows that the Cu2 vein is straight in Spaniotoma bivittata. The situation is further complicated by the loss of Philippi's original material, so that the precise definition of the genus Spaniotoma can never be established, except by a ruling of the ICZN.

*However, as Roback (1957a, p. 54) pointed out, if we follow the rules of nomenclature, Spaniotoma should be a nomen dubium.

Several dipterists used the name Spaniotoma in Europe (Pagast 1931, 1933; Edwards 1933, 1935a, 1935b) and in North America (Malloch 1934; Johannsen 1937; Miller 1941).

A more serious problem arose in the synonymy of Orthocladius with Hydrobaenus. Fries, discussed fully in Brundin (1956). Fries (1830) erected the genus Hydrobaenus based on the species H. lugubris. Edwards (1940) was the first to deal with the problem of synonymy of Orthocladius with Hydrobaenus, provoked by the report of Thienemann (1935). Thienemann (1935) found that the early stages of Hydrobaenus lugubris Fries and Trissocladius brevipalpis Kieffer were morphologically similar to those of Orthocladius grandis Kieffer and Dactylocladius distylus Kieffer. He concluded that they should be assigned to the genus Trissocladius. (Brundin correctly pointed out that the rules of priority would require the adoption of the earlier name Hydrobaenus.) Edwards (1940) examined the adults of these four species and was unable to separate Trissocladius from Orthocladius. Consequently, he regarded Orthocladius at best as a subgenus of Hydrobaenus. However, as Brundin pointed out, Edwards' conclusion was partly based on the faulty assumption that "Orthocladius" grandis* Kieffer, a typical Trissocladius, was identical with Orthocladius glabripennis Goethghebuer.

Earlier, Goethghebuer (1932) considered Trissocladius greiseipennis Goethghebuer as synonymous with the two species Trissocladius praticola Kieffer and Hydrobaenus lugubris Giard non

*See Mozley (1970) for a detailed discussion on the nomenclature of Trissocladius grandis (K.).

Fries, and he synonymized Hydrobaenus Fries with Trissocladius. Brundin (1956) noted that this identification was made without an examination of the type specimens of Hydrobaenus lugubris, and later, Goethghebuer (fide Brundin) himself considered that his synonymy was doubtful. Nonetheless, Goethghebuer (1942, p. 207) retained the above synonymy and treated Hydrobaenus as a doubtful genus which included two species, H. lugubris Fries and H. glacialis Lundström. Brundin (1956) suggested that Goethghebuer (1942) must have been unaware of Edwards (1940) who stated: "If Thienemann is correct in his conclusions, the consequence must be that the name Orthocladius will fall as a synonym of Hydrobaenus; and further, if the genus is to be understood in the wide sense in which I employed it in 1929, Spaniotoma Philippi will also become a synonym, and the various subgenera of Spaniotoma will have to be placed under Hydrobaenus".

Brundin (1956) examined the original specimens as well as new material of Hydrobaenus lugubris Fries, which revealed that both Goethghebuer (1932) and Edwards (1940) had recognized the species correctly, and assumed correctly that Hydrobaenus was closely related to Trissocladius Thienemann. In Brundin's opinion, Hydrobaenus Fries should be considered as a separate genus based on the striped paralabial plates of the larvae, and the mesosternal setae and anteprenotal structure of the adult, in spite of the great resemblance between the pupae of Trissocladius and Hydrobaenus. He proposed to maintain Trissocladius and Orthocladius as valid genera. Recently, Mozley (1970) reexamined the taxonomic position of Hydrobaenus lugubris Fries. He feels that to satisfactorily

resolve this problem his specimens must be compared with those examined by Brundin (1956).

Several dipterists used the name Hydrobaenus in Europe (Kloet and Hincks 1945; Coe 1950) and in North America (Johannsen 1947, 1952; Wirth and Stone 1956; Roback 1957a, 1959).

The problem of the proper designation of the type species of the genus Orthocladius has not been resolved. Two different names have been designated as the type species (Kieffer 1906a; Coquillett 1910), both of which do not belong to the genus Orthocladius as currently defined. Recent workers (Brundin 1956; Sublette and Sublette 1965; Cole 1969) have accepted Edwards' (1929) proposal that Orthocladius oblidens (Walker) should be accepted as the type species. For a discussion of the problem, see Edwards (1929). I have examined and described the holotype of O. oblidens. An application is being made to the International Commission on Zoological Nomenclature for acceptance of the designation of Orthocladius oblidens (Walker) as the type species of the genus Orthocladius.

Genus Orthocladius van der Wulp

Orthocladius van der Wulp, 1874. Kertész, 1902. Johannsen, 1905.

Kieffer, 1906a. Malloch, 1915. Goethghebuer, 1932.

Andersen, 1937. Henriksen, 1939. Goethghebuer, 1942.

Brundin, 1947. Chervnoskii, 1949. Freeman, 1956. Sublette and Sublette, 1965. Pankratova, 1970. (partim)

Spaniotoma (Orthocladius) Philippi, Edwards, 1929. Johannsen, 1937. (partim)

Rheorthocladius Thienemann, 1935. Thienemann, 1944.

Hydrobaenus Fries, Coe, 1950. Johannsen, 1952. Wirth and Stone, 1956. Roback, 1957a. Cole, 1969. (partim)

Orthocladus van der Wulp, Brundin, 1956. Fittkau, Schlee and Reiss, 1967. Hamilton, Saether and Oliver, 1969.

Type of Genus: application to the ICZN is being made for acceptance of O. oblidens (Walker) as the type species.

Remarks. Adult males of the genus Orthocladus are similar in general appearance to those of Chaetocladus, Psectrocladius, and Trissocladus. Orthocladus can be distinguished from them by a combination of characters: barely to moderately punctate wings, absence of pullvilli, shape of antepnotum, and genitalic features.

Van der Wulp (1874) named the genus Orthocladus on the basis of the straight or slightly curved Cu2 vein of the wing. The Cu2 vein in Orthocladus is slightly curved, and its apex curves parallel to the wing margin (Figs. 12, 13), as pointed out by Edwards (1929, p. 335). This is a reliable character for separating Orthocladus from some genera.

Brundin (1956) used the dorsal extensions of the eyes as a generic character of Orthocladus. I do not consider the eyes as being extended far medially in Orthocladus. Brundin (1956) separated the adults of Orthocladus from those of Trissocladus on the basis of the degree of separation of the antepnotal lobes. According to Brundin, in Orthocladus the lobes are joined along a median suture, whereas in Trissocladus, the lobes are widely separated. I have examined the dorsal aspect of specimens which are both pinned and in alcohol, and I have been unable to use this

character to separate these two genera. Saether (1969) found that the shape and position of the anteprenotal lobes varies within the genus Trissocladius.

The pupae of Orthocladius can be distinguished from the pupae of the above genera by the absence of swim hairs on the anal lobe. Hirvenoja (1973) found that the one character that sometimes distinguishes the pupae of Orthocladius from those of the Cricotopus-group is the more robust (thick) development of the dorsocentral setae in Orthocladius.

The larvae of Orthocladius can be distinguished from those of Chaetocladius, Psectrocladius, and Trissocladius by the bifurcate SI of the labrum. Hirvenoja (1973) could not find any character that separates all the larvae of the Cricotopus-group from those of Orthocladius, and neither could I.

Diagnosis of the Genus Orthocladius van der Wulp

MALES

Small to large size; usually brown or black, sometimes yellow. Eyes bare. Verticals extended from eye to midline of head. Palps 5-segmented. Antenna with 13 flagellomeres. A.R. usually more than 1.00 and less than 3.50. Wing bare, finely to moderately punctate; squama with fringe; anal lobe weakly to strongly rounded and produced; Costa extended or not extended beyond R4+5; Cu2 almost straight; V.R. usually more than 1.00, rarely less than 1.00. Anteprenotum collarlike; each anteprenotal lobe robust or narrowed medially; median anteprenotal setae absent. Acrostichals usually present, rarely absent, anteriorly begin close to anteprenotum. Scutellars present. Pulvilli absent, empodium

small, bristlelike. Hind tibia with comb. Anal point haired, apex rounded or pointed. Virga present or absent. Basal lobe well to poorly developed. Basal median lobes of gonocoxite collarlike or triangular in shape. Gonostylus simple, with single apical tooth.

FEMALES

Antenna with five flagellomeres, apical flagellomere without stiff apical seta. Wing moderately punctate; inner margin of anal lobe straight proximally, slightly rounded distally, and not produced; setae line basal half of inner margin. Lateral sternite IX with protuberance or projection. Tergite IX narrow or broad, its margins well or poorly delimited. Spermathecal duct straight or looped; two pear-shaped spermathecae.

PUPAL EXUVIAE

Golden to light brown. Frontals weak to robust and usually present. Thoracic horn usually present, rarely absent; highly variable in shape; round to oval, long and narrow to short and wide; bare or spine-covered. Frontal tubercles prominent or not. Anterior area along eclosion line smooth, wrinkled, or bumpy. Anal lobe bare or with spurs; 3 terminal setae usually present; swim hairs never present, sometimes thin chitinous threads present. Pedes spurii B usually present on tergite II and sometimes on tergite III; pedes spurii B is usually a bare conspicuous process, sometimes covered with minute protuberances; sometimes a whorl of spines. Pedes spurii A present or absent on sternites IV-VII. Tergites with robust spine patterns, often with conspicuous aggregations or rows of robust spines; tergite II sometimes with elliptical patch of

recurved spines posteromedially. Sternites usually with patterns of fine spines, sometimes bare.

LARVAE

Body usually green, sometimes white; head capsule yellow to dark brown; occipital margin and mouthparts darker. Eyespot dark, bipartite or tripartite. Labial plate convex or triangular in shape; 13 to 15 teeth (cf. Thienemann 1944, 19 teeth). Mandible with outer margin smooth or crenulate; 4 true teeth and 1 false tooth, dark; brush with 6 to 8 setae, most apices serrate.

Epipharynx with 3-toothed pecten, 4 to 8 chaetae laterales, 2 chaetae basales, 3 to 4 spinules; ungula U-shaped; premandible simple or bifid; SI bifurcate; SII long, robust or weak; SIII small and weak; SIV small and peglike; SV like SIV but smaller. Antenna 4- or 5-segmented. Lauterborn organs weak to robust; blade, sensory seta, and accessory seta present. Anal papilla with 6 to 7 terminal setae, 1 to 2 lateral setae. Anal gills number 4, sometimes 2 of them larger than other 2; apex rounded or triangular in shape.

Key to the Nearctic Subgenera of Orthocladus van der Wulp

MALES

1. Gonocoxite with well developed basal lobe (Fig. 22), ... 2
     Gonocoxite without well developed basal lobe (Fig. 21) . . . .
     . . . . . Eudactylocladius Thienemann
2. Fore leg with tarsal beard (Fig. 15b). . Pogonocladus Brundin
     Fore leg without tarsal beard. 3
3. Scutellars usually multiserial (Fig. 10c); anal point
     usually robust, with apex rounded (Fig. 20). . . . .
     . . . . . Euorthocladus Thienemann

Scutellars usually uniserial (Fig. 10a); anal point usually moderately developed, with apex pointed (Fig. 23). . . . .
 . . . . . Orthocladus van der Wulp (Kieffer)

FEMALES

1. Spermathecal duct with at least one U-shaped loop (Figs. 58, 59). 2
 Spermathecal duct straight, not looped (Figs. 57, 60). . . . 3
2. Tergite IX narrow, bandlike; loop short (Fig. 58). . . . .
 . . . . . Euorthocladus Thienemann
 Tergite IX broad, platelike; loop extensive (Fig. 59). . . . .
 . . . . . Eudactylocladus Thienemann
3. Tergite IX narrow, sometimes broad and with distinct, darkened margins (Fig. 57). . . . Orthocladus van der Wulp (Kieffer)
 Tergite IX very broad, platelike, and with indistinct, non-darkened margins (Fig. 60). . . . . Pogonocladus Brundin

PUPAL EXUVIAE

1. Anal setae absent (Figs. 105, 105) 2
 Anal setae present (Fig. 92) 4
2. Anal lobe with spurs (Fig. 105). . . . .
 . . . . . Euorthocladus Thienemann Type II
 Anal lobe bare (Fig. 106) 3
3. Tergites IV to VII with row of strong straight spines along posterior margin (Fig. 95). Euorthocladus Thienemann Type I
 Tergites IV to VII without row of strong straight spines along posterior margin. . Euorthocladus Thienemann Type III
4. Thoracic horn oval and robust (Fig. 80b); tergites III to VII with two central clumps of robust spines (Fig. 99) . . . . .
 . . . . . Pogonocladus Brundin

Thoracic horn not oval and robust (Figs. 80a, d); tergites

III to VII without two central clumps of robust spines . . . 5

5. Tergite II with patch of recurved spines posteromedially

(Fig. 92). . . . . Orthocladus van der Wulp (Kieffer)

Tergite II without patch of recurved spines posteromedially .

. . . . . Eudactylocladius Thienemann

LARVAE

1. Labial plate with 13 teeth. 2

Labial plate with more than 13 teeth . . . . .

. . . . . Euorthocladus Thienemann (part)

2. Head capsule yellow . . . Orthocladus van der Wulp (Kieffer)

Head capsule not yellow 3

3. Antenna 4-segmented, Lauterborn organs minute (Fig. 111a) .

. . . . . Pogonocladus Brundin

Antenna 5-segmented, Lauterborn organs not minute (Figs.

111b, c). 4

4. Head capsule dark brown. . . . . Eudactylocladius Thienemann

Head capsule light brown. . . Euorthocladus Thienemann (part)

Subgenus Eudactylocladius Thienemann

Figs. 21, 59, 80d, 98, 111c, 128

Eudactylocladius Thienemann 1935, p. 206.

Type of Subgenus: Orthocladus fuscimanus Kieffer, designated by

Thienemann (1935, p. 206).

Remarks. The adults, pupal exuviae, and larvae of O. (Eudactylocladius)

are easily distinguished from those of the other subgenera of

Orthocladus by the characters provided in the keys. Although this

subgenus is represented by numerous European species, there have

been relatively few species recorded for North America. The material available to me contained only two or three species, and this should be considered in interpreting the data presented here. Brundin (1956) distinguished the adults of O. (Eudactylocladius) from the adults of the other subgenera on the basis of the few, weak lateral anteprenotals and the club-shaped apical flagellomere of the antenna. However, I have found that these characters are not valid for the North American species.

Diagnosis of the Subgenus Orthocladius (Eudactylocladius)

MALES

Small to medium size; brown. Apex of antenna usually enlarged; A.R. more than 1.00, less than 2.00. Wing finely to moderately punctate; anal lobe rounded or straight, not produced; Costa-extended or not extended beyond R4+5, apex distal to apex of Cul; V.R. more than 1.00. Anteprenotal lobe robust or narrowed medially; lateral anteprenotals weak, 1 to 5 present. Scutellars usually uniserial, rarely biserial. Anal point well developed, short to medium in length, apex pointed. Virga absent. Basal lobe and basal median lobes of gonocoxite not well developed (Fig. 21).

Subgenus Eudactylocladius (Males)

VARIABLE	SAMPLE SIZE	MEAN	RANGE		VARIANCE
			MIN	MAX	
WING	25	2334.00	1900.00	2875.00	.1057 x 10 ⁶
ARM	25	933.00	725.00	1175.00	.2066 x 10 ⁵
AFCU	25	1012.00	825.00	1300.00	.2464 x 10 ⁵
R	25	10.72	7.00	18.00	.7377 x 10 ¹
SQUM	25	13.36	8.00	19.00	.9407 x 10 ¹
PI	25	33.00	20.00	50.00	.5208 x 10 ²

VARIABLE	SAMPLE SIZE	MEAN	RANGE		VARIANCE
			MIN	MAX	
P2	25	47.80	40.00	60.00	.4183 x 10 ²
P3	25	118.80	100.00	145.00	.2173 x 10 ³
P4	25	103.40	80.00	130.00	.1515 x 10 ³
P5	24	147.08	90.00	200.00	.7237 x 10 ³
EYE	22	292.50	255.00	365.00	.6661 x 10 ³
VERT	25	11.52	9.00	16.00	.3510 x 10 ¹
ETM	25	0.08	0.00	1.00	.7667 x 10 ¹
CLYP	25	8.80	6.00	15.00	.3833 x 10 ¹
PROL	25	2.56	1.00	5.00	.1007 x 10 ¹
AC	25	12.92	8.00	19.00	.8993 x 10 ¹
DC	25	11.08	6.00	14.00	.5077 x 10 ¹
PA	25	4.72	3.00	7.00	.1377 x 10 ¹
SC	25	10.76	8.00	18.00	.5940 x 10 ¹
ANSU	25	288.00	230.00	370.00	.1667 x 10 ⁴
ANT3	25	442.40	380.00	500.00	.1202 x 10 ⁴
ANTT	25	528.40	430.00	710.00	.5947 x 10 ⁴
BASI	25	239.60	190.00	300.00	.8790 x 10 ³
DISI	25	88.40	70.00	120.00	.2140 x 10 ³
FF	25	766.00	625.00	925.00	.9577 x 10 ⁴
FT	25	890.00	675.00	1100.00	.1854 x 10 ⁵
FTA1	25	608.00	500.00	750.00	.5350 x 10 ⁴
FTA2	25	371.00	300.00	450.00	.1910 x 10 ⁴
FTA3	25	255.00	200.00	325.00	.1354 x 10 ⁴
FTA4	25	166.00	125.00	200.00	.5146 x 10 ³
FTA5	25	121.00	100.00	150.00	.3479 x 10 ³
MF	25	798.00	675.00	1000.00	.9944 x 10 ⁴
MT	25	794.00	625.00	1000.00	.1210 x 10 ⁵
MTA1	25	355.00	275.00	450.00	.2500 x 10 ⁴
MTA2	25	225.00	200.00	275.00	.8854 x 10 ³
MTA3	25	167.00	125.00	200.00	.4542 x 10 ³
MTA4	25	108.00	100.00	150.00	.2458 x 10 ³
MTA5	25	108.00	100.00	125.00	.1417 x 10 ³
HF	25	881.00	750.00	1075.00	.1173 x 10 ⁵
HT	25	975.00	800.00	1225.00	.1734 x 10 ⁵

VARIABLE	SAMPLE SIZE	MEAN	RANGE		VARIANCE
			MIN	MAX	
HTA1	25	518.00	425.00	650.00	.4454 x 10 ⁴
HTA2	25	297.00	250.00	375.00	.1840 x 10 ⁴
HTA3	25	227.00	175.00	275.00	.9333 x 10 ³
HTA4	25	137.00	100.00	200.00	.5271 x 10 ³
HTA5	25	124.00	100.00	150.00	.2333 x 10 ³
COMB	24	10.63	9.00	13.00	.1288 x 10 ¹
TH	23	1081.52	900.00	1375.00	.2280 x 10 ⁵
AB	25	2385.00	2050.00	3275.00	.1002 x 10 ⁶
WW	25	693.00	550.00	850.00	.7110 x 10 ⁴
WR	25	3.37	3.07	3.61	.2688 x 10 ⁻¹
BL	23	3481.52	2975.00	4575.00	.2184 x 10 ⁶
AR	25	1.19	1.00	1.66	.2369 x 10 ⁻¹
VR	25	1.08	1.03	1.14	.9009 x 10 ⁻³
HR	25	2.75	2.11	3.75	.1301 x 10 ⁰
HV	23	3.94	3.25	4.78	.1456 x 10 ⁰
FLR	25	.69	.54	.84	.3762 x 10 ⁻²
FSV	25	2.73	3.35	3.52	.5411 x 10 ⁻¹
FBV	25	2.48	2.24	2.88	.2051 x 10 ⁻¹
MLR	25	.45	.40	.48	.4258 x 10 ⁻³
MSV	25	4.50	4.13	5.00	.5009 x 10 ⁻¹
MBV	25	3.20	3.00	3.67	.2178 x 10 ⁻¹
HLR	25	.53	.43	.74	.2913 x 10 ⁻²
HSV	25	3.60	2.50	4.35	.1055 x 10 ⁰
HBV	25	3.03	2.39	3.29	.3563 x 10 ⁻¹
BR	23	2.22	2.02	2.52	.1238 x 10 ⁻¹

FEMALES

Tergite IX broad, platelike, with margins well delimited.

Spermathecal duct extensive, with one or more loops; distal portion of duct sometimes enlarged (Fig. 59).

PUPAL EXUVIAE

Golden. Frontals weak. Thoracic horn a small, bare, ovoid structure on a short stalk (Fig. 80d). Anterior area along eclosion

line smooth and platelike. Anal lobe bare; three terminal setae present. Pedes spurii B on tergite II whorl of spines; pedes spurii A present on sternites IV to VII. Tergites II to VII with two well separated clumps of strong spines centrally (Fig. 98); rest of tergite with patterns of coarse spines.

LARVAE (4th INSTAR)

Head capsule dark brown, occipital margin and mouthparts darker; square in shape. Labial plate (Fig. 128b) convex in shape; 13 teeth. Mandible (Fig. 128a) with outer margin smooth, 4 true teeth and 1 false tooth, dark; brush with 7 setae, apices serrate. Epipharynx with 3-toothed pecten, ?4 chaetulae laterales, 2 chaetulae basales, ? spinules; ungula V-shaped; premandible simple or bifid; SI bifurcate. Antenna (Fig. 111c) dark, 5-segmented; Lauterborn organs robust; blade, robust accessory seta, and sensory seta present. Procercus with 7 terminal and 2 lateral setae. Anal gill long, with apex rounded in shape.

Subgenus Euorthocladius Thienemann

Figs. 20, 58, 80c, 80e, 95, 97, 105, 106, 111b, 124, 125, 126
Euorthocladius Thienemann 1935, p. 201.

Type of Subgenus: Orthocladius thienemanni Kieffer, designated by Thienemann (1935, p. 201).

Remarks. Brundin (1956) distinguished the adults of O.

(Euorthocladius) from those of O. (Orthocladius) on the basis of hypopygial characters and the different setal arrangements of the scutellum, i.e. uniserial in O. (Orthocladius) and multiserial in O. (Euorthocladius). However, I have examined a reared male of O. (Euorthocladius) which has uniserial scutellars, In O.

(Euorthocladius), the anal point is usually rounded at the tip, while in O. (Orthocladius) it is usually pointed. Only one type of virga (Fig. 18) occurs in males of O. (Euorthocladius), while both this type and the other type (Fig. 19) occur in males of O. (Orthocladius). Admittedly, the males of these two subgenera are difficult to separate, and sometimes a combination of characters is necessary to distinguish them.

There are three pupal exuvial types in O. (Euorthocladius), and type II resembles the pupal exuviae of O. (Orthocladius).

There are three larval types of O. (Euorthocladius), and type I resembles the larvae of O. (Euorthocladius). These findings suggest that a revision of O. (Euorthocladius) is especially needed.

Diagnosis of the Subgenus Orthocladius (Euorthocladius)

MALES

Small to medium size; brown. A.R. more than 1.00, less than 2.00. Wing finely to moderately punctate; anal lobe rounded, weakly to moderately produced; Costa-extended or not extended beyond R4+5, apex usually distal, sometimes above or proximal to apex of Cul; R4+5 usually bare, sometimes setose. V.R. 1.00 or more than 1.00. Anteprenotal lobe robust or narrowed medially. Scutellars usually multiserial, sometimes biserial or uniserial. Anal point robust with apex rounded, or moderately developed with apex pointed or parallel-sided to tip. Virga present or absent. Basal lobe well developed, usually short and wide. Basal median lobes of gonocoxite collarlike or triangular in shape (Fig. 20).

Subgenus Euorthocladius (Males)

VARIABLE	SAMPLE SIZE	MEAN	RANGE		VARIANCE
			MIN	MAX	
WING	51	2387.25	1750.00	3425.00	.1876 x 10 ⁶
ARM	51	942.65	675.00	1450.00	.3118 x 10 ⁵
AFCU	51	1019.12	725.00	1475.00	.2724 x 10 ⁵
R	51	7.49	2.00	18.00	.9455 x 10 ¹
SQUM	51	23.51	13.00	43.00	.4454 x 10 ²
P1	51	38.24	25.00	55.00	.3982 x 10 ²
P2	51	63.04	50.00	85.00	.7308 x 10 ²
P3	51	123.53	85.00	200.00	.8245 x 10 ³
P4	47	101.38	75.00	155.00	.3442 x 10 ³
P5	46	155.21	110.00	250.00	.1398 x 10 ⁴
EYE	44	332.95	255.00	400.00	.1450 x 10 ⁴
VERT	51	14.65	8.00	26.00	.9113 x 10 ¹
ETM	51	1.49	0.00	3.00	.4949 x 10 ⁰
CLYP	51	12.78	6.00	27.00	.2177 x 10 ²
PROL	51	5.94	1.00	22.00	.1770 x 10 ²
AC	50	7.10	0.00	17.00	.1332 x 10 ²
DC	51	10.22	6.00	18.00	.8773 x 10 ¹
PA	51	5.59	3.00	15.00	.6287 x 10 ¹
SC	51	16.80	6.00	65.00	.1604 x 10 ³
ANSU	51	317.84	210.00	420.00	.1581 x 10 ⁴
ANT3	48	428.33	320.00	570.00	.3342 x 10 ⁴
ANTT	47	635.11	460.00	920.00	.9634 x 10 ⁴
BAS1	51	257.25	180.00	370.00	.1928 x 10 ⁴
DIS1	51	120.20	90.00	170.00	.3660 x 10 ³
FF	51	796.57	475.00	1150.00	.2090 x 10 ⁵
FT	51	975.98	725.00	1425.00	.2785 x 10 ⁵
FTA1	51	661.27	475.00	1050.00	.2536 x 10 ⁵
FTA2	51	448.53	325.00	650.00	.5960 x 10 ⁴
FTA3	51	304.90	225.00	475.00	.3476 x 10 ⁴
FTA4	51	186.76	125.00	275.00	.1409 x 10 ⁴
FTA5	50	135.00	100.00	175.00	.3571 x 10 ³
MF	51	868.63	625.00	1275.00	.2677 x 10 ⁵
MT	51	912.25	675.00	1375.00	.2758 x 10 ⁵

VARIABLE	SAMPLE SIZE	MEAN	RANGE		VARIANCE
			MIN	MAX	
MTA1	51	445.10	300.00	700.00	.1013 x 10 ⁵
MTA2	51	282.36	200.00	425.00	.3732 x 10 ⁴
MTA3	51	214.71	150.00	325.00	.2404 x 10 ⁴
MTA4	50	127.00	75.00	200.00	.1195 x 10 ⁴
MTA5	50	125.50	100.00	175.00	.3696 x 10 ³
HF	51	940.69	675.00	1350.00	.3285 x 10 ⁵
HT	51	1089.22	725.00	1625.00	.4236 x 10 ⁵
HTA1	49	604.08	350.00	950.00	.1850 x 10 ⁵
HTA2	49	362.76	250.00	550.00	.5264 x 10 ⁴
HTA3	49	276.02	175.00	400.00	.2759 x 10 ⁴
HTA4	49	153.57	75.00	250.00	.1771 x 10 ⁴
HTA5	49	139.29	100.00	200.00	.5208 x 10 ³
COMB	51	10.14	8.00	12.00	.7208 x 10 ⁰
TH	44	1194.89	875.00	1550.00	.2234 x 10 ⁵
AB	51	2482.35	1750.00	3825.00	.2036 x 10 ⁶
WW	47	719.15	525.00	975.00	.1126 x 10 ⁵
WR	47	3.30	3.00	4.03	.3442 x 10 ⁻¹
BL	44	3671.02	2650.00	5375.00	.3449 x 10 ⁶
AR	47	1.49	1.03	1.90	.3977 x 10 ⁻¹
VR	51	1.09	1.00	1.15	.1456 x 10 ⁻²
HR	51	2.14	1.79	2.50	.3426 x 10 ⁻¹
HV	44	3.07	2.60	3.64	.6186 x 10 ⁻¹
FLR	51	.67	.58	.98	.5183 x 10 ⁻²
FSV	51	2.72	1.85	3.09	.6179 x 10 ⁻¹
FBV	50	2.26	2.00	2.48	.8829 x 10 ⁻²
MLR	51	.48	.43	.58	.1142 x 10 ⁻²
MSV	51	4.04	3.41	4.67	.6706 x 10 ⁻¹
MBV	50	2.98	2.55	3.33	.3317 x 10 ⁻¹
HLR	49	.55	.48	.60	.7793 x 10 ⁻³
HSV	49	3.42	3.11	4.21	.3415 x 10 ⁻¹
HBV	49	2.85	2.65	3.13	.1315 x 10 ⁻¹
BR	44	2.06	1.82	2.47	.2785 x 10 ⁻¹

FEMALES

Tergite IX narrow, bandlike, with margins well delimited.

Spermathecal duct wrinkled along most of length, with small loop (Fig. 58).

PUPAL EXUVIAE

TYPE I. Golden. Frontals absent. Thoracic horn (Fig. 80c) minute, bare sphere on stalk. Anterior area along eclosion line wrinkled, or smooth and platelike. Anal lobe (Fig. 106) bare except for small dorsal seta on each lobe; terminal setae absent. Pedes spurii A and B absent. Tergites IV to VIII (Fig. 95) with row of robust posteriorly-directed spines along posterior margin.

TYPE II. Golden. Frontals weak. Thoracic horn (Fig. 80e) long, narrow, and bare. Anterior area along eclosion line wrinkled. Anal lobe (Fig. 105) covered with several rows of spurs; terminal setae absent. Pedes spurii B (Fig. 97) present on segments II and III, covered with minute protuberances. Pedes spurii A present on sternites IV to VII. Tergites with patchlike patterns of spines; tergite II with patch of recurved spines posteromedially.

TYPE III. Golden. Frontals absent. Thoracic horn absent. Anterior area along eclosion line wrinkled. Anal lobe bare except for small dorsal seta on lobe; terminal setae absent. Pedes spurii A and B absent. Tergites II to V with patch of recurved spines posteromedially.

LARVAE (4th INSTAR)

TYPE I. Head capsule brown; occipital margin and mouthparts darker. Labial plate (Fig. 124b) convex in shape; 13 teeth present. Mandible (Fig. 124a) with outer margin smooth; 4 true

teeth and 1 false tooth, dark; brush with 6 setae. Epipharynx with 3-toothed pecten, ? chaetulae laterales, 2 chaetulae basales, ? spinules; ungula U-shaped; premandible simple; SI bifurcate.

Antenna 5-segmented; Lauterborn organs robust; blade, accessory seta, and sensory seta present. Body characters not available.

TYPE II. Head capsule dark brown; occipital margin and mouthparts darker. Labial plate (Fig. 125b) convex in shape; 15 teeth present. Mandible (Fig. 125a) with outer margin deeply crenulate; 4 true teeth and 1 false tooth; dark; brush with ? setae. Epipharynx with 3-toothed pecten, ?4 chaetulae laterales, 2 chaetulae basales, 3 spinules; ungula V-shaped; premandible bifid; SI bifurcate. Antenna (Fig. 111b) 5-segmented; Lauterborn organs robust; blade, accessory seta, and sensory seta present. Procercus with 6 terminal and 1 lateral setae. Anal gill with apex rounded in shape.

TYPE III. Head capsule light brown, almost yellow; occipital margin and mouthparts darker. Labial plate (Fig. 126a) convex in shape; 13 teeth present. Mandible (Fig. 126b) with outer margin smooth; 5 true teeth, dark; brush with ? 6 setae. Epipharynx with 3-toothed pecten, ?4 chaetulae laterales, 2 chaetulae basales, 3 spinules; ungula V-shaped, with bridge; premandible simple with apex blunt; SI bifurcate. Antenna 5-segmented; Lauterborn organs robust; blade, accessory seta, and sensory seta present. Body characters not available.

Subgenus Pogonocladius Brundin

Figs. 14g, 15b, 22, 60, 80b, 99, 109, 111a, 127

Pogonocladius Brundin, 1956; p. 99.

Type of Subgenus: Orthocladius consobrinus (Holmgren), designated by Brundin (1956, p. 99).

Remarks. The subgenus O. (Pogonocladius) is based on a single species O. consobrinus, although in the material I have examined, there is possibly another species present. The adults, pupal exuviae and larvae of O. consobrinus closely resemble those of O. (Orthocladius) in morphological details, and can be distinguished by the characters in the key.

Diagnosis of the Subgenus Orthocladius (Pogonocladius)

MALES

Large size; dark brown or black; hairy. Temporals biserial to multiserial. A.R. more than 2.00, less than 3.50. Wing finely punctate; anal lobe (Fig. 14g) strongly rounded, produced; Costa extended beyond R4+5, apex distal to apex of Cu1. V.R. more than 1.00. Anteprepectal lobe robust. Scutellars usually uniserial, sometimes biserial. Fore tarsal beard present (Fig. 15b). Anal point robust, medium in length, apex pointed. Virga poorly developed. Basal lobe robust. Basal median lobes of gonocoxite collarlike in shape. Gonostylus with preapical bump on dorsal edge (Fig. 22).

Subgenus Pogonocladius (Males)

VARIABLE	SAMPLE SIZE	MEAN	RANGE		VARIANCE
			MIN	MAX	
WING	22	3226.14	2575.00	3925.00	.1302 x 10 ⁶
ARM	25	1307.00	1050.00	1550.00	.1977 x 10 ⁵
AFCU	23	1420.65	1150.00	1675.00	.2350 x 10 ⁵
R	25	8.52	3.00	13.00	.6177 x 10 ¹
SQUM	25	53.12	33.00	100.00	.2034 x 10 ³
P1	25	51.80	40.00	65.00	.5600 x 10 ²

VARIABLE	SAMPLE SIZE	MEAN	RANGE		VARIANCE
			MIN	MAX	
P2	25	78.00	65.00	100.00	.6667 x 10 ²
P3	24	150.00	115.00	170.00	.1304 x 10 ³
P4	24	130.42	110.00	150.00	.1694 x 10 ³
P5	24	197.50	180.00	225.00	.1739 x 10 ³
EYE	25	421.40	355.00	515.00	.2112 x 10 ⁴
VERT	25	13.12	8.00	25.00	.1494 x 10 ²
ETM	25	8.60	4.00	21.00	.1158 x 10 ²
CLYP	25	19.68	8.00	31.00	.4023 x 10 ²
PROL	24	12.79	7.00	30.00	.2530 x 10 ²
AC	25	2.24	0.00	8.00	.8440 x 10 ¹
DC	25	23.12	14.00	42.00	.4078 x 10 ²
PA	25	7.52	5.00	10.00	.2343 x 10 ¹
SC	25	18.60	11.00	25.00	.1792 x 10 ²
ANSU	23	449.56	370.00	570.00	.2559 x 10 ⁴
ANT3	24	380.83	320.00	470.00	.1304 x 10 ⁴
ANTT	23	920.00	720.00	1140.00	.1426 x 10 ⁵
BASI	25	370.40	300.00	470.00	.2171 x 10 ⁴
DISI	25	164.40	110.00	200.00	.4257 x 10 ³
FF	25	1040.00	875.00	1175.00	.8229 x 10 ⁴
FT	25	1298.00	1100.00	1450.00	.1265 x 10 ⁵
FTA1	24	891.67	725.00	1000.00	.6178 x 10 ⁴
FTA2	24	529.17	425.00	625.00	.3243 x 10 ⁴
FTA3	24	366.30	275.00	425.00	.1455 x 10 ⁴
FTA4	23	201.09	150.00	225.00	.4249 x 10 ³
FTA5	23	167.39	150.00	200.00	.3656 x 10 ³
MF	25	1113.00	950.00	1300.00	.8444 x 10 ⁴
MT	25	1211.00	1000.00	1350.00	.1240 x 10 ⁵
MTA1	25	587.00	475.00	675.00	.3235 x 10 ⁴
MTA2	24	351.04	275.00	425.00	.1493 x 10 ⁴
MTA3	24	252.08	200.00	300.00	.5933 x 10 ³
MTA4	24	150.00	125.00	175.00	.2174 x 10 ³
MTA5	24	158.33	125.00	175.00	.2536 x 10 ³
HF	25	1293.00	1100.00	1500.00	.1154 x 10 ⁵
HT	25	1503.00	1250.00	1675.00	.1752 x 10 ⁵

VARIABLE	SAMPLE SIZE	MEAN	RANGE		VARIANCE
			MIN	MAX	
HTA1	25	816.00	650.00	925.00	.5358 x 10 ⁴
HTA2	25	460.00	375.00	550.00	.1771 x 10 ⁴
HTA3	25	339.00	275.00	400.00	.7854 x 10 ³
HTA4	25	180.00	150.00	200.00	.2604 x 10 ³
HTA5	25	185.00	125.00	225.00	.4167 x 10 ³
COMB	25	11.72	9.00	14.00	.2627 x 10 ¹
TH	10	1625.00	1350.00	1900.00	.3750 x 10 ⁵
AB	25	3793.00	3000.00	4775.00	.2333 x 10 ⁶
WW	20	945.00	800.00	1125.00	.1030 x 10 ⁵
WR	20	3.43	3.22	3.69	.1835 x 10 ⁻¹
BL	10	5235.00	4425.00	6150.00	.3803 x 10 ⁶
AR	23	2.41	2.05	3.09	.6733 x 10 ⁻¹
VR	23	1.09	1.04	1.15	.6398 x 10 ⁻³
HR	25	2.26	2.00	2.73	.4294 x 10 ⁻¹
HV	10	3.46	3.00	4.09	.8540 x 10 ⁻¹
FLR	24	.69	.63	.74	.5591 x 10 ⁻³
FSV	24	2.62	2.43	2.89	.1085 x 10 ⁻¹
FBV	23	2.56	2.37	2.80	.1140 x 10 ⁻¹
MLR	25	.48	.44	.52	.4555 x 10 ⁻³
MSV	25	3.97	3.64	4.32	.3247 x 10 ⁻¹
MBV	24	3.21	2.91	3.56	.3608 x 10 ⁻¹
HLR	25	.54	.51	.59	.3906 x 10 ⁻³
HSV	25	3.43	3.22	3.64	.1610 x 10 ⁻¹
HBV	25	3.10	2.91	3.40	.1742 x 10 ⁻¹
BR	10	2.22	2.00	2.46	.2276 x 10 ⁻¹

FEMALES

Fore tarsal beard absent. Tergite IX broad, platelike, with margins poorly delimited. Spermathecal duct straight (Fig. 60).

PUPAL EXUVIAE

Golden. Frontals weak. Thoracic horn (Fig. 80b) oval, robust and spine-covered, apex with two points. Anterior area along eclosion line very bumpy. Anal lobe bare; three terminal setae

present. Pedes spurii B present on segment II. Pedes spurii A present on sternites IV to VII. Tergites III to VIII (Fig. 99) with two well separated clumps of robust spines centrally; rest of tergite with patterns of coarse spines.

LARVAE (4th INSTAR)

Body green; head capsule brown (cf. Goethghebuer et al. 1949, yellow), occipital margin and mouthparts darker. Eyespot dark, tripartite with 2 small anterior, 1 large posterior spots; anterior spots sometimes fused. Labial plate (Fig. 127a) convex in shape; 13 teeth present. Mandible (Fig. 127b) with outer margin strongly crenulate; 4 true teeth and one false tooth, dark; brush with 8 robust setae, most apices serrate (cf. Goethghebuer et al. 1949, 6 setae). Epipharynx (Fig. 109) with 3-toothed pecten, 26 chaetulae laterales, not well developed; 2 chaetulae basales; 3 spinules; ungula U-shaped; premandible bifid; SI bifurcate; SII robust. Antenna (Fig. 111a) 4-segmented; Lauterborn organs weak; blade annulate, extended to 3rd segment; accessory seta robust, almost as long as blade; sensory seta present. Procercus with 7 terminal, 2 lateral setae (cf. Goethghebuer et al. 1949, 6 setae); anal gill long with apex triangular in shape.

Subgenus Orthocladius (Orthocladius) van der Wulp (Kieffer)

Orthocladius van der Wulp, 1874. Kertész, 1902. Johannsen, 1905.

Chervinskii, 1949. Freeman, 1956. Sublette and Sublette,

1965. Pankratova, 1970. (partim)

Orthocladius (Orthocladius) van der Wulp, Kieffer, 1906a. Malloch,

1915. Henriksen, 1939. Goethghebuer, 1942. (partim)

Spaniotoma (Orthocladius-Group C). Philippi, Edwards, 1929. (partim)

Orthocladus (s. str.) van der Wulp (Kieffer), Goethghebuer, 1932.

Andersen, 1937. (partim)

Spaniotoma (Orthocladus) Philippi Group Rheorthocladus Thienemann,

Johannsen, 1937. (partim)

Rheorthocladus saxicola group Thienemann, Thienemann, 1944.

Hydrobaenus (Orthocladus-Group C) Fries, Coe, 1950. (partim)

Hydrobaenus (Hydrobaenus) Fries, Johannsen, 1952. (partim)

Orthocladus (s. str.) van der Wulp (Kieffer), Brundin, 1956.

Hydrobaenus Fries, Wirth and Stone, 1956. Cole, 1969. (partim)

Hydrobaenus Fries Group Rheorthocladus Edwards, Roback, 1957a.

(non Edwards: Thienemann) (partim)

Orthocladus (Orthocladus) van der Wulp (Kieffer), Fittkau,

Schlee, and Reiss, 1967. Hamilton, Saether, and Oliver, 1969.

Type of Subgenus: application to the ICZN is being made for acceptance of O. oblidens (Walker) as the type species

Remarks. The males of O. (Orthocladus) are similar in morphological characters to those of O. (Euorthocladus), and sometimes a combination of characters is necessary to distinguish these two subgenera (see remarks under O. (Euorthocladus)).

The pupae of O. (Orthocladus) are very similar to those of the Cricotopus-group, and O. (Orthocladus) can be distinguished from the latter by a combination of the following characters: three to five rows of recurved spines in the posteromedial patch on tergite II; well developed pedes spurii B on segment II; presence of spurs on the anal lobe; curved and slender terminal setae on the anal lobe, which are usually more than one half the length of the anal lobe; presence of five lateral setae on

segment VIII.

The larvae of O. (Orthocladius) are very similar to those of the Cricotopus-group, and I have not found any character to separate all of them.

Diagnosis of the Subgenus Orthocladius (Orthocladius)

MALES

Small to medium size; dark brown, black or yellow. A.R. more than 1.00, less than 3.00. Wing finely to moderately punctate; anal lobe weakly to moderately rounded and produced; Costa extended or not extended beyond R4+5, its apex distal to apex of Cul in all species except in O. trigonolabis which is above or proximal to apex of Cul; R4+5 bare except in O. charensis. V.R. usually more than 1.00, rarely less than 1.00. Anteprenotal lobe weak or robust, wide or narrowed medially. Acrostichals present in all species except in O. appersoni; dorsocentrals uniserial in all species except in O. smolandicus, which are biserial; scutellars usually uniserial, sometimes biserial; mesonotal pit present or absent. Hypopygium with anal point weakly to robustly developed; short to long, and with apex pointed, except in O. trigonolabis which is rounded; virga present or absent. Basal lobe of gonocoxite well developed, short and wide to long and narrow. Basal median lobes of gonocoxite triangular or collarlike in shape.

Subgenus Orthocladius (Males)

VARIABLE	SAMPLE SIZE	MEAN	RANGE		VARIANCE
			MIN	MAX	
WING	575	2489.83	1300.00	3400.00	.2002 x 10 ⁶
ARM	582	989.39	475.00	1400.00	.3384 x 10 ⁵
AFCU	579	1056.82	550.00	1475.00	.3421 x 10 ⁵

VARIABLE	SAMPLE SIZE	MEAN	RANGE		VARIANCE
			MIN	MAX	
R	586	6.59	0.00	13.00	.3942 x 10 ¹
SQUM	585	22.89	8.00	50.00	.5823 x 10 ²
P1	585	36.16	15.00	55.00	.3598 x 10 ²
P2	586	56.24	20.00	85.00	.7885 x 10 ²
P3	586	116.13	55.00	200.00	.4504 x 10 ³
P4	566	104.14	55.00	165.00	.2920 x 10 ³
P5	557	151.44	80.00	250.00	.6046 x 10 ³
EYE	531	295.13	190.00	400.00	.1276 x 10 ⁴
VERT	576	11.46	5.00	19.00	.5421 x 10 ¹
ETM	574	1.92	0.00	9.00	.2065 x 10 ¹
CLYP	581	11.56	1.00	26.00	.1553 x 10 ²
PROL	584	6.11	0.00	16.00	.6453 x 10 ¹
AC	579	11.43	1.00	39.00	.2411 x 10 ²
DC	586	10.16	5.00	23.00	.8142 x 10 ¹
PA	585	4.78	0.00	9.00	.9926 x 10 ⁰
SC	582	13.91	2.00	24.00	.1924 x 10 ²
ANSU	578	326.14	190.00	450.00	.2779 x 10 ⁴
ANT3	566	408.92	290.00	550.00	.1826 x 10 ⁴
ANTT	567	735.33	420.00	1010.00	.1718 x 10 ⁵
BASI	586	276.16	130.00	360.00	.6584 x 10 ⁴
DISI	587	123.08	50.00	180.00	.1078 x 10 ⁴
FF	581	856.76	450.00	1225.00	.2008 x 10 ⁵
FT	581	1027.75	550.00	1425.00	.2710 x 10 ⁵
FTA1	576	720.53	375.00	1075.00	.1549 x 10 ⁵
FTA2	573	449.52	275.00	700.00	.4828 x 10 ⁴
FTA3	571	311.82	200.00	425.00	.2472 x 10 ⁴
FTA4	570	197.02	100.00	350.00	.1173 x 10 ⁴
FTA5	565	130.44	75.00	175.00	.4036 x 10 ³
MF	582	896.43	450.00	1300.00	.2532 x 10 ⁵
MT	586	937.37	475.00	1400.00	.2966 x 10 ⁵
MTA1	582	468.08	225.00	650.00	.8677 x 10 ⁴
MTA2	579	278.37	125.00	1550.00	.5304 x 10 ⁴
MTA3	576	206.94	100.00	325.00	.1508 x 10 ⁴
MTA4	576	132.29	50.00	200.00	.9120 x 10 ³
MTA5	572	124.48	50.00	175.00	.4290 x 10 ³

VARIABLE	SAMPLE SIZE	MEAN	RANGE		VARIANCE
			MIN	MAX	
HF	584	980.05	475.00	1425.00	.3742 x 10 ⁵
HT	583	1125.47	575.00	1625.00	.4545 x 10 ⁵
HTA1	582	636.25	300.00	1000.00	.1477 x 10 ⁵
HTA2	580	361.98	200.00	500.00	.4394 x 10 ⁴
HTA3	578	276.12	150.00	475.00	.2765 x 10 ⁴
HTA4	576	153.86	75.00	250.00	.1364 x 10 ⁴
HTA5	571	135.46	75.00	200.00	.4769 x 10 ³
COMB	579	10.72	6.00	15.00	.1293 x 10 ¹
TH	333	1284.08	750.00	1800.00	.3638 x 10 ⁵
AB	576	2814.80	1550.00	4150.00	.2122 x 10 ⁶
WW	560	743.48	425.00	1050.00	.1519 x 10 ⁵
WR	554	3.34	2.79	4.13	.3643 x 10 ⁻¹
BL	327	4178.82	2325.00	5650.00	.3790 x 10 ⁶
AR	565	1.82	1.08	2.93	.1502 x 10 ⁰
VR	579	1.07	.98	1.25	.1876 x 10 ⁻²
HR	586	2.25	1.67	2.95	.4327 x 10 ⁻¹
HV	327	3.26	1.55	4.95	.3606 x 10 ⁰
FLR	574	.70	.53	.97	.1657 x 10 ⁻²
FSV	572	2.63	2.13	3.67	.2528 x 10 ⁻¹
FBV	562	2.39	2.00	2.95	.1825 x 10 ⁻¹
MLR	582	.50	.30	.58	.7016 x 10 ⁻³
MSV	577	3.95	3.38	6.33	.5650 x 10 ⁻¹
MBV	569	3.11	1.22	3.59	.2818 x 10 ⁻¹
HLR	580	.57	.40	.83	.1035 x 10 ⁻²
HSV	580	3.32	2.28	4.58	.4334 x 10 ⁻¹
HBV	571	2.95	2.33	3.44	.1855 x 10 ⁻¹
BR	327	2.26	1.76	2.86	.3053 x 10 ⁻¹

FEMALES

Tergite IX narrow in all species except in O. charensis which is broad; margins darkened and well delimited. Spermathecal duct straight, and wrinkled for most of its length.

PUPAL EXUVIAE

Golden to light brown. Frontals weak to robust and usually present. Thoracic horn weak or robust, bare or spine-covered. Anterior area along eclosions line wrinkled, bumpy or smooth. Anal lobe bare or with spurs; three terminal setae present. Pedes spurii B present on tergite II, sometimes on tergite III. Pedes spurii A present on sternites IV-VII. Tergite II with an elliptical patch of recurved spines posteromedially. Tergites with patchlike patterns of spines.

LARVAE (4th INSTAR)

Body usually green, sometimes white; head capsule yellow, occipital margin and mouthparts darker. Eyespot bipartite or fused. Labial plate convex or triangular in shape; 13 teeth present. Mandible with outer margin smooth or crenulate; 4 true teeth and 1 false tooth, dark; brush with 6-8 setae, most with apex serrate.

Epipharynx with 3-toothed pecten, 6-8 chaetulae laterales, 2 chaetulae basales, 3-4 spinules; ungula U-shaped; premandible simple except for O. oliveri which is bifid; SI bifurcate. Antenna 5-segmented except for O. charensis which is 4-segmented; Lauterborn organs weak to robust; blade, accessory seta and sensory seta present. Procercus with 6 terminal and 2 lateral setae. Anal gill with apex rounded or triangular in shape.

Key to the Nearctic Species of Orthocladius (Orthocladius) van der Wulp (Kieffer)

MALES

1. Acrostichal setae absent . . . appersoni Sublette and Sublette
- Acrostichal setae present 2

2. Spines absent on first tarsal segments of mid and hind legs.
     . . . . . hellenthalii Sublette and Sublette
     Spines present on first tarsal segments of mid and hind
     legs 3
3. Dorsocentral setae biserial and with more than 17 present .
     . . . . . smolandicus Brundin
     Dorsocentral setae uniserial, or if biserial with less than
     17 present 4
4. Dorsocentral setae weak and reduced in size (Fig. 2) . . . .
     . . . . . carlatus (Roback), curtiseta Saether
     Dorsocentral setae robust and not reduced in size (Fig. 5) . 5
5. R4+5 with setae visible at 200 magnification 6
     R4+5 without setae visible at 200 magnification 7
6. Basal median lobes of gonocoxite collarlike in shape (Fig.
     31) . . . . . charensis new species
     Basal median lobes of gonocoxite not collarlike in shape
     (Fig. 50) . . . . . knuthi new species
7. Gonostylus with bump or protuberance 8
     Gonostylus without bump or protuberance 9
8. Gonostylus with complex protuberance on inner area (Figs. 16,
     33); Costa-R4+5 ending above or proximal to apex of Cul;
     midleg with tibial spurs not equal in length (Figs. 15d,
     e) . . . . . trigonolabis Edwards
     Gonostylus with simple preapical bump along dorsal edge
     (Fig. 30); Costa-R4+5 ending distal to apex of Cul;
     midleg with tibial spurs of equal length . dentifer Brundin
9. Virga absent ; 10

- Virga present 16
10. Postorbital setae absent 11
- Postorbital setae present 12
11. Basal lobe of gonocoxite not extended far medially and
appearing pinched (Fig. 38) . . . . . cooki new species
- Basal lobe of gonocoxite extended normally and not
appearing pinched (Figs. 36, 37) . . . . . nigritus Malloch
12. Basal median lobes of gonocoxite collarlike in shape (Fig.
42) 13
- Basal median lobes of gonocoxite not collarlike in shape. . 15
13. Basal lobe with dorsal part short and square (Fig. 42). . .
. . . . . oliveri new species
- Basal lobe with dorsal part not short and square . . . : . 14
14. Palps long and narrow, 3rd segment always much longer than
4th; gonocoxite with basal lobe robust; anal point usually
long (Fig. 43) . . . . . tryoni new species
- Palps not long and narrow, 3rd segment as long as, shorter
than, or slightly longer than 4th; gonocoxite with basal
lobe weak; anal point medium in length (Fig. 44). . . . .
. . . . . annectens Saether
15. Basal median lobes of gonocoxite with median margin
straight and thickened (Fig. 29). . . clarkei new species
- Basal median lobes of gonocoxite without median margin
straight and thickened (Figs. 36, 37) . . . nigritus Malloch
16. Basal median lobes of gonocoxite collarlike in shape (Fig.
32) . . . . . subletti new species
- Basal median lobes of gonocoxite not collarlike in shape . 17

17. Basal lobe of gonocoxite with ventral part extended
prominently beyond dorsal part (Figs. 34, 35) . . . . .
. . . . . lapponicus Goethghebuer
Basal lobe of gonocoxite without ventral part extended
prominently beyond dorsal part 18
18. Basal lobe with dorsal part short and square and posterior
margin straight (Fig. 40) 19
Basal lobe with dorsal part not short and square and
posterior margin not straight 20
19. Hypopygium as in Figs. 40, 41 . . . . . mallochi Kieffer
Hypopygium as in Fig. 39 . . . . . oblidens (Walker)
20. Basal lobe with dorsal part long and narrow (Fig. 46) . . . 21
Basal lobe with dorsal part not long and narrow 23
21. Basal lobe robust (Figs. 46, 47) . . . . . obumbratus Johannsen
Basal lobe weak 22
22. Basal median lobes of gonocoxite with lateral margin
shortest (Figs. 48, 49) . . . . . doreus (Roback)
Basal median lobes with posterior margin shortest (Fig.
50) . . . . . knuthi new species
23. Basal lobenoselike in shape (Figs. 36-38) . . . . .
. . . . . nigritus Malloch, cooki new species (see couplet 11)
Basal lobe not nose-like in shape 24
24. Basal lobe robust (Fig. 53) 25
Basal lobe weak (Fig. 55) 27
25. Anal lobe of wing not strongly rounded; hypopygium as in
Fig. 51 . . . . . groenlandensis Goethghebuer
Anal lobe of wing strongly rounded (Fig. 14f); hypopygium
not as in Fig. 51 26

26. Gonostylus robust with distal part obtuse (Fig. 52) . . . . .
 . . . . . hazensis new species
 Gonostylus weak with distal part constricted (Fig. 53). . . . .
 . . . . . paradecoratus new species
27. Apices of basal median lobes meeting medially (Fig. 55) . . . . .
 . . . . . manitobensis Saether
- Apices of basal median lobes not meeting medially 28
28. Basal median lobes of gonocoxite small (Fig. 54). . . . .
 . . . . . robacki new species
 Basal median lobes of gonocoxite large (Fig. 56). . . . .
 . . . . . wiensi Saether

FEMALES

1. Lateral sternite IX with long, narrow projection (Fig. 61) . 2
 Lateral sternite IX without long, narrow projection 3
2. Tergite IX broad (Fig. 61). . . . . charensis new species
 Tergite IX narrow (Fig. 63) . . . . . lapponicus Goethghebuer
3. Lateral sternite IX with small posterior area produced
 posterolaterally (Fig. 69) 4
 Lateral sternite IX with posterior margin produced
 posterolaterally (Fig. 68) 7
4. Lateral sternite IX with more than 15 setae (Fig. 72). . . . .
 . . . . . knuthi new species
 Lateral sternite IX with less than 15 setae 5
5. Apex of Costa-R4+5 ending above or proximal to apex of Cul;
 midleg with tibial spurs not equal in length; tergite IX
 broad (Fig. 66). . . . . trigonolabis Edwards

- Apex of Costa-R4+5 ending distal to apex of Cul; midleg
with tibial spurs equal in length; tergite IX narrow . . . 6
6. Genitalia as in Fig. 67 . . . . . clarkei new species
Genitalia as in Fig. 69 . . . . . doreus (Roback)
7. Lateral sternite IX with setae short and bristlelike*
(Fig. 76) . . . . . oliveri new species
Lateral sternite IX with setae not short and bristlelike . . 8
8. Lateral sternite IX with posterior margin curved and rounded
(Fig. 73) 9
Lateral sternite IX with posterior margin curved but not
rounded (Fig. 70) 12
9. Lateral sternite IX with posterior margin produced ball-
shaped (Fig. 73) . . . . . wiensi Saether
Lateral sternite IX with posterior area not produced ball-
shaped 10
10. Large brown species; genitalia as in Fig. 68 . . . . .
. . . . . mallochi Kieffer
Small yellow species; genitalia not as in Fig. 68 11
11. Antepnotum robust; genitalia as in Fig. 74 . . . . .
. . . . . carlatus (Roback)
Antepnotum narrowed medially; genitalia as in Fig. 75 . .
. . . . . annectens Saether
12. Postorbital setae absent; genitalia as in Figs. 70, 71 . .
. . . . . nigritus Malloch
Postorbital setae present; genitalia not as in Figs. 70, 71
. 13
13. Lateral sternite IX small (Fig. 63) . . lapponicus Goethghebuer

* I have seen one female that has one long setae in addition to the short, bristlelike setae.

Lateral sternite IX large (Figs. 64, 65). obumbratus Johannsen

PUPAL EXUVIAE

1. Anal lobe with spurs absent, at most thin chitinous threads present (Fig. 107) 2
     Anal lobe with spurs (Fig. 92) 5
2. Thoracic horn small, less than 150 microns long (Fig. 90q) .
     . . . . . trigonolabis Edwards
     Thoracic horn not small, more than 150 microns long 3
3. Tergites IV, V with anterior half bare (Fig. 101) . . . . .
     . . . . . appersoni Sublette and Sublette
     Tergites IV, V with anterior half spined 4
4. Exuvia with pale gold tinge . . . . . charensis new species
     Exuvia darker gold . . . . . nigritus Malloch
5. Tergites I to III with chitinous rings (Figs. 91g, h; 103) . 6
     Tergites I to III without chitinous rings 7
6. Pedes spurii B present on segment III (Fig. 91h) . . . . .
     . . . . . carlatus (Roback)
     Pedes spurii B absent on segment III . . . curtiseta Saether
7. Frontal setae absent 8
     Frontal setae present 9
8. Tergites IV to VI with circular spine patch medially (Fig. 102) . . . . . annectens Saether
     Tergites IV to VI without circular spine patch medially . .
     . . . . . dentifer Brundin
9. Anal lobe drawn into long narrow process with terminal clawlike spur (Fig. 104) . . . . . tryoni new species
     Anal lobe not drawn into long narrow process with terminal clawlike spur 10

10. Pedes spurii B present on segment III . . . . . mallochi Kieffer
     Pedes spurii B absent on segment III 11
11. Longest anal seta less than 0.4 anal lobe length . . . . .
     . . . . . robacki new species
     Longest anal seta more than 0.4 anal lobe length 12
12. Posterior patch of anteriorly-directed spines on tergites
     III, IV extending only as far laterally as recurved spines
     on tergite II (Fig. 100) . . . . . clarkei new species
     Posterior patch of anteriorly-directed spines on tergites
     III, IV extending well laterally of recurved spines on
     tergite II (Fig. 92) 13
13. Frontal tubercles (frontal view) prominent, erect
     protuberances (Fig. 94) 14
     Frontal tubercles (frontal view) not prominent, erect
     protuberances 15
14. Segment VIII with 4 setae on lateral margin . . . . .
     . . . . . knuthi new species
     Segment VIII with 5 setae on lateral margin. doreus (Roback)
15. Exuvia with pale gold tinge 16
     Exuvia darker gold 17
16. Thoracic horn densely covered with small, pointed spines
     (Figs. 90h, 91c, d); sternite II with fine spines
     present . . . . . oliveri new species
     Thoracic horn moderately covered with robust, pointed and
     scalelike spines (Fig. 90j); sternite II bare . . . . .
     . . . . . lapponicus Goethghebuer

17. Frontal setae thick and robust . . . . . wiensi Saether
 Frontal setae not thick and robust 18
18. Cephalothorax bumpy along eclosion line anteriorly (Fig.
 93) . . . . . manitobensis Saether
 Cephalothorax wrinkled along eclosion line anteriorly
 (Fig. 79) 19
19. Thoracic horn robust and densely covered with robust,
 scalelike spines (Fig. 90m) . . . . . obumbratus Johansen
 Thoracic horn slender and scarcely covered with small,
 pointed spines (Fig. 90g) . . . . . dentifer Brundin*

LARVAE (4th INSTAR)

1. Labial plate triangular in shape (Fig. 140b) 2
 Labial plate convex in shape (Fig. 129b) 4
2. Mandible with outer margin smooth (Fig. 138a) . . . . .
 . . . . . curtiseta Saether
 Mandible with outer margin crenulate (Fig. 139a) 3
3. Labial plate with median tooth clearly separated by gap
 from first laterals (Fig. 139b) . . . . . dentifer Brundin
 Labial plate with median tooth not clearly separated by
 gap from first laterals (Fig. 140b) . . . . . annectens Saether
4. Premandible bifid (Fig. 117a) . . . . . oliveri new species
 Premandible simple (Fig. 119a) 5
5. Labial plate with median tooth less than twice as wide as
 first lateral 6
 Labial plate with median tooth at least twice as wide as
 first lateral 7

*The specimens I have examined lack frontal setae. However, my material is in poor condition, and it is possible they may have fallen off.

6. Antenna 4-segmented (Fig. 122b) . . . . . charensis new species
     Antenna 5-segmented (Fig. 119b) . . . . . lapponicus Goethghebuer
7. Paralabial plate long (Fig. 123b) 8
     Paralabial plate not long 10
8. Mandible with outer margin smooth (Fig. 123a) . . . . .
     . . . . . clarkei new species
     Mandible with outer margin crenulate (Fig. 142b) 9
9. Lauterborn organs well developed (Fig. 112b) mallochi Kieffer
     Lauterborn organs not well developed (Fig. 113b) . . . . .
     . . . . . wiensi Saether
10. Mandible with outer margin smooth (Fig. 132a) 11
     Mandible with outer margin crenulate (Fig. 136b) 12
11. Small species; labial plate width less than 125 μ (Fig.
     132b) . . . . . carlatus (Roback)
     Large species; labial plate width more than 125 μ (Figs.
     133b, 134a) . . . . . obumbratus Johannsen, robacki new species
12. Mandible with crenulations weak (Figs. 133a, 135a) . . . . .
     . . . . . obumbratus Johannsen, manitobensis Saether
     Mandible with crenulations robust (Fig. 136b) 13
13. Labial plate with median tooth slightly anterior to first
     laterals (Fig. 136a) . . . . . doreus (Roback)
     Labial plate with median tooth clearly anterior to first
     laterals (Fig. 137b) . . . . . nigritus Malloch

Orthocladus (Orthocladus) annectens Saether

Figs. 44, 75, 78a, 90a, 102, 121, 140, 144

Orthocladus (s. str.) annectens Saether, 1969, p. 61, figs. 29, 30.

hydrobaenus sp. 2 Roback, 1957a, p. 80, figs. 179-182.

Saether (1969) described this small brown species based on two reared males from Manitoba and Ontario. Saether pointed out the similarity in certain larval and adult structures of this species to those in the subgenera Euorthocladus and Eudactylocladius. However, he also thought that the male genitalia of this species closely resembles those of O. excavatus Brundin and O. decoratus (Holmgren). I have not examined the type specimens of these two species. However, based on the literature and specimens available to me, I do not see a close resemblance of O. annectens to either of these two species.

Earlier, Roback (1957a) found the unusual pupa and unassociated larva in Pennsylvania of what I now recognize as O. annectens. But, as he did not have the associated adult male, he was unable at that time to give a name to this species. I have examined Roback's pupal material, and found it to be O. annectens. I have not examined Roback's larval material. However, judging from his figure and description of the larva, I also regard it to be O. annectens. Saether (1969) was apparently unaware of Roback's findings, since he did not mention Roback's larval and pupal descriptions. The female is described here for the first time.

Holotype Male

Color. Brown; halteres golden; scutal stripes distinct, not merging posteriorly.

Length (m μ). Body 2700, thorax 900, abdomen 1800.

Head. Femalelike. Interocular distance 280 m μ .

Temporals 11, verticals 7, postorbitals 4. A.R. 1.35. Antennal flagellomere lengths (m μ): 1st-12th 925, 13th 1250. Clypeus small and rectangular, with 7 setae. Palpal segment lengths (m μ): 30, 45, 85, 85, 145.

Thorax. Antepronotal lobe wide medially, and not robust. Lateral antepronotals 3, acrostichals 9, prealars 4, dorsocentrals 10, uniserial; scutellars 6, uniserial. Anapleural suture length 240 m μ . No mesonotal pit.

Wing. Length 1550 m μ , width 450 m μ . L/W.R. 3.44.

Scarcely punctate. Anal lobe rounded, and not produced. V.R. 1.16. Stem vein with 1 seta, R with 3, squama with 10. Costa not extended beyond R4+5, apex well distal to apex of Cu1. R2+3 ending about 1/3 distance between R1 and R4+5.

Legs. Hind tibial comb composed of 12 setae. Spines absent on fore leg, 2 on each of first two tarsal segments of mid leg, 2 on first tarsal segment of hind leg.

Leg lengths (m μ) and proportions:

	F	T	Ta1	Ta2	Ta3	Ta4	Ta5	L.R.	B.V.	S.V.
Fore	500	650	425	300	225	125	100	0.65	2.10	2.70
Mid	525	550	275	175	150	75	100	0.50	2.70	3.90
Hind	550	650	400	225	175	100	100	0.61	2.66	3.00

Hypopygium (Fig. 44). Gonocoxite length 180 m μ , gonostylus length 70 m μ , H.R. 2.57. H.V. 3.85. Lateral margin of tergite IX with group of 3 setae. Anal point medium in length. Virga absent. Basal median lobes of gonocoxite collarlike. Basal lobe with

dorsal part rounded and extended beyond ventral part. Gonostylus rounded, cuplike.

Remarks: The male of Orthocladius (O.) annectens closely resembles the male of O. tryoni in hypopygial features; annectens can be distinguished from tryoni by the shorter anal point and the less developed basal lobe of the gonocoxite, as well as by the less developed anal lobe of the wing and the different lengths of palpal segments 3 and 4.

O. annectens Saether

VARIABLE	SAMPLE SIZE	MEAN	RANGE		VARIANCE
			MIN	MAX	
WING	29	1659.48	1300.00	1975.00	.3234 x 10 ⁵
ARM	29	625.86	475.00	725.00	.4531 x 10 ⁴
AFCU	29	734.48	550.00	875.00	.6715 x 10 ⁴
R	29	4.10	3.00	7.00	.1382 x 10 ¹
SQUM	28	11.29	8.00	16.00	.4064 x 10 ¹
P1	29	26.55	15.00	35.00	.2161 x 10 ²
P2	29	41.90	20.00	60.00	.4712 x 10 ²
P3	29	81.90	55.00	100.00	.9360 x 10 ²
P4	28	73.21	55.00	90.00	.8003 x 10 ²
P5	29	127.76	80.00	160.00	.3600 x 10 ³
EYE	29	285.86	245.00	325.00	.3466 x 10 ³
VERT	29	7.38	5.00	10.00	.1887 x 10 ¹
ETM	29	2.14	1.00	4.00	.6232 x 10 ⁰
CLYP	29	5.72	1.00	9.00	.3207 x 10 ¹
PROL	29	3.28	2.00	7.00	.1350 x 10 ¹
AC	27	8.26	4.00	12.00	.4584 x 10 ¹
DC	29	6.76	5.00	10.00	.1690 x 10 ¹
PA	29	3.14	3.00	5.00	.1946 x 10 ⁰
SC	29	5.38	3.00	7.00	.1530 x 10 ¹
ANSU	29	245.52	190.00	280.00	.3970 x 10 ³
ANT3	29	385.52	320.00	430.00	.7828 x 10 ³
ANTT	29	503.79	420.00	600.00	.1567 x 10 ⁴

VARIABLE	SAMPLE SIZE	MEAN	RANGE		VARIANCE
			MIN	MAX	
BASI	29	181.03	130.00	220.00	.3810 x 10 ³
DISI	29	79.31	50.00	100.00	.1067 x 10 ³
FF	29	575.00	450.00	650.00	.3036 x 10 ⁴
FT	29	700.86	550.00	825.00	.4441 x 10 ⁴
FTA1	27	458.33	375.00	525.00	.1394 x 10 ⁴
FTA2	27	326.85	275.00	375.00	.7657 x 10 ³
FTA3	27	225.00	200.00	250.00	.3365 x 10 ³
FTA4	27	137.04	100.00	150.00	.2582 x 10 ³
FTA5	27	101.85	75.00	125.00	.1407 x 10 ³
MF	28	577.68	450.00	675.00	.3673 x 10 ⁴
MT	29	618.10	475.00	750.00	.5174 x 10 ⁴
MTA1	27	284.26	225.00	350.00	.9687 x 10 ³
MTA2	27	187.04	125.00	225.00	.5467 x 10 ³
MTA3	27	134.26	100.00	175.00	.2475 x 10 ³
MTA4	27	74.07	50.00	100.00	.1674 x 10 ³
MTA5	27	95.37	50.00	125.00	.1941 x 10 ³
HF	29	609.48	475.00	725.00	.5152 x 10 ⁴
HT	29	728.45	575.00	875.00	.5702 x 10 ⁴
HTA1	29	419.83	300.00	500.00	.2428 x 10 ⁴
HTA2	29	239.65	200.00	300.00	.7374 x 10 ³
HTA3	29	183.62	150.00	225.00	.3695 x 10 ³
HTA4	29	92.24	75.00	125.00	.1832 x 10 ³
HTA5	29	106.03	75.00	125.00	.1632 x 10 ³
COMB	29	11.45	9.00	14.00	.1042 x 10 ¹
TH	9	861.11	750.00	950.00	.5799 x 10 ⁴
AB	29	1921.55	1550.00	2275.00	.4003 x 10 ⁵
WW	29	525.00	425.00	625.00	.3527 x 10 ⁴
WR	29	3.16	2.94	3.45	.1673 x 10 ⁻¹
BL	9	2558.33	2325.00	2725.00	.2797 x 10 ⁵
AR	29	1.31	1.09	1.67	.1284 x 10 ⁻¹
VR	29	1.17	1.10	1.25	.1202 x 10 ⁻²
HR	29	2.30	1.86	2.80	.5186 x 10 ⁻¹
HV	9	3.50	2.94	4.70	.2854 x 10 ⁰
FLR	27	.65	.62	.72	.5621 x 10 ⁻³

VARIABLE	SAMPLE SIZE	MEAN	RANGE		VARIANCE
			MIN	MAX	
FSV	27	2.80	2.56	3.00	.1300 x 10 ⁻¹
FBV	27	2.20	2.00	2.47	.1089 x 10 ⁻¹
MLR	27	.46	.30	.50	.1396 x 10 ⁻²
MSV	26	4.25	3.90	6.33	.2099 x 10 ⁰
MBV	26	3.03	2.58	3.37	.3608 x 10 ⁻¹
HLR	29	.58	.50	.64	.9703 x 10 ⁻³
HSV	29	3.19	3.00	3.75	.3064 x 10 ⁻¹
HBV	29	2.83	2.67	3.08	.1230 x 10 ⁻¹
BR	9	1.98	1.76	2.15	.1743 x 10 ⁻¹

Female (reared)

Color. Yellow; halteres golden; scutal stripes distinct, not merging posteriorly.

Length (mμ). Body 1800, thorax 725, abdomen 1075.

Head. Interocular distance 225 mμ. Temporals 7, verticals 4, postorbitals 3. A.R. 0.56. Antennal flagellomere lengths (mμ, Fig. 78a): 55, 30, 30, 35, 85. Clypeus large and rectangular, with 8 setae. Palpal segment lengths (mμ): 25, 35, 60, 60, 125.

Thorax. Anteprenotal lobe narrowed medially. Lateral anteprenotals 6, acrostichals 7, prealars 3, dorsocentrals 6, uniserial; scutellars 4, uniserial. Anapleural suture length 170 mμ. No mesonotal pit.

Wing. Length 1125 mμ, width 450 mμ. L/W.R. 3.50.

Finely punctate. Anal lobe straight proximally, slightly rounded distally, and not produced. V.R. 1.13. Stem vein with 1 seta, R with 6, R1 with 2, R4+5 with 4, squama with 10. Costa extended beyond R4+5, apex well distal to apex of Cu1. R2+3 ending about

1/4 distance between R1 and R4+5.

Legs. Hind tibial comb composed of 11 setae. Spines absent on fore leg, mid leg damaged, 2 spines on first tarsal segment of hind leg.

Leg lengths (μ) and proportions:

	F	T	Ta1	Ta2	Ta3	Ta4	Ta5	L.R.	B.V.	S.V.
Fore	400	500	325	200	150	75	----	0.65	---	2.76
Mid	375	425	---	---	---	---	---	---	---	---
Hind	425	500	200	125	100	50	75	0.40	3.21	4.62

Genitalia (Fig. 75). Lateral sternite IX with posterior margin rounded, slightly produced, posterolaterally; few long setae dorsally, few shorter setae ventrally. Tergite IX narrow. Spermathecal duct wrinkled for most of length.

Remarks. The female of Orthocladius (O.) annectens closely resembles the female of O. carlatus in genitalic features; annectens can be distinguished from carlatus by the presence of the narrowed anteprenotal lobes.

Holotype Pupal Exuvia

Color. Brown.

Length (μ). Body 3600, cephalothorax 1350, abdomen 2250.

Cephalothorax. Setae: frontals 0, postorbitals 1, humerals 3, lateral anteprenotals 1, median anteprenotals 2, prealars 1, dorsocentrals 4. Thoracic horn (Fig. 90a) small and slender, with apex tapered distally, bare, length 130 μ. Frontal tubercles not prominent. Anterior part of notum wrinkled along eclosion line.

Abdomen. Anal lobe length 250 μ; moderately developed;

with 4 right and 5 left spurs; spurs small, wide, and pointed; longest anal seta length 160 μ . A.L.R. 0.64. Pedes spurii B weak, present on segment II.

Setae present on segments I-VIII:

dorsals	5	5	5	5	5	5	5	2
laterals	1	3	3	3	3	3	3	3
ventrals	2	3	3	4	3	3	2	1

Tergal spine patterns (composite, Fig. 102). I: bare; Omm 2, Amm 0. II: elliptical patch posteromedial, with about 57 recurved spines in 3 rows; horizontal rectangular patch of coarse spines anterior to recurved spines; Omm 3, Amm 2. III: horizontal rectangular patch of coarse spines separated by bare line from similar patch of anteriorly-directed spines along posterior margin; 2 well spaced patches of fine spines along anterior margin connected to patch of coarse spines by lateral bands; Omm 0, Amm 2. IV, V: as in III, but with circular patch of robust spines centrally; Omm 0, Amm 2. VI: as in IV, V but without patch of anteriorly-directed spines; Omm 2, Amm 2. VII: 2 well spaced patches of fine spines along anterior margin continuous posteriorly with large central patch of fine spines; Omm 2, Amm 2. VIII: 2 well spaced patches of fine spines along anterior margin; patch of fine spines along posterior margin medially; Omm 2, Amm 2. IX: band of fine spines along anterior margin.

Sternal spine patterns (composite). I: bare. II: 2 well spaced patches of fine spines along anterior margin. III, IV: 2 well spaced patches of fine spines along anterior margin continuous with lateral bands reaching posterior margin. V: 2

well spaced patches of fine spines along anterior margin. VI: as in V, but with patch of fine spines along posterior margin medially. VII, VIII: 2 well spaced patches of fine spines along anterior margin. IX: bare.

Variation. The thoracic horn in the material from N.W.T. is not as slender as that in the holotype. The thoracic horn is covered with a few small, pointed spines in the material from N.W.T., Florida, and Pennsylvania. The anterior part of the notum is provided with a few rounded protuberances in the N.W.T. material. Exuvia curls.

Remarks. The pupa of Orthocladus (O.) annectens can be distinguished from other known pupae of Orthocladus (Orthocladus) by the circular spine patches on tergites IV-VI.

Larva (n = 10)

Color. Body yellow (Roback 1957a).

Head. Labial plate (Fig. 140b) acutely triangular; median tooth flanked by first laterals, which are extended anteriorly, clearly beyond other teeth. Mandible (Fig. 140a) with outer margin strongly crenulate; brush with 8 setae, most serrate. Epipharynx (Fig. 121a) with 8 chaetae laterales, edges of some serrate; 2 chaetae basales, 3 spinules. Premandible simple.

A.R. 1.96-2.71. Antennal segment lengths (μm, Figs. 121b, c): 49-68, 13-16, 2-5, 3-4; 2-4; blade grooved, extended to 4th segment. Lauterborn organs robust.

Variation. - Mandible with outer margin strongly to moderately crenulate.

Remarks. The larva of Orthocladus (O.) annectens

clearly resembles the larva of O. dentifer; it can be distinguished from dentifer by the close position of the median and first lateral teeth, and the serrated chaetulae laterales.

MATERIAL EXAMINED (Fig. 144)

Holotype. Male, reared, on submerged birch, Rushing River, Duck Mountains, Man., 31.V.1967, A.L. Hamilton and O.A. Saether, (CNC No. 9982). Paratype. Male, reared, in colonies of Aphanocapsa on lake bottom, small lake, between mile 18 and 19 on Mando logging road, Kenora, Ont., 22.VIII.1967, A.L. Hamilton and O.A. Saether, (BNC No. 9982).

Florida. Collected by W.M. Beck, Jr., and E.C. Beck, (BECK): Hamilton Co., Swift Creek, 12-16-66-1G, 12-1666-1G, 2 reared female, 1 reared male; same data except 12-8-66-2G, 2 reared male; Clay Co., Peter's Creek, March 6, 1968, 3-668-1G, 2 reared males; same data except 11-15-66-1G, 1 reared male, 1 reared female; 1-31-67-1G, 4 reared females; Clay Co., Black Creek, south prong, 8-29-63-1G, 1 reared male; Clay Co., Black Creek on Fla. 16, 4-1-66-2G, 3 reared males; Calhoun Co., Bear Creek, 10-22-67-1G, 1 reared male, 2 reared female; Calhoun Co., Juniper Creek, 12-4-69-1G, 2 reared females; 2 reared males; Escambia Co., Pine Barren Creek, 1-27-68-1G, 2 reared males, 2 reared females; Escambia Co., Perdido River, 7 February 1966, 2-766-2G, 1 reared male; Flegler Co., Little Haw Creek, March 12, 1966, 3-1266-1G, 2 reared females, 3 reared males; Flegler Co., Rayonier Ditch, 2-27-69-1G, 2 reared males; same data except 3-15-67-2G, 1 reared female; Minnesota. Collected by E.F. Cook, (MINN): Cook Co., Min. F.S., Hovland, N.J. Mosquito Trap, Sept. 1, 1968, 2 males;

same data except Aug. 24, 1969, 1 male Aug. 17, 1969, 2 males; Aug. 21, 1968, 2 males; St. Louis Co. U. of M. Duluth, July 10, 1969, 1 male; St. Louis Co., Duluth, N.J. Mosquito Trap, July 1, 1970, FWCPA Lab, 1 male; Clearwater Co., Miss. R. at Co. Rd. 2, N.J. Mosquito Trap, May 12, 1970, 1 male; Hubbard Co., Lower La Salle Lake, N.J. Mosquito Trap, Oct. 4, 1970, 2 males; same data except May 7, 1970, 2 males; Oct. 22, 1970, 7 males. New Jersey. Springer's Brook, 1/2 mi. southeast of Indian Mills, July 29, 1953, 44A, LP, S.S. Roback, (ANSP), 1 pupal ex. Northwest Territories. Tuktoyatuk, 9.VII.1971, DRO, No. CH410, (CNC), 1 reared male; same data except 11.VII.1971, 1 reared male. Ontario. Algonquin Park, Costello Lake, 6.VII.1964, D.W. Webb, (INHS), 1 male. Pennsylvania. Schuylkill, Leesport 1, 10-1-53, S.S. Roback, (ANSP), 1 pupal ex.

Orthocladius (Orthocladius) appersoni Sublette and Sublette

Figs. 23, 24, 77, 90b, 101, 145

Orthocladius (Orthocladius) appersoni Sublette and Sublette, 1974.

Holotype Male

Color. Brown; halteres golden; scutal stripes distinct, merging posteriorly.

Length (mu). Body 4250, thorax 1150, abdomen 3100.

Head. Interocular distance 290 mu. Temporals 13, verticals 12, postorbitals 1. A.R. 1.36. Antennal flagellomere

lengths (mu): 1st-12th 1300, 13th 1775. Clypeus rectangular, with 8 setae. Palpal segment lengths (mu): 40, 55, 115, 100, 155.

Thorax. Anteprenotal lobe narrowed medially, not robust.

Lateral anteprenotals 6, acrostichals 0, prealars 4, dorsocentrals 7, ~~un~~iserial; scutellars 8, uniserial. Anapleural suture length 320 μ . Mesonotal pit as in O. oliveri.

Wing (Paratype Male). Length 2250 μ , width 625 μ . L/W.R. 3.60. Finely punctate. Anal lobe slightly rounded, almost straight, and not produced. V.R. 1.11. Stem vein with 1 seta, R with 5, squama with 15. Costa not extended beyond R4+5, apex slightly distal to apex of Cu1. R2+3 ending about 1/3 distance between R1 and R4+5.

Legs. Hind tibial comb composed of ?10 setae. Spines absent on fore leg, 2 on each of first two tarsal segments of mid and hind legs.

Leg lengths (μ) and proportions:

	F	T	Ta1	Ta2	Ta3	Ta4	Ta5	L.R.	B.V.	S.V.
Fore	800	1075	725	525	350	225	150	0.67	2.08	2.58
Mid	825	900	500	300	250	175	150	0.55	2.54	3.45
Hind	950	1100	625	375	325	200	150	0.56	2.54	3.28

Hypopygium (Fig. 23, paratype male). Gonocoxite length 220 μ , gonostylus length 120 μ . H.R. 1.83. H.V. 3.54. Lateral margin of tergite IX with group of 6 setae. Anal point medium in length. Virga absent. Basal median lobes of gonocoxite triangular, with median apices pointed. Basal lobe with dorsal part long and narrow, ventral part not evident. Gonostylus rounded, not robust.

Remarks. The male of Orthocladus (O.) appersoni closely resembles the male of O. nigrinus in hypopygial features; appersoni can be distinguished from nigrinus by the distinct shape of the basal median lobes of the gonocoxite, and the lack of acrostichal

setae. Distorted specimens of O. appersoni (Fig. 24) closely resemble the male of O. tryoni in hypopygial features; these can be distinguished from tryoni by the above characters.

O. appersoni Sublette and Sublette

VARIABLE	SAMPLE SIZE	MEAN	RANGE		VARIANCE
			MIN	MAX	
WING	5	2395.00	2100.00	3025.00	.1320 x 10 ⁶
ARM	6	887.50	800.00	1075.00	.9188 x 10 ⁴
AFCU	6	987.50	900.00	1200.00	.1243 x 10 ⁵
R	10	5.80	3.00	8.00	.1956 x 10 ¹
SQUM	9	19.22	15.00	27.00	.1644 x 10 ²
P1	10	34.50	30.00	40.00	.1361 x 10 ²
P2	10	56.50	50.00	60.00	.1139 x 10 ²
P3	9	108.33	95.00	125.00	.1125 x 10 ³
P4	10	86.50	75.00	100.00	.6139 x 10 ²
P5	9	156.67	135.00	175.00	.1625 x 10 ³
EYE	8	260.00	230.00	290.00	.4357 x 10 ³
VERT	10	11.70	10.00	14.00	.1567 x 10 ¹
ETM	10	1.10	1.00	2.00	.1000 x 10 ⁰
CLYP	10	9.60	8.00	13.00	.2489 x 10 ¹
PROL	9	3.22	1.00	6.00	.2444 x 10 ¹
AC	10	0.00	0.00	0.00	.0000
DC	10	6.00	5.00	7.00	.8889 x 10 ⁰
PA	10	4.20	4.00	5.00	.1778 x 10 ⁰
SC	10	6.90	4.00	10.00	.3878 x 10 ¹
ANSU	9	280.00	210.00	360.00	.1925 x 10 ⁴
ANT3	9	488.89	450.00	540.00	.8611 x 10 ³
ANTT	8	608.75	520.00	710.00	.3927 x 10 ⁴
BASI	10	222.00	210.00	250.00	.1511 x 10 ³
DISI	10	106.00	100.00	120.00	.7111 x 10 ²
FF	8	750.00	650.00	875.00	.6429 x 10 ⁴
FT	10	927.50	775.00	1100.00	.1256 x 10 ⁵
FTA1	10	607.50	500.00	725.00	.5701 x 10 ⁴
FTA2	9	458.33	375.00	525.00	.3437 x 10 ⁴

VARIABLE	SAMPLE SIZE	MEAN	RANGE		VARIANCE
			MIN	MAX	
FTA3	10	302.50	225.00	350.00	$.2007 \times 10^4$
FTA4	10	210.00	175.00	250.00	$.5833 \times 10^3$
FTA5	10	135.00	125.00	150.00	$.1667 \times 10^3$
MF	9	800.00	700.00	950.00	$.5312 \times 10^4$
MT	10	805.00	725.00	950.00	$.7472 \times 10^4$
MTA1	9	438.89	375.00	500.00	$.2517 \times 10^4$
MTA2	9	286.11	250.00	325.00	$.7986 \times 10^3$
MTA3	9	222.22	175.00	250.00	$.8507 \times 10^3$
MTA4	9	150.00	125.00	175.00	$.3125 \times 10^3$
MTA5	9	127.78	100.00	150.00	$.2257 \times 10^3$
HF	10	875.00	775.00	1025.00	$.6806 \times 10^4$
HT	10	970.00	875.00	1150.00	$.8722 \times 10^4$
HTA1	10	542.50	475.00	650.00	$.3757 \times 10^4$
HTA2	9	327.78	275.00	400.00	$.2257 \times 10^4$
HTA3	9	272.22	225.00	325.00	$.1319 \times 10^4$
HTA4	9	183.33	150.00	200.00	$.4687 \times 10^3$
HTA5	9	138.89	125.00	150.00	$.1736 \times 10^3$
COMB	10	10.60	8.00	13.00	$.2489 \times 10^1$
TH	10	1077.50	950.00	1375.00	$.1853 \times 10^5$
AB	10	2580.00	2025.00	3100.00	$.1857 \times 10^6$
WW	5	720.00	625.00	950.00	$.1731 \times 10^5$
WR	5	3.34	3.11	3.60	$.3982 \times 10^{-1}$
BL	10	3657.50	2975.00	4300.00	$.2896 \times 10^6$
AR	8	1.25	1.11	1.36	$.5594 \times 10^{-2}$
VR	6	1.11	1.06	1.14	$.8006 \times 10^{-3}$
HR	10	2.10	1.83	2.20	$.1128 \times 10^{-1}$
HV	10	3.44	2.97	4.00	$.1327 \times 10^0$
FLR	10	.66	.60	.70	$.8148 \times 10^{-3}$
FSV	8	2.78	2.56	3.00	$.2266 \times 10^{-1}$
FBV	7	2.10	1.87	2.23	$.1560 \times 10^{-1}$
MLR	9	.54	.48	.59	$.1119 \times 10^{-2}$
MSV	8	3.74	3.41	4.27	$.8868 \times 10^{-1}$
MBV	8	2.65	2.50	2.85	$.1672 \times 10^{-1}$
HLR	10	.56	.53	.58	$.3476 \times 10^{-3}$

VARIABLE	SAMPLE SIZE	MEAN	RANGE		VARIANCE
			MIN.	MAX	
HSV	10	3.41	3.21	3.65	$.2025 \times 10^{-1}$
HBV	9	2.62	3.47	2.74	$.7689 \times 10^{-2}$
BR	10	2.39	2.08	2.81	$.7578 \times 10^{-1}$

Female (Pupa)

This single female is not mature, so that most characters are absent. However, the genitalia (Fig. 77) are clearly formed, mounted with the ventral side up. I have not included the female of O. appersoni in the key to females since the characters I use are seen on a female specimen mounted laterally.

Male Pupal Exuvia

Color. Pale golden.

Length (mm). Body 4300, cephalothorax 1600, abdomen 2700.

Cephalothorax. Setae (robust): frontals 1, postorbitals 1, humerals 3, lateral anteprenotals 1, median anteprenotals 2, prealars 1, dorsocentrals 4. Thoracic horn (Fig. 90b) robust with rounded bare apex, and densely covered with robust, pointed spines, length 290 mm. Frontal tubercles not prominent. Anterior part of notum smooth along eclosion line.

Abdomen. Anal lobe length 300 mm; narrowed, without spurs; longest anal seta length 200 mm. A.L.R. 0.67. Pedes spurii B. robust, present on segment II.

Setae present on segments I-VIII:

dorsals	3	4	4	5	5	5	5	3
laterals	1	3	3	3	3	3	4	3
ventrals	1	3	3	3	3	4	4	1

2

MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS
STANDARD REFERENCE MATERIAL 1010a
(ANSI and ISO TEST CHART No. 2)

Tergal spine patterns (Fig. 101). I: bare; Omm 0, Amm 0. II: elliptical patch posteromedial, with about 56 recurved spines in 4 rows; rest of tergite bare; Omm 2, Amm 2. III: horizontal rectangular patch of coarse spines posteromedial, with peak anteromedially, separated by bare line from rectangular patch of anteriorly-directed spines along posterior margin; Omm 3, Amm 3. IV: as in III, but with medial peak continued more anteriorly; Omm 2, Amm 4. V: as in IV, but with large patch reduced in size; Omm 2, Amm 4. VI: as in V but patch further reduced in size, and without patch of anteriorly-directed spines; Omm 1, Amm 2. VII: 2 well spaced patches of fine spines along anterior margin; small patch of fine spines between 4th dorsal setae medially; Omm 1, Amm 2. VIII: as in VII, but with medial patch larger; Omm 0, Amm 1. IX: band of fine spines along anterior margin.

Sternal spine patterns. I: bare. II: patch of fine spines along anterior margin medially. III: 2 well spaced patches and one medial patch of fine spines along anterior margin. IV: 2 well spaced patches of fine spines along anterior margin continuous with lateral bands reaching posterior margin. V: 2 well spaced patches of fine spines along anterior margin; small patch of fine spines along posterior margin medially. VI: as in V, but with medial patch larger. VII: as in V, but with medial patch smaller. VIII: 2 well spaced patches of fine spines along anterior margin. IX: bare.

Remarks. The pupa of Orthocladus (O.) appersoni can be distinguished from the other known pupae of Orthocladus (Orthocladus) by the pattern of spines on the tergites and the

very robust development of the setae on the cephalothorax. The larva of O. appersoni is unknown.

MATERIAL EXAMINED (Fig. 145)

Holotype. Male, Hat Creek, near Fall River Mills, Shasta Co., California, drift net, C. Apperson, 2.XI.68; (SUBLETTE). Paratypes. Same data as holotype, 2 males and 1 male pupa; Hat Creek Fall, River Mills, Shasta Co., California, 5.I.69, C. Apperson, 2 male pupae, 1 female pupa; Convict Creek, Calif., 7200', 13 Feb. 1963, H.D. Kennedy, 1 male, (SUBLETTE).

Alaska. Palmer-Anchorage Hwy., jeep trap, 22 June 1964, K.M. Sommerman, (USNM), 1 male. Colorado. Ninsdale Co., Lake Fork of Gunnison R., above L. San Cristobal, 10.IV.65, A.V. Nebeker, (ANSP), 1 male. Montana. Hamilton, 4.IV.60, B.B. Philip, (SUBLETTE), 1 male. Yukon Territory. Whitehorse, 13.VII.49, (S-2), L.R. Pickering, (CNC), 1 male; same data except 23.VII.49, 1 male.

Orthocladus (Orthocladus) carlatus (Roback)

Figs. 28, 74, 78b, 90c, 91g, 91h, 103, 114a, 132, 146

Hydrobaenus carlatus Roback, 1957a, p. 77, figs. 161-167.

Orthocladus carlatus (Roback), Sublette and Sublette, 1965, p.

156. Sublette, 1966, p. 594. Sublette, 1967b, p. 504.

Sublette, 1970, p. 55.

Orthocladus (s. s.) carlatus Roback, Sublette, 1967a, p. 316.

Orthocladus (Orthocladus) cf. saxicola, Coffman, 1973, p. 311.

Roback (1957a) described this species from three reared males from Pennsylvania. His figures of O. carlatus are correct, except for the robust Lauterborn organs on the larval antennae (fig. 161). Roback separated the male of O. carlatus from the

male of O. obumbratus on the basis of the smaller leg ratio, smaller A.R., and the yellow color. Sublette (1966b, 1967a, 1967b, 1970) placed the male of O. carlatus in his "obumbratus group". I do not consider that O. carlatus is particularly close to O. obumbratus in any of its stages. However, I am unable to distinguish the male of O. carlatus from the male of O. curtiseta, although the larvae and pupae of these two species are readily separated. The male of Orthocladus carlatus has been described as yellow, and the male of O. curtiseta as brown, but the difference in color is admittedly not a reliable character. It is also possible that Roback's reared material contains teneral specimens, which are generally lighter than mature adults. I have examined the holotype specimen of O. carlatus, but I was unable to locate either the larval or pupal exuviae of the holotype, or the two reared paratypes in the ANSP collection. The data for characters and localities of adult males may include those of O. curtiseta Saether.

Holotype Male

Color. Yellow; halteres golden; scutal stripes distinct (Roback 1957a).

Length (mm). Body 3075, thorax 975, abdomen 2100.

Head. Interocular distance 240 mm. Temporals 11, verticals 11, postorbitals 0. A.R. 1.35. Antennal flagellomere lengths (mm): 1st-12th 975, 13th 1325. Clypeus rectangular, with 8 setae. Palpal segment lengths (mm): 30, 45, 90, 90, 160.

Thorax. Anteprenotal lobe jutting out medially, robust. Lateral anteprenotals 12, acrostichals 22, prealars 4, dorsocentrals 18, uniserial, with anterior setae short and posterior setae longer;

scutellars 9, uniserial. Anapleural suture length 280 μ . No mesonotal pit.

Wing. Length 1875 μ , width 575 μ . L/W.R. 3.26.

Finely punctate. Anal lobe rounded, and not produced. V.R. 1.06. Stem vein with 1 seta, R with 10, squama with 12. Costa extended beyond R4+5, apex well distal to apex of Cul. R2+3 ending about 1/3 distance between R1 and R4+5.

Legs. Hind tibial comb composed of 12 setae. Spines absent on fore leg, 2 on each of first two tarsal segments of mid leg, 2 on first tarsal segment of hind leg.

Leg lengths (μ) and proportions:

	F.	T	Ta1	Ta2	Ta3	Ta4	Ta5	L.R.	B.V.	S.V.
Fore	700	900	550	375	275	175	100	0.61	2.32	2.90
Mid	700	575	325	200	150	100	100	0.56	2.90	3.92
Hind	700	775	475	250	200	125	100	0.61	2.88	3.10

Hypopygium (Fig. 28). Gonocoxite length 200 μ , gonostylus length 90 μ . H.R. 2.22. H.V. 3.41. Lateral margin of tergite IX with group of 6 setae. Anal point medium in length and parallel-sided to tip. Virga present. Basal median lobes of gonocoxite triangular. Basal lobe with dorsal part noselike, extended beyond ventral part. Gonostylus rounded, platelike.

Remarks. The male of Orthocladus (O.) carlatus closely resembles the male of O. curtiseta in hypopygial features and I am unable to distinguish these two species in the adult male. Therefore, the counts and measurements in the table given below may represent males of both of these species.

O. carlatus (Roback)

VARIABLE	SAMPLE SIZE	MEAN	RANGE		VARIANCE
			MIN	MAX	
WING	28	1781.25	1525.00	2050.00	.2614 x 10 ⁵
ARM	28	704.46	600.00	825.00	.4030 x 10 ⁴
AFCU	28	756.25	650.00	875.00	.4797 x 10 ⁴
R	28	5.75	4.00	10.00	.2046 x 10 ¹
SQUM	28	10.93	8.00	13.00	.2143 x 10 ¹
P1	27	27.04	20.00	30.00	.8191 x 10 ¹
P2	27	45.00	35.00	50.00	.1923 x 10 ²
P3	28	92.68	75.00	115.00	.1046 x 10 ³
P4	24	85.83	70.00	100.00	.5797 x 10 ²
P5	25	135.40	110.00	160.00	.1623 x 10 ³
EYE	23	237.83	210.00	290.00	.3269 x 10 ³
VERT	26	9.19	6.00	12.00	.2241 x 10 ¹
ETM	26	.15	0.00	3.00	.3754 x 10 ⁰
CLYP	27	7.33	4.00	10.00	.2538 x 10 ¹
PROL	28	5.96	3.00	12.00	.5665 x 10 ¹
AC	28	18.68	11.00	29.00	.1711 x 10 ²
DC	28	11.75	6.00	21.00	.9898 x 10 ¹
PA	27	4.18	3.00	5.00	.3105 x 10 ⁰
SC	28	8.00	2.00	11.00	.3407 x 10 ¹
ANSU	27	238.89	200.00	280.00	.4410 x 10 ³
ANT3	27	424.07	360.00	470.00	.6635 x 10 ³
ANTT	26	538.46	450.00	620.00	.2509 x 10 ⁴
BASI	28	190.71	170.00	220.00	.1402 x 10 ³
DISI	28	82.86	70.00	90.00	.3598 x 10 ²
FF	28	633.93	550.00	700.00	.2556 x 10 ⁴
FT	28	781.25	575.00	900.00	.4612 x 10 ⁴
FTA1	28	517.86	425.00	600.00	.1660 x 10 ⁴
FTA2	28	351.79	300.00	400.00	.8300 x 10 ³
FTA3	28	239.29	200.00	275.00	.5291 x 10 ³
FTA4	28	159.82	125.00	200.00	.3398 x 10 ³
FTA5	28	96.43	75.00	125.00	.1257 x 10 ³
MF	28	646.43	550.00	750.00	.3135 x 10 ⁴

VARIABLE	SAMPLE SIZE	MEAN	RANGE		VARIANCE
			MIN	MAX	
MT	28	652.68	575.00	750.00	.2886 x 10 ⁴
MTA1	28	310.71	275.00	375.00	.8995 x 10 ³
MTA2	28	187.50	150.00	225.00	.3009 x 10 ³
MTA3	28	145.54	125.00	175.00	.2340 x 10 ³
MTA4	28	96.43	75.00	100.00	.7936 x 10 ²
MTA5	28	91.07	75.00	100.00	.1488 x 10 ³
HF	28	664.29	525.00	750.00	.4418 x 10 ⁴
HT	28	777.68	675.00	875.00	.3673 x 10 ⁴
HTA1	28	446.43	375.00	525.00	.1931 x 10 ⁴
HTA2	28	260.71	225.00	325.00	.7143 x 10 ³
HTA3	28	188.39	150.00	225.00	.3927 x 10 ³
HTA4	28	115.18	100.00	150.00	.2472 x 10 ³
HTA5	28	95.54	75.00	125.00	.1414 x 10 ³
COMB	27	10.04	8.00	12.00	.8832 x 10 ⁰
TH	8	878.13	750.00	975.00	.5435 x 10 ⁴
AB	27	2064.81	1650.00	2500.00	.4698 x 10 ⁵
WW	27	549.07	475.00	625.00	.1898 x 10 ⁴
WR	27	3.25	3.05	3.43	.8354 x 10 ⁻²
BL	7	2878.57	2475.00	3400.00	.8988 x 10 ⁵
AR	26	1.27	1.11	1.40	.7525 x 10 ⁻²
VR	28	1.07	1.03	1.15	.1140 x 10 ⁻²
HR	28	2.31	2.11	2.62	.1694 x 10 ⁻¹
HV	7	3.54	3.09	4.25	.1315 x 10 ⁰
FLR	28	.67	.61	.83	.2584 x 10 ⁻²
FSV	28	2.74	2.12	3.00	.3131 x 10 ⁻¹
FBV	28	2.28	2.13	2.64	.9794 x 10 ⁻²
MLR	28	.48	.44	.56	.7705 x 10 ⁻³
MSV	28	4.19	3.80	4.64	.3664 x 10 ⁻¹
MBV	28	3.10	2.81	3.59	.2565 x 10 ⁻¹
HLR	28	.57	.52	.70	.1113 x 10 ⁻²
HSV	28	3.24	2.62	3.55	.3250 x 10 ⁻¹
HBV	28	2.87	2.37	3.09	.1986 x 10 ⁻¹
BR	7	2.26	2.00	2.78	.8238 x 10 ⁻¹

Female (reared)

(Color. Yellow; halteres golden; scutal stripes not distinct.

Length ($m\mu$). Body 2175, thorax 700, abdomen 1475.

Head.. Interocular distance 410 $m\mu$. Temporals 7, verticals 7, postorbitals 0. A.R. 0.63. Antennal flagellomere lengths ($m\mu$, Fig. 78b): 60, 35, 35, 35, 105. Clypeus large and rectangular, with 13 setae. Palpal segment lengths ($m\mu$): 25, 35, 75, 80, 130.

Thorax. Anteprenotal lobe juts out medially, robust. Lateral anteprenotals ?4, acrostichals ?15, prealars ?4, dorsocentrals ?8, uniserial, short but not as reduced as in male; scutellars 8, uniserial. Anapleural suture damaged. No mesonotal pit.

Wing. Length 1575 $m\mu$, width 575 $m\mu$. L/W.R. 2.73. Finely punctate; anal lobe straight proximally, slightly rounded distally, and not produced. V.R. 1.04. Stem vein with 1 seta, R with 9, R1 with 6, R4+5 with 8, squama with 12. Costa extended beyond R4+5, apex slightly distal to apex of Cu1. R2+3 ending about 1/5 distance between R1 and R4+5.

Legs. Hind tibial comb composed of 11 setae. Spines absent on fore leg, 2 on each of first two tarsal segments of mid leg, hind leg damaged.

Leg lengths ($m\mu$) and proportions:

	F	T	Ta1	Ta2	Ta3	Ta4	Ta5	L.R.	B.V.	S.V.
Fore	525	600	375	275	175	125	100	0.62	2.22	3.00
Mid	475	500	250	150	100	75	100	0.50	2.88	3.90
Hind	500	600	---	---	---	100	100	---	---	---

Genitalia (Fig. 74). Lateral sternite IX with posterior margin rounded, produced posterolaterally; few long setae dorsally, and shorter setae ventrally. Tergite IX narrow. Spermathecal duct wrinkled for most of length. (The clasper is folded under, but I have drawn it in the normal position.)

Remarks. The female of Orthocladus (O.) carlatus closely resembles the female of O. annectens in genitalic features; carlatus can be distinguished from annectens by the robust antepnotum.

Male Pupal Exuvia

Color. Golden.

Length (m μ). Body 3825, cephalothorax 750, abdomen 3075.

Cephalothorax. Setae: frontals 1, weak; postorbitals 1, humerals 3, lateral antepnotals 1, median antepnotals 2, prealars 1, dorsocentrals 4. Thoracic horn (Fig. 90c) small and slender, bare, length 1800 m μ . Frontal tubercles not prominent. Anterior part of notum wrinkled along eclosion line.

Abdomen. Anal lobe length 290 m μ , heart-shaped with 4 right and 4 left spurs; spurs robust, with blunt apices; longest anal seta length 180 m μ . A.L.R. 0.62. Pedes spurii B robust, present on segments II, III.

Setae present on segments I-VIII:

dorsals	4	4	4	5	5	5	5	2
laterals	1	3	3	3	3	3	4	3
ventrals	1	3	3	2	4	3	2	1

Tergal spine patterns (composite, Figs. 91g, h; 103).

I: bare; group of 3-rowed chitinous rings well spaced along

posterior margin; patch of faint chitinous rings centrally; Omm 2, Amm 1. II: elliptical patch posteromedial, with about 118 recurved spines in 4 rows; band of 2-3 rowed chitinous rings on either side of recurved spines; 2 well-spaced patches of fine spines along anterior margin; band of coarse spines anterior to recurved spines; Omm 3, Amm 2. III: reduced patch of coarse spines, separated by bare line from rectangular patch of anteriorly-directed spines along posterior margin; band of 2-rowed chitinous rings on either side of anteriorly-directed spines; 2 well-spaced patches of fine spines along anterior margin; Omm 3, Amm 2. IV: as in III, but with central patch larger; Omm 4, Amm 2. V: as in IV but without chitinous rings; Omm 3, Amm 2. VI: as in V but with large patch reduced in size, and without posterior patch of anteriorly-directed spines; Omm 2, Amm 2. VII: 2 well-spaced patches of fine spines along anterior margin; few spines along posterior margin medially; Omm 4, Amm 2. VIII: as in VII but with medial patch smaller; Omm 3, Amm 2. IX: band of fine spines along anterior margin.

Sternal spine patterns (composite). I: bare. II: bare; 2 well-spaced bands of 4-rowed chitinous rings along posterior margin. III: 2 well-spaced patches of fine spines along anterior margin, continuous with lateral bands reaching posterior margin; 2 well-spaced bands of 3-rowed chitinous rings along posterior margin. IV: as in III but without chitinous rings; band of faint chitinous rings along posterior margin. V: 2 well-spaced patches of fine spines along anterior margin; band of faint chitinous rings along posterior margin. VI: as

in V and with patch of fine spines along posterior margin medially. VII: as in VI but with medial patch smaller, and 2 well-spaced patches of faint chitinous rings along posterior margin. VIII: 2 well-spaced patches of fine spines along anterior margin. IX: bare.

Variation. Exuvia golden to light brown. Thoracic horn with a few spines on outer margin (N. Mexico). Chitinous rings can be light, appear as sculpturing (L.C.). Notum with a few bumps anteriorly, but never as bumpy as dorenus.

Remarks. The pupa of Orthocladus (O.) carlatus closely resembles the pupa of O. curtiseta; it can be distinguished from curtiseta by the presence of pedes spurii B on segment III, and the absence of chitinous rings on tergites V and VI.

Larva

Head. Labial plate (Fig. 132b) convex in shape; broad median tooth extended anteriorly, beyond first laterals; all teeth evenly dark. Mandible (Fig. 132a) with outer margin smooth; brush with 28 setae, apices serrate. Epipharynx obscured. Premandible simple. A.R. 1.42. Antennal segment lengths (mu, Fig. 114a): 30; 9, 5, 4, 3; blade grooved, extended to 4th segment; Lauterborn organs weakly developed.

Variation. A.R. 1.64; mandibular brush with 6 setae (Roback 1957a)".

Remarks. The larva of Orthocladus (O.) carlatus closely resembles the larva of O. robacki; it can be distinguished from robacki by the smaller size, measured by the width of the labial plate.

ECOLOGY

The pupal exuviae of O. carlatus were collected during April to August in Pennsylvania (Coffman 1973). These data, and the material examined here, suggest that the emergence of this species is bivoltine.

Roback (1957a) provided specific information on the habitats of the larvae of this species.

MATERIAL EXAMINED (Fig. 146)

Holotype. Male, reared, Plymouth Valley, Pa., on grounds of Community Baptist Church, (approx. 1 1/2 miles south of U.S. route 202 along Germantown Pike (6A), emerged May 13, 1953, (ANSP No. 6780).

Arkansas. Carroll Co., Big Clifty Cr., SW 1/4 Sec. T1 9N, R 27W. 8.V.63, A. Hite and R. Aggus, (SUBLETTE), 3 males.

California. Mono Co., Cevet Cr. below Sonora Pass, 8500 ft., light trap. 18.VII.68, R.A. Hellenenthal, (SUBLETTE), 1-male; Mono Co., nr. Sonora Pass, Elev. 8500', 18.VII.68, R.A. Hellenenthal, (SUBLETTE), 1 male; Mono Co., Sonora Pass, Levet Creek, El. 8000 ft., lt. trap, July 18, 1968, Ronald A. Hellenenthal, (MINN), 1 male; Humboldt Co., Van Duzen River nr. Grizzly Creek, 22 Sept. 1961, E.L. Kessel, (USNM), 1 male. Maryland. Montgomery Co., Fairland, light trap, May 1959, A.A. Hubert, (USNM), 2 males. Minnesota. Collected by E.F. Cook (MINN): Cook Co., Min. F.S., Hovland, N.J. Mosquito Trap, July 22, 1968, 6 males; same data, except June 9, 1969, 10 males; June 30, 1969, 1 male; July 6, 1969, 1 male; Aug. 24, 1969, 1 male; Cook Co., 2 mi. N. Hovland on U.S. 61, N.J. Mosquito Trap, Sept. 14, 1970, 1 male; Koochiching Co., Min. F.S.,

Little Fk., N.J. Mosquito Trap, Sept. 27, 1969, 2 males; Euclaire Co., Euclaire, 13.VIII.67, D.W. Webb, (INHS), 1 male; Hubbard Co., Lower LaSalle Lake, N.J. Mosquito Trap, May 22, 1970, 1 male; same data except Oct. 4, 1970, 1 male; Oct. 22, 1970, 1 male; Clearwater Co., Miss. R. at Co. Rd. 2, N.J. Mosquito Trap, Oct. 4, 1970, 2 males; same data except July 1, 1970, 2 males.

New Mexico. Hot Springs, 5 mi. N. of Las Vegas, 18.IV.67, J.E.S. and M.F.S., (SUBLETTE), 1 reared male. New York. Tompkins Co., Ellis Hollow, light trap, 15 June 1963, C.O. Berg, (USNM), 6 males. Oregon. Salem, Willamette R., 22 May 1963, K. Goeden-light, (USNM), 2 males. Pennsylvania. Mill Creek, about 1 mile below Dove Lake, May 20, 1953, S.S. Roback, (ANSP) 1 larva; same data except 10A PA2 5.20.53, 21, 1 reared female; SRP #21, Sta. 1, IX.1.60, (ANSP), 4 larvae; SRP 7.53, (ANSP), 1 larva; Linesville Creek, Crawford Co., 17 Sept. 70, W.P. Coffman, L.C.P. #14, (PITT), 1 pupal ex.; same data except 6 May 71, L.C.P. #7, 3 pupal ex. Virginia. Falls Church, Holmes Run, light trap, 19 May 1960, W.W. Wirth, (USNM), 1 male.

Orthocladus (Orthocladus) charensis n. sp.

Figs. 31, 61, 78c, 90d, 107, 108, 122, 147

This new species, referred to as Orthocladus sp., was collected in Char Lake by Welch (1973, p. 1115).

Holotype Male

Color. Dark brown; halteres golden; scutal stripes distinct, merging posteriorly.

Length (mm). Body 4475, thorax 1300, abdomen 3175.

Head. Interocular distance 310 μ . Temporals 16, verticals 14, postorbitals 2. A.R. 1.61. Antennal flagellomere lengths (μ): 1st-12th 1300, 13th 2100. Clypeus rectangular, with 6 setae. Palpal segment lengths (μ): 40, 65, 130, 115, 175.

Thorax. Anteprenotal lobe wide medially, robust. Lateral anteprenotals 3, acrostichals 13, prealars 5, dorsocentrals 9, uniserial; scutellars 9, uniserial. Anapleural suture length 340 μ . No mesonotal pit.

Wing. Length 2425 μ , width 900 μ . L/W.R. 2.69. Moderately punctate. Anal lobe rounded, and produced. V.R. 1.13. Stem vein with 1 seta, R with 8, R4+5 with 5, squama with 26. Costa extended beyond R4+5, apex well distal to apex of Cu1. R2+3 ending before midpoint of R1 and R4+5.

Legs. Hind tibial comb composed of 10 setae. Spines absent on fore leg, 2 on each of first two tarsal segments of mid leg, 2 on first tarsal segment and one on second tarsal segment of hind leg.

Leg lengths (μ) and proportions:

	F	T	Ta1	Ta2	Ta3	Ta4	Ta5	L.R.	B.V.	S.V.
Fore	1075	1150	800	475	325	200	150	0.69	2.63	2.78
Mid	1125	1075	525	300	225	150	150	0.48	3.30	4.19
Hind	1300	1250	700	425	300	175	150	0.56	3.09	3.64

Hy (Fig. 31). Gonocoxite length 280 μ , gonostylus 125 μ . H.R. 2.24. H.V. 3.58. Lateral margin of tergite IX with group of 7 setae. Anal point medium in length. Virga present. Basal median lobes of gonocoxite collarlike.

Basal lobe with dorsal part noselike, ventral part hidden below.

Gonostylus robust, cuplike, with rounded apex.

Variation. The virga is often difficult to see.

Remarks. The male of Orthocladus (O.) charensis closely resembles the male of O. sublettj in hypopygial features; charensis can be distinguished from sublettj by the presence of setae on vein R4+5 of the wing.

O. charensis n. sp.

VARIABLE	SAMPLE SIZE	MEAN	RANGE		VARIANCE
			MIN	MAX	
WING	33	2860.61	2600.00	3150.00	.2078 x 10 ⁵
ARM	33	1081.06	950.00	1175.00	.2814 x 10 ⁴
AFCU	33	1174.24	1050.00	1275.00	.4824 x 10 ⁴
R	33	77.88	40.00	130.00	.4547 x 10 ³
SQUM	33	21.97	15.00	31.00	.1084 x 10 ²
P1	33	35.45	30.00	40.00	.9943 x 10 ¹
P2	33	60.61	55.00	75.00	.3087 x 10 ²
P3	33	117.57	105.00	140.00	.1017 x 10 ³
P4	31	99.03	70.00	120.00	.1307 x 10 ³
P5	27	152.22	115.00	175.00	.2564 x 10 ³
EYE	25	294.00	245.00	340.00	.5333 x 10 ³
VERT	33	12.00	9.00	15.00	.2312 x 10 ¹
ETM	33	2.18	1.00	4.00	.7784 x 10 ⁰
CLYP	33	7.12	4.00	10.00	.1860 x 10 ¹
PROL	33	2.94	0.00	6.00	.2059 x 10 ¹
AC	32	10.81	6.00	17.00	.7705 x 10 ¹
DC	33	9.09	7.00	12.00	.1273 x 10 ¹
PA	33	4.85	3.00	6.00	.3826 x 10 ⁰
SC	33	10.55	9.00	14.00	.2131 x 10 ¹
ANSU	33	320.91	290.00	360.00	.4148 x 10 ³
ANT3	33	496.36	440.00	550.00	.7426 x 10 ³
ANTT	33	771.52	650.00	880.00	.2763 x 10 ⁴
BASI	33	283.79		325.00	.1813 x 10 ³

VARIABLE	SAMPLE SIZE	MEAN	RANGE		VARIANCE
			MIN	MAX	
DISI	33	114.70	95.00	135.00	.7959 x 10 ²
FF	33	1000.00	925.00	1100.00	.2461 x 10 ⁴
FT	33	1088.64	975.00	1200.00	.3207 x 10 ⁴
FTA1	33	737.88	600.00	825.00	.2192 x 10 ⁴
FTA2	33	440.91	350.00	500.00	.8523 x 10 ³
FTA3	33	307.57	275.00	350.00	.4096 x 10 ³
FTA4	33	200.76	175.00	225.00	.2142 x 10 ³
FTA5	33	143.94	125.00	150.00	.1184 x 10 ³
MF	33	1028.03	925.00	1125.00	.2842 x 10 ⁴
MT	33	1001.52	900.00	1125.00	.3357 x 10 ⁴
MTA1	33	490.15	425.00	525.00	.6226 x 10 ³
MTA2	33	291.67	250.00	325.00	.3385 x 10 ³
MTA3	33	218.94	200.00	250.00	.1965 x 10 ³
MTA4	33	147.73	125.00	175.00	.1314 x 10 ³
MTA5	33	138.64	125.00	150.00	.1598 x 10 ³
HF	33	1168.94	950.00	1325.00	.6407 x 10 ⁴
HT	33	1209.09	1000.00	1350.00	.5618 x 10 ⁴
HTA1	33	650.00	550.00	725.00	.1641 x 10 ⁴
HTA2	33	387.12	325.00	425.00	.5907 x 10 ³
HTA3	33	291.67	250.00	325.00	.2995 x 10 ³
HTA4	33	1750.00	1500.00	2000.00	.2344 x 10 ⁵
HTA5	33	152.27	125.00	175.00	.9233 x 10 ²
COMB	33	10.21	9.00	12.00	.6723 x 10 ⁰
TH	33	1231.82	1100.00	1425.00	.5206 x 10 ⁴
AB	33	2956.06	2550.00	3600.00	.4488 x 10 ⁵
WW	31	852.42	775.00	950.00	.2098 x 10 ⁴
WR	31	3.36	3.11	3.75	.2476 x 10 ⁻¹
BL	33	4187.88	3800.00	5025.00	.7164 x 10 ⁵
AR	33	1.56	1.37	1.80	.1184 x 10 ⁻¹
VR	33	1.09	1.02	1.16	.8684 x 10 ⁻³
HR	33	2.48	2.19	2.95	.3030 x 10 ⁻¹
HV	33	1.83	1.55	2.28	.3091 x 10 ⁻¹
FLR	33	.68	.53	.71	.1172 x 10 ⁻²
FSV	33	2.84	2.69	3.67	.3169 x 10 ⁻¹

VARIABLE	SAMPLE SIZE	MEAN	RANGE		VARIANCE
			MIN	MAX	
FBV	33	2.59	2.38	2.95	.1331 x 10 ⁻¹
MLR	33	.49	.45	.53	.3348 x 10 ⁻³
MSV	33	4.14	3.90	4.47	.2111 x 10 ⁻¹
MBV	33	3.16	2.97	3.31	.8535 x 10 ⁻²
HLR	33	.54	.44	.67	.1162 x 10 ⁻²
HSV	33	3.66	2.89	4.55	.5719 x 10 ⁻¹
HBV	33	1.18	1.02	1.32	.5269 x 10 ⁻²
BR	33	2.40	2.04	2.56	.1512 x 10 ⁻¹

Allotype Female

Color. Brown; halteres golden; scutal stripes distinct, merging posteriorly.

Length (m_μ). Body 3925, thorax 1125, abdomen 2800.

Head. Interocular distance 220 m_μ. Temporals 6, verticals 5, postorbitals 1. A.R. 0.71. Antennal flagellomere lengths (m_μ, Fig. 78c): 90, 45, 45, 50, 165. Clypeus large and rectangular, with 9 setae. Palpal segment length (m_μ): 40, 55, 120, 100, 155.

Thorax. Anteprenotal lobe wide medially and robust, as in male. Lateral anteprenotals 2, acrostichals 12, prealars 4, dorsocentrals 10, uniserial; scutellars 8, uniserial. Anapleural suture length 280 m_μ. Indication of mesonotal pit.

Wing. Length 3075 m_μ, width 900 m_μ. L/W.R. 3.41.

Moderately punctate; anal lobe straight proximally, slightly rounded distally, and not produced. V.R. 1.07. Stem vein with 1 seta, R with 11, R1 with 3, R4+5 with 8, squama with 22. Costa extended beyond R4+5, apex well distal to apex of Cul. R2+3 ending about 1/4 distance between R1 and R4+5.

Legs. Hind tibial comb composed of 8 setae. Spines absent on fore leg, 2 on each of first two tarsal segments of mid leg, 2 on first tarsal segment of hind leg.

Leg lengths ($m\mu$) and proportions:

	F	T	Ta1	Ta2	Ta3	Ta4	Ta5	L.R.	B.V.	S.V.
Fore	775	925	650	350	225	150	125	0.70	2.76	2.61
Mid	825	875	425	225	150	100	100	0.48	3.69	4.00
Hind	950	1075	575	325	225	125	100	0.53	3.35	3.52

Genitalia (Fig. 61, paratype). Lateral sternite IX with long, narrow projection posterolaterally; long setae proximally, shorter setae distally. Tergite IX broad. Spermathecal duct wrinkled for most of length.

Variation. Postorbitals 1-2.

Remarks. The female of Orthocladus (O.) charensis closely resembles the female of O. lapponicus in genitalic features; charensis can be distinguished from lapponicus by the broad tergite IX and the more slender projection of lateral sternite IX.

Male Pupal Exuvia

Color. Pale golden.

Length ($m\mu$). Body 4325, cephalothorax 1375, abdomen 2950.

Cephalothorax. Setae: frontals 1, weak; postorbitals 1, humerals 3, lateral anteprenotals 1, median anteprenotals 2, prealars 2, dorsocentrals 4. Thoracic horn (Fig. 90d) robust with long tapered apex, well covered with moderately developed, pointed spines, length 300 $m\mu$. Frontal tubercles not prominent. Anterior part of notum wrinkled along eclosion line.

Abdomen. Anal lobe length 310 μ ; moderately developed, without spurs, but with thin citinous threads along outer margin, (Fig. 107); longest anal seta length 220 μ . A.L.R. 0.70. Pedes spurii-B weakly developed, present on segment II.

Setae present on segments I-VIII:

dorsals	2	4	4	5	5	5	4	1
laterals	1	3	3	3	3	3	4	4
ventrals	0	4	3	4	4	3	3	1

Tergal spine patterns (composite). I: bare; Omm 0, Anm 0. II: elliptical patch posteromedial, with about 29 recurved spines in 3 rows; large patch of coarse spines anterior to recurved spines; bare bands laterally; Omm 2, Anm 1. III-V: large patch of coarse spines separated by bare line from rectangular patch of anteriorly-directed spines along posterior margin; bare bands laterally; Omm 3, Anm 1 (III); Omm 2, Anm 1 (IV, V). VI: as in III-V, but with large patch reduced in size and without patch of anteriorly-directed spines; Omm 3, Anm 1. VII, VIII: 2 well-spaced patches of fine spines along anterior margin; Omm 1, Anm 1 (VII); Omm 4, Anm 1 (VIII). IX: band of fine spines along anterior margin.

Sternal spine patterns (composite). I, II: bare. III-V: 2 well-spaced patches of fine spines along anterior margin. VI: 2 well-spaced patches of fine spines along anterior margin; small patch of fine spines along posterior margin medially. VII: as in VI, but with medial patch larger. VIII: 2 well-spaced patches of fine spines along anterior margin. IX: bare.

Remarks. The pupa of Orthocladus (0.) charensis

closely resembles the pupa of O. nigrinus; it can be distinguished from nigrinus by the paler exuvia and the more robust lateral setae on segments VII, VIII.

Larva (n = 10)

Color. Body white with head capsule yellow.

Head. Eyespots (Fig. 122c) bipartite, and sometimes fused. Labial plate (Fig. 129b) convex; median tooth narrow, extended anteriorly, beyond first laterals; paralabials not prominent. Mandible (Fig. 129a) with outer margin almost smooth, at most with weak crenulations; brush with 7 setae, most apices serrate. Epipharynx (Figs. 108a, b, c; 122a) with 8 chaetae laterales, 2 chaetae basales, 4 spinules. Premandible simple, with preapical notch. A.R. 1.50-1.93. Antennal segment lengths (mv, Figs. 108c, 122b): 45-65, 16-21, 7-11, 4-6; blade grooved, extended to 3rd segment; Lauterborn organs weakly developed. Anal gills rounded.

Remarks. The larva of Orthocladus (O.) charensis closely resembles the larva of O. lapponicus; it can be distinguished from lapponicus by a combination of characters: 4-segmented antenna, shape of the labial plate, shape of anal gills, white body, and ecology (Welch 1973).

ECOLOGY

The larvae of O. charensis are found in the rocky zone along shore (2-4m. deep) in Char Lake, N.W.T. (Welch 1973). The larvae do not build tubes.

TYPE MATERIAL (Fig. 147)

Holotype. Male, Trap. No. Tr4b-11, #1 08, Cornwallis

T., Resolute, Char Lake, N.W.T., 23 August 1969, D.R. Oliver, P. Corbet, (CNC). Allotype. Female, Cornwallis I., Resolute, Char Lake, N.W.T., August 13, 1970, no collector, (CNC).

Paratypes (77). Greenland. Nedre Midsommer So, 8.VIII.66, Can. Peary Land Expd., GP31-16, (CNC), 1 male; same data except 3.VIII.66, T1013, 1 male. Northwest Territories. Axel Heiberg I., 79° 25'N., 90° 45'W., Glacier Hill, 26 July 1963, H.K. Rutz, (CNC) 3 males; Axel Heiberg I., 79° 25'N., 90° 45'W., Wolf R., 24 July 1963, H.K. Rutz, (CNC), 1 male; Baffin I., Nettilung L., Island D, 13.VIII.56, D.R. Oliver, N. 104-7, (CNC), 1 male; Cornwallis I., Hazen Camp Pond, WE 165, 140, no collector, L.F. 14.12.62, (CNC), 1 male; Resolute Bay, 13.VIII.59, J.A. Downes, No. DR052-9, (CNC), 1 male; Resolute Creek, 14.VII.60, D.R. Oliver, No. DR052-2, (CNC), 8 pupal ex.; Type locality (CNC): 28.VII.56, K. Lange, No. ~~DR~~052-7, 1 male; 23.5 m., 13.I.70, H.E. Welch, No. 71-82, 1 larva; #9 cake pan, 1 m., 8.VIII.70, H.E. Welch, No. 71-731, 1 larva; vial 133, 0.5 M, Rocky zone, 17.VIII.69, H. Welch, 5 pupae, 4 larvae; Rocky zone, 20.VIII.72, H.E. Welch, 1 reared female, 1 reared male pupa; Rocky zone, 13.9.72, H.E. Welch, Tape #5285, 1 reared male; same data except Tape #6, 1 reared male, 1 reared female; same data except no label, 1 reared male pupa; emerg. traps #5, 13 Aug. 1970, no collector, 1 male pupa, 1 female pupa; collected by D.R. Oliver: 14 Aug. 1960, 6 pupal exuviae; 17 July 1968, DRO. 52-12-12, 1 pupal exuvia; 25 July 1968, DRO. 52. 76-5, 1 pupal exuvia; 30 July 1968, DRO 52.101.1, 1 larva; DRO 52.101.2, 1 larva; DRO 52.101.3, 1 pupal exuvia; 3.VIII.68, DRO 52-117, 1 male; 5.VIII.1968, DRO

52-125, 1 pupal exuvia; pres. 6 Aug. 1968, DRO 52.65-4, 1 reared male; collected by DRO and P. Corbet: 4 Aug. 1969, Tr. 52-125, 1 pupal exuvia; 12 Aug. 1969, Tr 7-8, 1 male; Tr 8-8, 1 male; 15 Aug. 1969, Tr 4b-9, 1 male; 23 Aug. 1969, Tr 1-11, 1 male; Tr 4a-11, 2 females, 13 males; Tr 4b-11 #1 08, 11 males; Tr 4b-11 #2, 4 males; Tr 6-11, 2 males.

Orthocladus (Orthocladus) clarkei n. sp.

Figs. 14c, 29, 67, 78d, 90t, 100, 123, 141, 148

The pupal exuviae of this species, referred to as O. (Orthocladus) sp. 2, were collected in Pennsylvania by Coffman (1973, p. 311).

Holotype Male

Color. Brown; halteres golden; scutal stripes not distinct.

Length (mμ). Body 2875, thorax 975, abdomen 1900.

Head. Interocular distance 250 mμ. Temporals 13, verticals 11, postorbitals 2. A.R. 1.52. Antennal flagellomere lengths (mμ): 1st-12th 850; 13th 1300. Clypeus rectangular, with 12 setae. Palpal segment lengths (mμ): 30, 50, 90, 75, 115.

Thorax. Anteprenotal lobe damaged, appears robust. Lateral anteprenotals 6, acrostichals 10, prealars 4, dorsocentrals 13, uniserial; scutellars 9, uniserial. Anapleural suture length 250 mμ. No mesonotal pit.

Wing (Fig. 14c). Length 1550 mμ, width 525 mμ. L/W.R. 2.95. Scarcely punctate. Anal lobe well rounded, and produced. V.R. 1.12. Stem vein with 2 setae; R with 6, squama with 22. Costa not extended beyond R4+5, apex well distal to apex of Cul.

R2+3 ending before midpoint of R1 and R4+5.

Legs. Hind tibial comb composed of 11 setae. Spines absent on fore leg, 2 on each of first two tarsal segments of mid leg, 2 on first tarsal segment of hind leg.

Leg lengths ($m\mu$) and proportions:

	F	T	Ta1	Ta2	Ta3	Ta4	Ta5	L.R.	B.V.	S.V.
Fore	550	700	475	300	225	125	100	0.67	2.30	2.63
Mid	575	625	300	175	125	75	75	0.48	3.33	4.00
Hind	625	750	300	250	175	75	100	0.40	2.79	4.58

Hypopygium (Fig. 29). Gonocoxite length 200 $m\mu$, gonostylus length 90 $m\mu$. H.R. 2.22. H.V. 3.19. Lateral margin of coxite IX with group of 6 setae. Anal point short. Virga absent. Basal median lobes of gonocoxite triangular, with median margins straight and thickened. Basal lobe with dorsal part weak, long and narrow, with ventral part hidden below. Gonostylus rounded.

Variation. Stem vein usually with 1 seta.

Remarks. The male of Orthocladus (O.) clarkei closely resembles the male of O. nigritus in hypopygial features; clarkei can be distinguished from nigritus by the shape of the basal median lobes and the less well developed basal lobe of the gonocoxite.

O. clarkei n. sp.

VARIABLE	SAMPLE SIZE	MEAN	RANGE		VARIANCE
			MIN	MAX	
WING	8	1956.25	1550.00	2525.00	.1171 x 10 ⁶
ARM	8	771.87	600.00	1000.00	.1865 x 10 ⁵
AFCU	8	846.87	675.00	1100.00	.2401 x 10 ⁵

VARIABLE	SAMPLE SIZE	MEAN	RANGE		VARIANCE
			MIN	MAX	
R	8	5.37	3.00	6.00	.1411 x 10 ¹
SQUM	7	23.00	17.00	31.00	.2700 x 10 ²
P1	8	34.37	30.00	45.00	.3170 x 10 ²
P2	8	53.75	45.00	60.00	.3393 x 10 ²
P3	8	106.25	90.00	130.00	.1768 x 10 ³
P4	8	86.25	70.00	110.00	.2339 x 10 ³
P5	8	137.50	115.00	160.00	.2643 x 10 ³
EYE	8	275.00	250.00	320.00	.5786 x 10 ³
VERT	8	11.37	9.00	13.00	.2554 x 10 ¹
ETM	8	2.37	2.00	3.00	.2679 x 10 ⁰
CLYP	8	13.12	10.00	19.00	.7554 x 10 ¹
PROL	8	5.37	3.00	8.00	.2268 x 10 ¹
AC	8	12.37	10.00	20.00	.1084 x 10 ²
DC	8	12.25	10.00	14.00	.2214 x 10 ¹
PA	8	4.87	4.00	6.00	.6964 x 10 ⁰
SC	8	8.62	6.00	11.00	.1982 x 10 ¹
ANSU	8	305.00	250.00	400.00	.3029 x 10 ⁴
ANT3	7	371.43	340.00	420.00	.9809 x 10 ³
ANTT	7	602.86	520.00	720.00	.6190 x 10 ⁴
BASI	8	220.00	200.00	250.00	.3429 x 10 ³
DISI	8	97.50	90.00	110.00	.5000 x 10 ²
FF	8	693.75	550.00	900.00	.1460 x 10 ⁵
FT	8	865.62	700.00	1125.00	.2392 x 10 ⁵
FTA1	8	578.12	475.00	700.00	.7757 x 10 ⁴
FTA2	8	381.25	300.00	500.00	.4777 x 10 ⁴
FTA3	8	265.62	225.00	325.00	.1953 x 10 ⁴
FTA4	8	159.37	125.00	200.00	.5245 x 10 ³
FTA5	8	112.50	100.00	125.00	.1786 x 10 ³
MF	7	721.43	575.00	950.00	.1967 x 10 ⁵
MT	8	771.87	625.00	1025.00	.1972 x 10 ⁵
MTA1	8	387.50	300.00	525.00	.5893 x 10 ⁴
MTA2	8	234.37	175.00	325.00	.2846 x 10 ⁴
MTA3	8	162.50	125.00	200.00	.7143 x 10 ³
MTA4	8	93.75	75.00	125.00	.4911 x 10 ³

VARIABLE	SAMPLE SIZE	MEAN	RANGE		VARIANCE
			MIN	MAX	
MTA5	8	96.87	75.00	125.00	.4353 x 10 ³
HF	8	775.00	25.00	1025.00	.1964 x 10 ⁵
HT	8	931.25	750.00	1250.00	.3192 x 10 ⁵
HTA1	8	528.12	300.00	750.00	.1936 x 10 ⁵
HTA2	8	318.75	250.00	425.00	.3527 x 10 ⁴
HTA3	8	234.37	175.00	300.00	.1775 x 10 ⁴
HTA4	8	109.37	75.00	150.00	.5245 x 10 ³
HTA5	8	115.62	100.00	150.00	.3460 x 10 ³
COMB	8	10.50	10.00	11.00	.2857 x 10 ⁰
TH	6	1091.67	975.00	1500.00	.4117 x 10 ⁵
AB	8	2318.75	1825.00	3025.00	.1798 x 10 ⁶
WW	8	625.00	525.00	800.00	.8571 x 10 ⁴
WR	8	3.12	1.95	3.36	.2101 x 10 ⁻¹
BL	6	3295.83	2825.00	4525.00	.3946 x 10 ⁶
AR	7	1.62	1.51	1.76	.7419 x 10 ⁻²
VR	8	1.10	1.03	1.12	.8469 x 10 ⁻³
HR	8	2.26	2.10	2.67	.3211 x 10 ⁻¹
HV	6	3.34	2.82	4.11	.1984 x 10 ⁰
FLR	8	.67	.62	.70	.4866 x 10 ⁻³
FSV	8	2.69	2.62	2.89	.7415 x 10 ⁻²
FBV	8	2.32	2.24	2.42	.3827 x 10 ⁻²
MLR	8	.50	.48	.52	.2766 x 10 ⁻³
LSV	7	3.86	3.71	4.00	.1326 x 10 ⁻¹
MBV	7	3.23	3.03	3.45	.1815 x 10 ⁻¹
HLR	8	.56	.40	.61	.4622 x 10 ⁻²
HSV	8	3.32	3.03	4.58	.2697 x 10 ⁰
HBV	8	2.86	2.70	3.02	.1291 x 10 ⁻¹
BR	6	2.02	1.82	2.17	.1453 x 10 ⁻¹

Allotype Female

Color. Brown; halteres golden; scutal stripes distinct, not merging posteriorly.

Length (mm). Body 2900, thorax 1050, abdomen 1850.

Head. Interocular distance 250 μ . Temporals 10, verticals 7, postorbitals 3. A.R. 0.69. Antennal flagellomere lengths (μ , Fig. 78d): 65, 40, 45, 45, 135. Clypeus large and rectangular, with 20 setae. Palpal segment lengths (μ): 30, 50, 100, 90, 110.

Thorax. Antepronotal lobe wide medially, and robust as in male. Lateral anteprenotals 8, acrostichals 14, prealars 5, dorsocentrals 14, uniserial; scutellars 12, uniserial. Anapleural suture length 240 μ . Indication of mesonotal pit.

Wing. Length 1900 μ , width 750 μ . L/W.R. 2.53. Finely punctate. Anal lobe straight proximally, slightly rounded distally, and not produced. V.R. 1.07. Stem vein with 1 seta, R with 10, R1 with 7, R4+5 with 7, squama with 19. Costa extended beyond R4+5, apex well distal to apex of Cu1. R2+3 ending about 1/3 distance between R1 and R4+5.

Legs. Hind tibial comb composed of 10 setae. Spines absent on fore leg, 2 on each of first two tarsal segments of mid leg, 2 on first tarsal segment of hind leg.

Leg lengths (μ) and proportions:

	F	T	Ta1	Ta2	Ta3	Ta4	Ta5	L.R.	B.V.	S.V.
Fore	600	725	450	275	175	125	100	0.62	2.62	2.94
Mid	625	650	325	200	125	75	100	0.50	3.20	3.92
Hind	650	775	450	250	175	75	100	0.58	3.12	3.16

Genitalia (Fig. 67). Lateral sternite IX with small area rounded, produced posterolaterally; few long setae dorsally, shorter setae ventrally, and less than 15 setae present. Tergite IX narrow. Spermathecal duct wrinkled for most of length.

Remarks. The female of Orthocladius (O.) clarkei closely resembles the female of O. doreus in genitalic features; clarkei can be distinguished from doreus by the more produced area on lateral sternite IX.

Holotype Pupal Exuvia

Color. Pale golden.

Length (m μ). Body 3925, cephalothorax 1350, abdomen 2575.

Cephalothorax. Setae: frontals 1, weak; postorbitals 1, humerals 3, lateral antepnotals 1, median antepnotals 2, prealars 1, dorsocentrals 4. Thoracic horn (Fig. 90e) slender, with long tapered apex and densely covered with moderately developed, pointed spines, length 260 m μ . Frontal tubercles not prominent. Anterior part of notum bumpy along eclosion line.

Abdomen. Anal lobe length 240 m μ ; moderately developed with 3 right and 2 left spurs; spurs short; longest anal seta length 150 m μ . A.L.R. 0.62. Pedes spurii B weakly developed, present on segment II.

Setae present on segments I-VIII:

dorsals	2	5	5	5	5	5	5	1
laterals	1	3	3	3	3	3	4	4
ventrals	3	1	3	3	3	3	2	1

Tergal spine patterns (composite, Fig. 100). I: bare; Omm 0, Ann 0. II: elliptical patch posteromedial, with about 66 recurved spines in 4 rows; reduced patch of coarse spines anterior to recurved spines reaching anterior margin; Omm 1, Ann 2. III-V: large patch of coarse spines separated by bare line

from small rectangular patch of anteriorly-directed spines along posterior margin; bare bands laterally; Omm 3, Amm 2. VI: as in III-V, but with large patch reduced in size and without patch of anteriorly-directed spines; Omm 2, Amm 2. VII: band of fine spines along anterior margin; 2 well-spaced vertical bands of fine spines centrally; Omm 2, Amm 0. VIII: band of fine spines along anterior margin; Omm 0, Amm 0. IX: band of fine spines along anterior margin.

Sternal spine patterns (composite). I: bare. II, III: band of fine spines along anterior margin continued posteriorly as medial peak. IV: band of fine spines along anterior margin continuous with lateral bands reaching posterior margin; small patch of fine spines along posterior margin medially. V, VI: 2 well-spaced patches of fine spines along anterior margin; patch of fine spines along posterior margin medially. VII, VIII: 2 well-spaced patches of fine spines along anterior margin. IX: bare.

Variation. Exuvia pale golden to light brown. Frontals weakly to moderately developed. Exuvia curls.

Remarks. The pupa of Orthocladus (O.) clarkei closely resembles the pupa of O. obumbratus; it can be distinguished from obumbratus by the smaller patches of anteriorly-directed spines on tergites III-V, and the moderately developed, pointed spines of the thoracic horn.

Larva (n = 10)

Color. Body green with head capsule yellow.

Head. Labial plate (Fig. 141a) convex; broad median

tooth extended anteriorly, beyond first laterals; paralabials long and prominent. Mandible (Fig. 141b) with outer margin smooth; brush with 7 setae, apices serrate. Epipharynx (Fig. 123a) with 8 chaetae laterales, 2 chaetae basales, 3 spinules. Premandible simple, with preapical notch. A.R. 2.18-2.79. Antennal segment lengths (μ , Fig. 123b): 47-56, 9-11, 3-5, 3-4, 3; blade grooved, extended to tip of 5th segment; Lauterborn organs moderately developed.

Remarks. The larva of Orthocladus (O.) clarkei closely resembles the larva of O. mallochi; it can be distinguished from mallochi by the smooth outer margin of the mandible.

ECOLOGY

The larvae of O. clarkei were collected in a small, bog-fed stream in a deciduous forest near Almonte, Ontario. The larvae build tubes.

The pupal exuviae of O. clarkei were collected from April to June in Pennsylvania (Coffman 1973). These data, and the material examined here, suggest that the emergence of this species is univoltine.

TYPE MATERIAL (Fig. 148)

Holotype. Male with larval and pupal exuviae, Clarke's farm, 4 miles NE of Almonte, Lanark Co., Ontario, coll. 13.V.72, em. 17.V.72, A.R. Soptonis, (CNC). Allotype. Female, with larval and pupal exuviae, same locality as holotype, coll. 13.V.72, em. 16.V.72, A.R. Soptonis, (CNC).

Paratypes (32). Illinois. Champaign Co., Hart Mem. Woods, light trap, IV.11-12.64, M.W. Sanderson, (INHS), 1 male.

Iowa. Ames 29.IV.49, (MINN), 1 male, S66-630. Minnesota. Mille Lacs, Crow Wing Cr. V.18.40, S64-1104, (MINN), 1 male. Ontario. Type locality (CNC): coll. May 13, 1972, em. May 16, 1972, A.R. Soptonis, 6 reared males and 2 reared female; same data except em. May 17, 1972, 7 reared males and 3 reared females; same data except em. May 18, 1 reared male and 1 reared female; same data except em, May 23, 3 reared males; Ottawa, Cyrville Rd., Green Creek, coll. 12.V.72, em. 14.V.72, A.R. Soptonis, (CNC), 1 reared female; same data except 1.VI.72, A.R. Soptonis, JR10, (CNC), 1 reared male; Jock R., 1 mi. from Munster Hamlet, coll. 16.IV.73, pres. 26.IV.73, A.R. Soptonis, (CNC), 1 reared male. Pennsylvania. Linesville Creek, light trap, 3.V.65, W.P. Coffman, (PITT), 1 male. Texas. 4.5 mi. S.E. Denison, (SUBLETTE), 1 male; 1 mi. n. of Whitewright, 12.IV.60, J.E. Sublette, (SUBLETTE), 1 male.

Orthocladius (Orthocladius) cooki n. sp.

Figs. 14d, 38

Holotype Male

Color. Brown; halteres golden; scutal stripes not distinct.

Length (mm). Thorax damaged; abdomen 3250.

Head. Interocular distance 275 mm. Temporals 14, verticals 14, postorbitals 0. A.R. 1.66. Antennal flagellomere lengths (mm): 1st-12th 1200, 13th 2000. Clypeus rectangular, with 14 setae. Palpal segment lengths (mm): 45, 75, 135, 130, 190.

Thorax. Anteprenotal lobe wide medially, robust.

Lateral anteprenotals 8, acrostichals 11, prealars 5, dorsocentrals

10, uniserial; scutellars 10, uniserial. Anapleural suture length 360 μ . No mesonotal pit.

Wing (Fig. 14d). Length 2625 μ , width 850 μ . L/W.R.

3.08. Finely punctate. Anal lobe well rounded, and produced.

V.R. 1.14. Stem vein with 1 seta, R with 9, squama with 23.

Costa slightly extended beyond R4+5, apex well distal to apex of

Cul. R2+3 ending before midpoint of R1 and R4+5.

Legs. Hind tibial comb composed of 12 setae. Spines absent on fore leg, 2 on each of first two tarsal segments of mid leg, 2 on first tarsal segment of hind leg.

Leg. lengths (μ) and proportions:

	F	T	Ta1	Ta2	Ta3	Ta4	Ta5	L.R.	B.V.	S.V.
Fore	925	1125	750	475	350	225	150	0.66	2.33	2.73
Mid	925	1000	500	275	225	150	125	0.50	3.12	3.85
Hind	1000	1150	675	375	325	200	150	0.58	2.69	3.18

Hypopygium (Fig. 38). Gonocoxite length 280 μ , gonostylus length 120 μ . H.R. 2.33. Lateral margin of tergite IX with group of 10 setae. Anal point medium in length. Virga absent. Basal median lobes of gonocoxite triangular, with median margins long. Basal lobe with dorsal part noselike, pinched, extended beyond ventral part. Gonostylus in folded position.

Variation. Virga present or absent. Gonostylus rounded, robust.

Remarks. The male of Orthocladus (O.) cooki closely resembles the male of O. nigratus in hypopygial features; cooki can be distinguished from nigratus by the less developed basal lobe and the shape of the basal median lobes of the gonocoxite. The

female and immature stages of O. cooki are unknown.

O. cooki n. sp.

VARIABLE	SAMPLE SIZE	MEAN	RANGE		VARIANCE
			MIN	MAX	
WING	17	2658.80	2475.00	2875.00	.1445 x 10 ⁵
ARM	17	1073.50	1000.00	1175.00	.3162 x 10 ⁴
ARCU	17	1166.20	1075.00	1275.00	.3745 x 10 ⁴
R	17	6.24	4.00	9.00	.1816 x 10 ¹
SQUM	17	23.06	17.00	28.00	.6684 x 10 ¹
P1	17	40.88	35.00	45.00	.6985 x 10 ¹
P2	17	65.00	55.00	75.00	.3437 x 10 ²
P3	17	130.29	115.00	150.00	.7960 x 10 ²
P4	17	126.18	105.00	140.00	.9540 x 10 ²
P5	17	183.82	165.00	205.00	.1391 x 10 ³
EYE	17	264.67	245.00	290.00	.1552 x 10 ³
VERT	17	11.23	8.00	14.00	.2441 x 10 ¹
ETM	17	0.00	0.00	0.00	.0000
CLYP	17	10.23	5.00	14.00	.6191 x 10 ¹
PROL	16	6.06	4.00	8.00	.1929 x 10 ¹
AC	16	14.50	10.00	20.00	.9200 x 10 ¹
DC	17	9.18	6.00	13.00	.3654 x 10 ¹
PA	17	4.12	3.00	5.00	.3603 x 10 ⁰
SC	17	9.53	5.00	14.00	.4265 x 10 ¹
ANSU	17	354.71	330.00	390.00	.3515 x 10 ³
ANT3	17	469.41	430.00	510.00	.3184 x 10 ³
ANTT	17	776.47	730.00	820.00	.8618 x 10 ³
BASI	17	270.59	260.00	290.00	.8088 x 10 ²
DISI	17	115.29	110.00	120.00	.2647 x 10 ²
FF	17	922.06	850.00	1000.00	.1553 x 10 ⁴
FT	17	1108.80	1025.00	1175.00	.1870 x 10 ⁴
FTA1	17	748.53	700.00	800.00	.1130 x 10 ⁴
FTA2	17	482.35	450.00	525.00	.4504 x 10 ³
FTA3	17	341.18	325.00	375.00	.2298 x 10 ³
FTA4	17	216.18	200.00	225.00	.1516 x 10 ³
FTA5	17	129.41	125.00	150.00	.9651 x 10 ²

VARIABLE	SAMPLE SIZE	MEAN	RANGE		VARIANCE
			MIN	MAX	
MF	17	935.29	850.00	1000.00	.1489 x 10 ⁴
MT	17	980.88	900.00	1050.00	.1994 x 10 ⁴
MTA1	17	501.47	450.00	525.00	.5836 x 10 ³
MTA2	17	289.71	275.00	300.00	.1608 x 10 ³
MTA3	17	235.29	225.00	250.00	.1608 x 10 ³
MTA4	17	148.53	125.00	175.00	.1149 x 10 ³
MTA5	17	126.47	125.00	150.00	.3676 x 10 ²
HF	17	1022.10	950.00	1100.00	.1319 x 10 ⁴
HT	17	1177.90	1075.00	1250.00	.2569 x 10 ⁴
HTA1	17	679.41	625.00	750.00	.1346 x 10 ⁴
HTA2	17	388.24	350.00	425.00	.3217 x 10 ³
HTA3	17	311.76	300.00	325.00	.1654 x 10 ³
HTA4	17	180.88	175.00	200.00	.1195 x 10 ³
HTA5	17	139.71	125.00	150.00	.1608 x 10 ³
COMB	17	10.71	9.00	13.00	.1221 x 10 ¹
TH	0	0.00	0.00	0.00	.0000
AB	17	3123.50	2900.00	3375.00	.1777 x 10 ⁵
WW	17	829.41	775.00	875.00	.1112 x 10 ⁴
WR	17	3.20	3.09	3.31	.5155 x 10 ⁻²
BL	0	0.00	0.00	0.00	.0000
AR	17	1.66	1.52	1.84	.6235 x 10 ⁻²
VR	17	1.09	1.04	1.14	.4709 x 10 ⁻³
HR	17	2.35	2.17	2.55	.1371 x 10 ⁻¹
HV	0	0.00	0.00	0.00	.0000
FLR	17	.67	.64	.70	.2650 x 10 ⁻³
FSV	17	2.71	2.58	2.86	.4959 x 10 ⁻²
FBV	17	2.38	2.23	2.54	.4547 x 10 ⁻²
MLR	17	.51	.49	.54	.2074 x 10 ⁻³
MSV	17	3.82	3.67	4.05	.1371 x 10 ⁻¹
MBV	17	3.02	2.84	3.26	.1336 x 10 ⁻¹
HLR	17	.58	.54	.60	.3827 x 10 ⁻³
HSV	17	3.24	3.07	3.46	.1289 x 10 ⁻¹
HBV	17	2.82	2.69	3.02	.7873 x 10 ⁻²
BR	0	0.00	0.00	0.00	.0000

TYPE MATERIAL

Holotype. Male, N.J. Mosquito trap, U. of M., Duluth, St. Louis Co., Minn., June 4, 1969, E.F. Cook, (MINN).

Paratypes (22). Minnesota. Collected by E.F. Cook, (MINN): Cook Co., Min. F.S., Hovland, N.J. Mosquito Trap, May 9, 1968, 1 male; same data except May 20, 1968, 1 male; Cook Co., 2 mi. N. Hovland on U.S. 61, N.J. Mosquito Trap, May 16, 1970, 2 males; St. Louis Co., U. of M. Duluth, N.J. Mosquito Trap, June 17, 1969, 6 males; same data except June 4, 1969, 1 male; June 9, 1969, 7 males; June 24, 1969, 2 males; Pennsylvania. S. Chester Co., Stroud Estate, E. Branch of White Clay Creek, St. 926, 10.IV.71, J.W. Richardson, Jr. A-5, (ANSP), 2 males.

Orthocladius (Orthocladius) curtiseta Saether

Figs. 27, 90f, 114b, 138, 146

Orthocladius (s. str.) breviseta Saether, 1969, p. 65, figs. 31-33.

Orthocladius (Orthocladius) curtiseta Saether, 1973, p. 58, nomen novum for Orthocladius (s. str.) breviseta Saether, 1969, non Orthocladius breviseta Kieffer, 1923.

non Orthocladius breviseta Kieffer, 1923, p. 7.

Saether (1969) described this small brown species based on a single reared male from British Columbia, under the name O. breviseta. Later, Saether (1973) discovered that Kieffer (1923) had used the same name to describe a species from Novaya-Zemlya, based on a single female. In a short note, Saether (1973) gave the new name O. curtiseta to his species.

Saether (1969) discussed the similarities and differences of certain structures of O. curtiseta with those in the European

species O. saxicola Kieffer, and I agree that the pupae of these two species are morphologically similar. I have examined the holotype male of O. curtiseta, and I am unable to distinguish it from the male of O. carlatus, although the larvae and pupae of these two species are readily separated. The female of O. curtiseta is unknown. In the original description, the F.B.V. should be 2.16, not 3.16.

Holotype Male

Color. Brown; halteres golden; scutal stripes distinct, not merging posteriorly.

Length (m μ). Body 3400, thorax 900, abdomen 2500.

Head. Interocular distance 220 m μ . Temporals 9, verticals 9, postorbitals 0. A.R. 1.22. Antennal flagellomere lengths (m μ): 1st-12th 1000, 13th 1225. Clypeus rectangular, with 7 setae. Papal segment lengths (m μ): 25, 40, 85, 80, 125.

Thorax. Anteprenotal lobe wide medially, robust. Lateral anteprenotals 5, acrostichals 19, prealars 4, dorsocentrals 13, uniserial, with anterior setae short and posterior setae longer; scutellars 10, uniserial. Anapleural suture length 240 m μ . No mesonotal pit.

Wing. Length 1750 m μ , width 525 m μ . L/W.R. 3.33. Finely punctate. Anal lobe distorted. V.R. 1.06. Stem vein with 1 seta, R with 5, squama with 10. Costa not extended beyond R4+5, apex well distal to apex of Cu1. R2+3 ending about 1/3 distance between R1 and R4+5.

Legs. Hind tibial comb composed of 12 setae. Spines absent on fore leg, 2 on each of first two tarsal segments of mid

leg, 2 on first tarsal segment of hind leg.

Leg lengths ($m\mu$) and proportions:

	F	T	Ta1	Ta2	Ta3	Ta4	Ta5	L.R.	B.V.	S.V.
Fore	625	750	500	350	250	150	100	0.67	2.20	2.75
Mid	650	625	325	200	150	100	100	0.52	2.90	3.92
Hind	700	775	425	250	175	125	100	0.54	2.92	3.47

Hypopygium (Fig. 27). Gonocoxite length 190 $m\mu$, gonostylus length 80 $m\mu$. H.R. 2.37. H.V. 4.25. Lateral margin of tergite IX with group of 4 setae. Anal point medium in length and parallel-sided to tip. Virga present. Basal median lobes of gonocoxite triangular. Basal lobe with dorsal part noselike, extended beyond ventral part. Gonostylus flat and platelike.

Remarks. The male of Orthocladus (O.) curtiseta closely resembles the male of O. carlatus in hypopygial features; I am unable to distinguish the males of these two species.

Holotype Pupal Exuvia

Color. Light brown.

Length ($m\mu$). Body 3475, cephalothorax 1175, abdomen 2300.

Cephalothorax. Setae: frontals 1, moderately developed; postorbitals 1, humerals 3, lateral anteprenotals 1, median anteprenotals 2, prealars 1, dorsocentrals 4. Thoracic horn (Fig. 90f) small and slender, sparsely covered with small, pointed spines, length 175 $m\mu$. Frontal tubercles not prominent. Anterior part of notum wrinkled, and slightly bumpy along eclosion line.

Abdomen. Anal lobe length 230 $m\mu$; moderately developed, with 3 right and 3 left spurs; spurs short with apices blunt;

longest anal seta length 140 μ , A.L.R. 0.60. Pedes spurii B robust, present on segment II.

Setae present on segments I-VIII:

dorsals	4	4	4	4	4	4	5	1
laterals	1	3	3	3	3	3	4	4
ventrals	1	3	3	2	3	2	3	1

Tergal spine patterns: I: bare; band of 4-rowed chitinous rings along posterior margin; Omm 0, Amm 2. II: elliptical patch posteromedial, with about 30 recurved spines in 3 rows; few coarse spines anterior to recurved spines; band of 3-rowed chitinous rings on either side of recurved spines; Omm 4, Amm 2. III: horizontal rectangular patch of coarse spines separated by bare line from similar patch of anteriorly-directed spines along posterior margin; 2 well-spaced patches of fine spines along anterior margin; band of 3-rowed chitinous rings on either side of anteriorly-directed spines; Omm 3, Amm 2. IV: as in III, but with group of chitinous rings on either side of anteriorly-directed spines; Omm 4, Amm 2. V: as in IV but with additional chitinous rings anterior to groups of chitinous rings; Omm 4, Amm 2. VI: as in V but with anterior half of patch reduced in size, and without patch of anteriorly-directed spines; Omm 3, Amm 1. VII: 2 well-spaced patches of fine spines along anterior margin; patch of fine spines medially; anterior to band of 5-rowed chitinous rings along posterior margin; Omm 2, Amm 2. VIII: as in VII, but without chitinous rings and with thorns lateral to dorsal seta IV; Omm 1, Amm 1. IX: band of fine spines along anterior margin.

Sternal spine patterns. I: bare; central group of faint chitinous rings. II: bare; posteromedial patch of chitinous rings, continuous with 2-rowed band of chitinous rings along posterior margin. III: 2 well-spaced patches of fine spines along anterior margin, continuous with lateral bands reaching to posterior margin; band of 5-rowed chitinous rings along posterior margin. IV: as in III, but with lateral bands narrowed. V: 2 well-spaced patches of fine spines along anterior margin; medial patch of fine spines anterior to band of 5-rowed chitinous rings along posterior margin. VI, VII: as in V, but with medial patch larger. VIII: 2 well-spaced patches of fine spines along anterior margin. IX: bare.

Remarks. The pupa of Orthocladus (O.) curtiseta closely resembles the pupa of O. carlatus; it can be distinguished from carlatus by the absence of pedes spurii B on segment II, the distribution of chitinous rings on the tergites and sternites, and the presence of thorns on tergite VIII.

Holotype Larval Exuvia

Head. Labial plate (Fig. 138b) acutely triangular; broad median tooth extended clearly anteriorly, beyond first laterals. Mandible (Fig. 138a) with outer margin smooth; brush with 7 setae, apices serrate. Epipharynx obscured. Premandible simple. A.R. 1.45. Antennal segment lengths (mu, Fig. 114b): 32, 9, 5, 4, 4; blade extended to tip of 4th segment; Lauterborn organs moderately developed.

Remarks. The larva of Orthocladus (O.) curtiseta closely resembles the larvae of O. annectens and O. dentifer;

curtiseta can be distinguished from them by the smooth outer margin of the mandible.

MATERIAL EXAMINED (Fig. 146)

Holotype. Male with pupal and larval skins attached, small mountain stream, water temp. 13°C, Marion Lake, University of B.C. Forestry Farm, Haney, B.C., 15.VII.1967, A.L. Hamilton and O.A. Saether (CNC No. 9983). For possible additional localities, refer to O. carlatus.

Orthocladus (Orthocladus) dentifer Brundin

Figs. 30, 90g, 114c, 139, 149

Orthocladus dentifer Brundin, 1947, p. 21, fig. 42.

Orthocladus (s. s.) dentifer Brundin, Brundin, 1949, p. 888.

Orthocladus (s. str.) dentifer Brundin, Brundin, 1956, p. 104.

Orthocladus (Orthocladus) dentifer Brundin, Fittkau, Schlee, and Reiss, 1967, p. 362.

Brundin (1947) described this species based on two males from Sweden, without designating a holotype. He provided a figure of the male genitalia, but this does not show the basal median lobes of the gonocoxite. Brundin distinguished the male of O. dentifer from the male of O. oblidens on the basis of the gonostylus and the lower F.L.R. Because of the similarity of the gonostylus of the male of O. thienemanni Kieffer to that in O. dentifer, Brundin distinguished the males of these two species based on color, higher F.L.R., and the shape of the basal lobe of the gonocoxite. He also noted that the larvae of O. thienemanni occur in fast flowing waters, and those of O. dentifer occur in lakes. Brundin (1949) found the adults and pupae of O. dentifer in

and around lakes of southern Sweden, and later (1956) he included this species in a list of Orthocladius (Orthocladius) from Sweden.

I have not examined the type specimens of O. dentifer. The North American material I have seen agrees with the original description, except for the condition of the scutal stripes, which admittedly is not a reliable character. The male of O. dentifer closely resembles the male of O. (Pogonocladius) consobrinus (Holmgren); dentifer can be distinguished from consobrinus by the absence of a fore tarsal beard. The male of O. dentifer also closely resembles the male of a species of O. (Quorthocladius); dentifer can be distinguished from it by the uniserial arrangement of the scutellar setae, and the weaker anal point. The adults of O. dentifer are often found in the vicinity of large lakes, but I have collected the larvae and pupae in a small river. The female of this species is unknown. The larva and pupal exuviae are described here for the first time.

Male

Color. Brown; halteres golden; scutal stripes distinct, not merging posteriorly.

Length (m μ). Thorax damaged; abdomen 2750.

Head. Interocular distance 250 m μ . Temporals 10, verticals 10, postorbitals 0. A.R. 1.59. Antennal flagellomere lengths (m μ): 1st-12th 1100, 13th 1750. Clypeus rectangular, with 7 setae. Palpal segment lengths (m μ): 35, 65, 120, 110, 170.

Thorax. Anteprenotal lobe jutting out medially, robust. Lateral anteprenotals 6, acrostichals 9, prealars 4, dorsocentrals

9, uniserial; scutellars 8, uniserial. Anapleural suture length 310 μ . No mesonotal pit.

Wing. Length 2375 μ , width 700 μ . L/W.R. 3.39.

Moderately punctate. Anal lobe well rounded, and produced. V.R. 1.08. Stem vein with 1 seta, R with 4, squama with 16. Costa not extended beyond R4+5, apex well distal to apex of Cul. R2+3 ending before midpoint of R1 and R4+5.

Legs. Hind tibial comb composed of 11 setae. Spines absent on fore leg, 2 on each of first two tarsal segments of mid leg, 2 on first tarsal segment of hind leg.

Leg lengths (μ) and proportions:

	F	T	Ta1	Ta2	Ta3	Ta4	Ta5	L.R.	B.V.	S.V.
Fore	825	1000	675	450	300	200	125	0.67	2.32	2.70
Mid	850	900	425	250	200	125	125	0.47	3.10	4.11
Hind	875	1075	600	325	275	150	150	0.55	2.83	3.25

Hypopygium (Fig. 30). Gonocoxite length 280 μ , gonostylus length 120 μ . H.R. 2.33. Lateral margin of tergite IX with group of 11 setae. Anal point medium in length, and parallel-sided to tip. Virga present. Basal median lobes of gonocoxite collarlike. Basal lobe with dorsal part long and narrow, with ventral part slightly extended below. Gonostylus with preapical bump on dorsal edge.

Variation. Body length 4 mm; color dark brown with scutal stripes merging (Brundin 1956).

Remarks. The male of Orthocladius (O.) dentifer closely resembles the male of O. charensis in hypopygial features; dentifer can be distinguished from charensis by the bump on the dorsal edge

of the gonostylus, and absence of setae on vein R4+5 of the wing.

O. dentifer Brundin

VARIABLE	SAMPLE SIZE	MEAN	RANGE		VARIANCE
			MIN	MAX	
WING	25	2237.00	2000.00	2575.00	.2214 x 10 ⁵
ARM	25	879.00	775.00	1025.00	.4254 x 10 ⁴
AFCU	25	944.00	825.00	1100.00	.5327 x 10 ⁴
R	25	5.80	3.00	10.00	.2750 x 10 ¹
SQUM	25	14.60	10.00	21.00	.5833 x 10 ¹
P1	25	36.80	30.00	45.00	.1433 x 10 ¹
P2	25	55.40	50.00	65.00	.1858 x 10 ²
P3	25	112.60	90.00	135.00	.1232 x 10 ³
P4	25	101.60	85.00	115.00	.5150 x 10 ²
P5	25	158.40	125.00	185.00	.2390 x 10 ³
EYE	25	255.40	225.00	300.00	.3415 x 10 ³
VERT	25	11.56	8.00	15.00	.3090 x 10 ¹
ETM	25	0.00	0.00	0.00	.0000
CLYP	25	9.92	5.00	14.00	.5327 x 10 ¹
PROL	25	6.64	3.00	14.00	.6740 x 10 ¹
AC	25	13.32	8.00	21.00	.1339 x 10 ²
DC	25	8.84	7.00	13.00	.2140 x 10 ¹
PA	25	4.60	4.00	6.00	.7500 x 10 ⁰
SC	25	8.16	6.00	11.00	.1890 x 10 ¹
ANSU	24	301.25	260.00	350.00	.6288 x 10 ³
ANT3	24	440.42	380.00	490.00	.4911 x 10 ³
ANTT	24	667.92	580.00	750.00	.1643 x 10 ⁴
BASI	25	266.00	230.00	300.00	.3000 x 10 ³
DISI	25	111.20	90.00	130.00	.9433 x 10 ²
FF	25	761.00	675.00	875.00	.3077 x 10 ⁴
FT	25	926.00	800.00	1050.00	.3515 x 10 ⁴
FTA1	25	651.00	550.00	775.00	.2525 x 10 ⁴
FTA2	25	426.00	375.00	475.00	.1015 x 10 ⁴
FTA3	25	291.00	250.00	325.00	.6187 x 10 ³
FTA4	25	192.00	175.00	225.00	.1937 x 10 ³
FTA5	25	121.00	100.00	125.00	.8750 x 10 ²

VARIABLE	SAMPLE SIZE	MEAN	RANGE		VARIANCE
			MIN	MAX	
MF	25	794.00	700.00	900.00	.3087 x 10 ⁴
MT	25	827.00	725.00	925.00	.2860 x 10 ⁴
MTA1	25	415.00	375.00	475.00	.6771 x 10 ³
MTA2	25	235.00	200.00	250.00	.3125 x 10 ³
MTA3	25	192.00	150.00	225.00	.2458 x 10 ³
MTA4	25	125.00	100.00	150.00	.5208 x 10 ²
MTA5	25	110.00	100.00	125.00	.1562 x 10 ³
HF	25	835.00	725.00	975.00	.4375 x 10 ⁴
HT	25	982.00	875.00	1100.00	.4819 x 10 ⁴
HTA1	25	567.00	500.00	650.00	.1392 x 10 ⁴
HTA2	25	317.00	275.00	350.00	.6104 x 10 ³
HTA3	25	254.00	225.00	275.00	.3479 x 10 ³
HTA4	25	151.00	125.00	175.00	.1292 x 10 ³
HTA5	25	123.00	100.00	150.00	.1521 x 10 ³
COMB	25	10.24	9.00	12.00	.7733 x 10 ⁰
TH	2	1112.50	1025.00	1200.00	.1531 x 10 ⁵
AB	25	2609.00	2300.00	3025.00	.3145 x 10 ⁵
WW	24	682.29	575.00	800.00	.3396 x 10 ⁴
WR	24	3.30	3.13	3.61	.1197 x 10 ⁻¹
BL	2	3500.00	3325.00	3675.00	.6125 x 10 ⁵
AR	24	1.52	1.40	1.87	.1050 x 10 ⁻¹
VR	25	1.07	1.03	1.11	.3810 x 10 ⁻³
HR	25	2.40	2.15	2.90	.3874 x 10 ⁻¹
HV	2	3.26	2.83	3.69	.3763 x 10 ⁰
FLR	25	.70	.66	.76	.6928 x 10 ⁻³
FSV	25	2.60	2.36	2.80	.1279 x 10 ⁻¹
FBV	25	2.27	2.04	2.47	.9618 x 10 ⁻²
MLR	25	.50	.47	.53	.2913 x 10 ⁻³
MSV	25	3.91	3.69	4.18	.1731 x 10 ⁻¹
MBV	25	3.08	2.88	3.23	.1215 x 10 ⁻¹
HLR	25	.58	.53	.63	.4507 x 10 ⁻³
HSV	25	3.21	3.00	3.43	.1270 x 10 ⁻¹
HBV	25	2.82	2.56	2.97	.1129 x 10 ⁻¹
BR	2	2.15	2.06	2.24	.1645 x 10 ⁻¹

Male Pupal Exuvia

Color. Golden.

Length (mu). Body 4250, cephalothorax (lateral) 1250, abdomen 3000.

Cephalothorax. Setae: frontals 0, postorbitals ?1, humerals 3, lateral anteprenotals 1, median anteprenotals 2, prealars 1, dorsocentrals 4. Thoracic horn (Fig. 90g) slender, with apex tapered; scarcely covered with small, pointed spines; length 250 mu. Frontal tubercles not prominent. Anterior part of notum wrinkled along eclosion line.

Abdomen. Anal lobe length 330 mu, narrowed, with 4 right and ? left spurs; spurs short and pointed; longest anal seta length 170 mu. A.L.R. 0.51. Pedes spurii B robust, present on segment II.

Setae present on segments I-VIII:

dorsals	2	4	3	2	4	4	5	1
laterals	1	3	3	3	3	3	3	4
ventrals	0	2	3	4	2	2	1	0

Tergal spine patterns (composite). I: bare. II: elliptical patch posteromedial, with about 80 recurved spines in 4 rows; patch of coarse spines anterior to recurved spines; bare bands laterally. III-V: large patch of coarse spines separated by bare line from rectangular patch of anteriorly-directed spines along posterior margin; bare bands laterally. VI: as in III-V, but with large patch reduced in size and without patch of anteriorly-directed spines. VII: 2 well-spaced patches of fine spines along anterior margin; small patch of fine spines along

posterior margin medially. VIII: as in VII, but with medial patch larger. IX: band of fine spines along anterior margin.

Sternal spine patterns (composite). I: bare. II: band of fine spines along anterior margin. III, IV: 2 well-spaced patches of fine spines along anterior margin, continuous with lateral bands reaching posterior margin. V: 2 well-spaced patches of fine spines along anterior margin; small patch of fine spines along posterior margin medially. VI: as in V, but with medial patch larger. VII, VIII: 2 well-spaced patches of fine spines along anterior margin. IX: bare.

Remarks. The pupa of Orthocladus (O.) dentifer closely resembles the pupa of O. nigritus; it can be distinguished from nigritus by presence of spurs on the anal lobe and the different spine patterns on tergites VII, VIII and sternites IV-VI. I have examined two specimens, both in poor condition; it is possible that frontal setae may be present in this species.

Larva (n = 2)

Head. Labial plate (Fig. 139b) acutely triangular; broad median tooth extended anteriorly, beyond first laterals. Mandible (Fig. 139a) with outer margin weakly crenulate; brush with ?8 setae, apices serrate. Epipharynx obscured. Premandible simple. A.R. 1.31-1.56. Antennal segment lengths (μ , Fig. 114c): 42-47, 14, 6-7, 5-6, 5; blade grooved, extended to 5th segment; Lauterborn organs moderately developed.

Remarks. The larva of Orthocladus (O.) dentifer closely resembles the larva of O. annectens; it can be distinguished from annectens by the shape of the labial plate, especially the degree

of separation between the median tooth and first laterals.

MATERIAL EXAMINED (Fig. 149)

Alaska. Kenai Pen., Seward-Primrose C G, jeep trap, 17 June 1965, K.M. Sommerman, (USNM), 1 male; Palmer, jeep trap, June 1964, K.M. Sommerman, (USNM), 1 male. Manitoba. Lake Winnipeg (L.T.) 4622, 6½ mi. off Sturgeonskin Pt., 14.VII.69, S.S. Chang, No. 4622, (FRBW), 1 male; Minnesota. Collected by E.F. Cook (MINN): Hubbard Co., Lower La Salle Lake, N.J. Mosquito Trap, May 7, 1970, 1 male; Koochiching Co., Min. F.S., Little Fk., N.J. Mosquito Trap, Oct. 6, 1969, 1 male; Clearwater Co., Miss. R. at Co. Rd. 2, N.J. Mosquito Trap, May 20, 1970, 16 males; Cook Co., 2 mi. N. Hovland on U.S. 61, N.J. Mosquito Trap, June 8, 1970, 4 males; Cook Co., Min. F.S., Hovland, N.J. Mosquito Trap, July 22, 1968, 3 males; same data except June 9, 1969, 3 males; Sept. 30, 1968, 1 male; St. Louis Co., U. of M. Duluth, N.J. Mosquito Trap, June 17, 1968, 2 males; same data except July 10, 1968, 2 males; Sept. 3, 1968, 1 male; Sept. 9, 1968, 2 males; Sept. 19, 1968, 2 males; Oct. 7, 1968, 1 male; Oct. 21, 1968, 1 male; St. Louis Co., Duluth, FWPCA Lab, N.J. Mosquito Trap, July 1, 1970, 1 male. Nevada. Winnemucca, 16 June 1952, E.I. Schlinger, (USNM), 1 male. Northwest Territories. Trail R., 62° 06' N, 122° 11' W, 31.V.73, No. CH854, D.R. Oliver, (CNC), 1 male. Ontario. Jock R. nr. Munster Hamlet, coll. 7.V.73, pres. 14.V.73, A.R. Sponis, (CNC), 2 reared males; Lake Ontario, Sta. X, May 1968, M.B. Johnson, (SUBLETTE), 1 male. Oregon. Aumsville, light, 22 March 1963, K. Goeden, (USNM), 1 male. Wyoming. Albany Co., Laramie, 6.IX.67, D.W. Ribble, (INHS), 1 male.

Orthocladius (Orthocladius) doreus (Roback)

Figs. 48, 49, 69, 78e, 90h, 91a, b, f; 93, 94, 118, 136, 150

Hydrobaenus doreus Roback, 1957a, p. 78, figs. 168-171.

Orthocladius doreus (Roback), Sublette and Sublette, 1965, p.

156. Sublette, 1966, p. 594. Sublette, 1967a, p. 316.

Sublette, 1967b, p. 504. Sublette, 1970, p. 55.

Orthocladius (Orthocladius) sp. 3, Coffman, 1973, p. 311.

Roback (1957a) described this brown, medium-sized species based on 5 reared males and 2 reared females from Pennsylvania. He separated the male of O. doreus from the male of O. obumbratus on the basis of the smaller A.R., smaller F.L.R., and the relatively shorter anal point. The figure of the male genitalia of O. doreus given by Roback (Fig. 168) is misleading and inaccurate. I agree with Roback that the male of O. doreus is similar to the male of O. obumbratus in hypopygial features. However, the basal median lobes of the gonocoxite are very different in males of O. doreus. Roback separated the female of this species from the female of O. obumbratus on the basis of the length and shape of the terminal flagellomere of the antenna. He was unable to separate the pupa of O. doreus from that of O. obumbratus. Apparently he overlooked the prominent frontal tubercles and the bumpy area along the eclosion line of the cephalothorax of O. doreus. Roback (1957a) separated the larva of O. doreus from the larva of O. paradoreus (= obumbratus) on the basis of the width and darkening of the median tooth of the labial plate. It should be noted however, that Roback had a misidentified larva of O. obumbratus. This is evident by the fact

that, in the key, the species was described as having a pair of several rayed digitate bristles (SI) on the labrum. Sublette (1966, 1967a, 1967b, 1970) placed the male of O. doreus in his "obumbratus group". The pupal exuviae of O. doreus, referred to as Orthocladus (Orthocladus) sp. 3, were collected in Pennsylvania by Coffman (1973).

Holotype Male

Color. Dark brown; halteres golden; scutal stripes distinct (Roback 1957a).

Length (mμ). Body 3475, thorax 1250, abdomen 2225.

Head. Flattened. Interocular distance 240 mμ. Temporals 13, verticals 12, postorbitals 1. A.R. 1.54. Antennal flagellomere lengths (mμ): 1st-12th 1050, 13th 1625. Clypeus rectangular, with 8 setae. Palpal segment lengths (mμ): 45, 40, 120, 110, 155.

Thorax. Anteprenotal lobe jutting out medially, robust. Lateral anteprenotals ?3, acrostichals 10, prealars ?4, dorsocentrals 10, uniserial; scutellars ?5, uniserial. Anapleural suture length 280 mμ. No mesonotal pit.

Wing. Length 2100 mμ, width 625 mμ. L/W.R. 3.23. Scarcely punctate. Anal lobe strongly rounded, and produced. V.R. 1.02. Stem vein with 1 seta, R with 9, squama with 22. Costa not extended beyond R4+5, apex well distal to apex of Cul. R2+3 ending before midpoint of R1 and R4+5.

Legs. Hind tibial comb composed of 10 setae. Fore leg damaged, 2 spines on each of first two tarsal segments of mid leg, 2 on first tarsal segment of hind leg.

Leg lengths (μ) and proportions:

	F	T	Ta1	Ta2	Ta3	Ta4	Ta5	L.R.	B.V.	S.V.
Fore	775	950	625	---	---	---	---	0.65	---	2.76
Mid	825	850	400	250	175	100	125	0.47	3.19	4.18
Hind	850	1000	550	350	225	100	125	0.55	3.00	3.36

Hypopygium (Figs. 48, 49). Gonocoxite length 200 μ , gonostylus length 100 μ . H.R. 2.00. H.V. 3.47. Lateral margin of tergite IX with group of 6 setae. Anal point short. Virga present. Basal median lobes of gonocoxite triangular. Basal lobe with dorsal part long and narrow, extended beyond ventral part. Gonostylus rounded, with blunt apex. (The endophallus is everted in the holotype male, but I have drawn it in the retracted position.)

Variation. Anal point short to medium in length. Indication of mesonotal pit. Scutellars biserial (2 specimens out of 26). Clypeus large.

Remarks. The male of Orthocladus (O.) doreus closely resembles the male of O. knuthi in genitalic features; doreus can be distinguished from knuthi by the shape of the basal median lobes of the gonocoxite.

O. doreus (Roback)

VARIABLE	SAMPLE SIZE	MEAN	RANGE		VARIANCE
			MIN	MAX	
WING	27	2234.26	1850.00	2625.00	$.3919 \times 10^5$
ARM	27	911.11	750.00	1100.00	$.7468 \times 10^4$
AFCU	27	952.78	775.00	1125.00	$.7660 \times 10^4$
R	27	7.18	5.00	13.00	$.3772 \times 10^1$
SQUM	27	19.30	12.00	24.00	$.7832 \times 10^1$
P1	27	37.41	25.00	55.00	$.4110 \times 10^2$
P2	27	59.26	40.00	80.00	$.7635 \times 10^2$

VARIABLE	SAMPLE SIZE	MEAN	RANGE		VARIANCE
			MIN	MAX	
P3	27	126.11	100.00	160.00	.2256 x 10 ³
P4	27	114.26	90.00	135.00	.1340 x 10 ³
P5	27	159.44	125.00	205.00	.3622 x 10 ³
EYE	25	294.00	240.00	350.00	.5500 x 10 ³
VERT	27	12.41	8.00	16.00	.4097 x 10 ¹
ETM	27	1.15	0.00	2.00	.2849 x 10 ⁰
CLYP	27	10.93	7.00	16.00	.4994 x 10 ¹
PROL	27	8.48	3.00	14.00	.9567 x 10 ¹
AC	27	11.96	8.00	17.00	.3960 x 10 ¹
DC	27	9.74	7.00	15.00	.4122 x 10 ¹
PA	27	5.04	4.00	7.00	.8063 x 10 ⁰
SC	26	11.65	7.00	20.00	.7835 x 10 ¹
ANSU	27	303.33	250.00	370.00	.9923 x 10 ³
ANT3	26	431.92	370.00	490.00	.6801 x 10 ³
ANTT	26	672.69	600.00	770.00	.2300 x 10 ⁴
BASI	27	230.00	200.00	250.00	.2077 x 10 ³
DISI	27	101.48	80.00	120.00	.6695 x 10 ²
FF	27	813.89	675.00	1000.00	.6026 x 10 ⁴
FT	27	979.63	825.00	1225.00	.9281 x 10 ⁴
FTA1	27	687.04	600.00	875.00	.4297 x 10 ⁴
FTA2	26	456.73	375.00	575.00	.2028 x 10 ⁴
FTA3	26	300.96	275.00	375.00	.7740 x 10 ³
FTA4	26	175.00	150.00	225.00	.3500 x 10 ³
FTA5	26	118.27	100.00	150.00	.2279 x 10 ³
MF	27	836.11	675.00	1075.00	.7468 x 10 ⁴
MT	27	860.18	725.00	1075.00	.7609 x 10 ⁴
MTA1	27	423.15	275.00	550.00	.3025 x 10 ⁴
MTA2	27	261.11	225.00	325.00	.6891 x 10 ³
MTA3	27	185.18	150.00	225.00	.4932 x 10 ³
MTA4	27	96.30	75.00	125.00	.1781 x 10 ³
MTA5	27	109.26	75.00	125.00	.1994 x 10 ³
HF	27	879.63	725.00	1100.00	.7886 x 10 ⁴
HT	27	1023.15	750.00	1250.00	.1240 x 10 ⁵
HTA1	27	586.11	475.00	750.00	.4247 x 10 ⁴

VARIABLE	SAMPLE SIZE	MEAN	RANGE		VARIANCE
			MIN	MAX	
HTA2	27	340.74	275.00	425.00	.1161 x 10 ⁴
HTA3	27	240.74	200.00	300.00	.7763 x 10 ³
HTA4	27	105.55	75.00	150.00	.3045 x 10 ³
HTA5	27	123.15	100.00	150.00	.1887 x 10 ³
COMB	27	10.44	9.00	12.00	.4103 x 10 ⁰
TH	6	1150.00	975.00	1275.00	.1300 x 10 ⁵
AB	27	2594.44	1975.00	3175.00	.6814 x 10 ⁵
WW	26	687.50	550.00	775.00	.3462 x 10 ⁴
WR	26	3.24	2.79	3.55	.2153 x 10 ⁻¹
BL	6	3608.33	2950.00	4200.00	.1819 x 10 ⁶
AR	26	1.56	1.37	1.73	.7579 x 10 ⁻²
VR	27	1.05	1.00	1.08	.5480 x 10 ⁻³
HR	27	2.28	1.82	2.87	.5760 x 10 ⁻¹
HV	6	3.54	2.95	3.82	.1158 x 10 ⁰
FLR	27	.70	.66	.76	.5185 x 10 ⁻³
FSV	27	2.61	2.40	2.76	.4972 x 10 ⁻²
FBV	26	2.36	2.26	2.52	.4210 x 10 ⁻²
MLR	27	.49	.35	.53	.1054 x 10 ⁻²
MSV	27	4.04	3.78	5.64	.1207 x 10 ⁰
MBV	27	3.25	2.92	3.48	.2173 x 10 ⁻¹
HLR	27	.57	.54	.67	.6290 x 10 ⁻³
HSV	27	3.25	2.95	3.45	.1063 x 10 ⁻¹
HBV	27	3.07	2.82	3.29	.1462 x 10 ⁻¹
BR	6	2.14	1.78	2.35	.4345 x 10 ⁻¹

Allotype Female

Color. Lighter than male; scutal stripes distinct (Roback 1957a).

Length. Body 2.16 mm (Roback 1957a).

Head. Damaged. A.R. 0.74. Antennal flagellomere lengths (mμ, Fig. 78e): 70, 35, 35, 35, 130. Clypeus large and rectangular, with 10 setae. Palpal segment lengths (mμ): 35, 40,

90, 95, 135.

Thorax. Damaged.

Wing. Length 1175 μ , width 700 μ . L/W.R. 2.53.

Finely punctate. Anal lobe straight proximally, slightly rounded distally, and not produced. V.R. 1.03. Stem vein with 1 seta, R with 10, R1 with 5, R4+5 with 7, squama with 24. Costa slightly extended beyond R4+5, apex well distal to apex of Cul. R2+3 ending about 1/3 distance between R1 and R4+5.

Legs. Hind tibial comb composed of 10 setae. Spines absent on fore leg, 2 on each of first two tarsal segments of mid leg, 2 on first tarsal segment of hind leg.

Leg lengths (μ) and proportions:

	F	T	Ta1	Ta2	Ta3	Ta4	Ta5	L.R.	B.V.	S.V.
Fore	775	775	525	325	225	125	100	0.67	2.67	2.95
Mid	725	650	325	200	125	75	100	0.50	3.40	4.23
Hind	700	775	450	275	175	75	100	0.58	3.08	3.27

Genitalia (Fig. 69). Lateral sternite IX with small area rounded, produced posterolaterally; few long setae dorsally, numerous shorter setae ventrally, and less than 15 setae present. Tergite IX narrow. Spermathecal duct wrinkled for most of length.

Remarks. The female of Orthocladus (O.) dorenius closely resembles the female of O. clarkei in genitalic features; dorenius can be distinguished from clarkei by the less produced area of lateral sternite IX.

Holotype Pupal Exuvia

Color. Brown.

Length (μ). Body 4200, cephalothorax 1500, abdomen 2700.

Cephalothorax. Setae: frontals 1, long and robust; postorbitals 1, humerals 3, lateral anteprenotals 1, median anteprenotals 2, prealars 1, dorsocentrals 4. Thoracic horn (Figs. 90h, 91a) robust and densely covered with robust, scalelike spines (Fig. 91b), length 350 μ . Frontal tubercles (Fig. 94) prominent, erect, saclike, and brown. Anterior part of notum bumpy along eclosion line (Figs. 91f, 93).

Abdomen. Anal lobe length 300 μ ; heart-shaped, with 6 right and 4 left spurs; spurs long, robust, iciclelike and directed medially; longest anal seta length 200 μ . A.L.R. 0.66. Pedes spurii B robust, present on segment II.

Setae present on segments I-VIII:

dorsals	4	5	5	5	5	5	2
laterals	1	3	3	3	3	3	4
ventrals	0	3	3	3	3	3	1

Tergal spine patterns (composite). I: bare; Omm 3, Ann 2. II: elliptical patch posteromedial, with about 146 recurved spines in 5 rows; incomplete patch of spines anterior to recurved spines; Omm 3, Ann 0. III-V: large patch of coarse spines separated by bare line from rectangular patch of anteriorly-directed spines along posterior margin; bare bands laterally; Omm 3, Ann 2. VI: as in III-V, but with large patch reduced in size and without patch of anteriorly-directed spines; Omm 2, Ann 2. VII: 2 well-spaced patches of fine spines along anterior margin continuous with lateral bands reaching posterior margin; Omm 3, Ann 2. VIII: band of fine spines along anterior margin; Omm 4, Ann 0. IX: band of fine spines along anterior margin. Pigmented

blotches on intersegmental membranes II-III to VII-VIII.

Sternal spine patterns (composite). I: bare. II: wide band of fine spines along anterior margin continuous with medial band posteriorly. III, IV: 2 well-spaced patches of fine spines along anterior margin continuous with lateral bands reaching posterior margin. V: 2 well-spaced patches of fine spines along anterior margin; small patch of fine spines along posterior margin medially. VI: as in V, but with medial patch larger. VII, VIII: 2 well-spaced patches of fine spines along anterior margin. IX: bare.

Variation. Exuvia brown to golden. Thoracic horn with reduced number of spines. Reduced bumpy area along eclosion line. The blotches on intersegmental membranes present, absent, or distributed differently from that in the holotype.

Remarks. The pupa of Orthocladus (O.) doreus closely resembles the pupa of O. obumbratus; it can be distinguished from obumbratus by the prominent frontal tubercles, bumpy notal area, and the medially-directed spurs of the anal lobe.

Larva (n = 10)

Head. Labial plate (Fig. 136a) convex; broad median tooth extended anteriorly, slightly beyond first laterals; all teeth evenly dark. Mandible (Fig. 136b) with outer margin strongly crenulate; brush with 7 setae, apices serrate. Epipharynx (Fig. 118a) with 6 chaetae laterals, 2 chaetae basales, 3 spinules. Premandible simple. A.R. 1.63-2.23. Antennal segment lengths (mm, Fig. 118b): 42-58, 12-15, 4-5, 3-5, 2-5; blade grooved, extended to tip of 5th segment; Lauterborn organs well developed, robust. Anal papillae as long as wide (Roback 1957a).

Variation. Crenulations on mandible strong to moderate, never weak. Mandibular brush with 5 setae (Roback 1957a).

Remarks. The larva of Orthocladus (O.) doreus closely resembles the larvae of O. obumbratus and O. manitobensis; doreus can be distinguished from them by the stronger crenulations on the mandible. Roback separated the larva of O. paradoreus (= obumbratus) from the larva of O. doreus on the basis of the evenly dark teeth of the labial plate. This is consistent in larvae of O. doreus, but it is inconsistent in the larvae of O. paradoreus (Roback's material) and O. obumbratus.

ECOLOGY

The pupal exuviae of O. doreus were collected during May and June in Pennsylvania (Coffman 1973). Although the emergence of this species is univoltine in Linesville Creek, the material examined here suggests that the emergence of this species may be bivoltine. Roback (1957a) provided specific information on the habitats of the larvae of this species.

MATERIAL EXAMINED (Fig. 150)

Holotype. Male, reared, Wissahickon Creek, 1 mile above mouth, Philadelphia, Pa.; (5), emerged May 13, 1953, S.S. Roback (ANSP No. 4A, 6790). Allotype. Female, reared, Darby Creek at the intersection of Sawmill and Darby-Paoli Roads, Pa., May 11, 1953, S.S. Roback (ANSP No. 4A, 614). Paratypes. One female, 1 reared male pupa, same data as allotype, (ANSP No. 4Ag, 4Ad 13); 1 pupa, Lititz, Pa., IV.25.55, S.S. Roback (ANSP No. 122); 1 male with pupal ex., Mill Creek, about 1 mile below Dove Lake, May 20, 1953, S.S. Roback, (ANSP No. 10A PA2 21).

Indiana. Putnam Co., 19.IV.1967, C. White, (INHS), 1 male. Maryland. Montgomery Co., Fairland, light trap, May 1959, A.A. Hubert, (USNM), 1 male. Minnesota. Collected by E.F. Cook (MINN): Polk Co., Red Lake River nr. Crookston, N.J. Mosquito Trap, June 2, 1970, 1 male; Houston Co., 1 mi. S. Caledonia, N.J. Mosquito Trap, July 17, 1968, 1 male; St. Louis Co., Duluth, N.J. Mosquito Trap, July 15, 1970, FWCP Lab, 1 male; same data except July 1, 1970, 1 male; St. Louis Co., U. of M. Duluth, N.J. Mosquito Trap, July 10, 1969, 5 males; same data except July 16, 1969, 1 male, July 31, 1969, 1 male; Oct. 6, 1969, 1 male; Cook Co., Min. F.S., Hovland, N.J. Mosquito Trap, June 9, 1969, 9 males, same data except Aug. 17, 1969, 2 males; Aug. 24, 1969, 1 male; Aug. 31, 1969, 2 males; Sept. 16, 1969, 1 male; Sept. 28, 1969, 1 male; Oct. 13-19, 1968, 2 males; Cook Co., 2 mi. N. Hovland on U.S. 61, N.J. Mosquito Trap, July 16, 1970, 25 males; same data except June 2, 1970, 2 males; May 16, 1970, 1 male; Sept. 21, 1970, 2 males. New Brunswick. Fredericton, May 27, 193-, R.P. Gorham, (CNC), 1 male; Camp Adams, Northumberland Co., 4.VI.1962, J. Marshall, (CNC), 1 male. New Mexico. San Miguel Co., Sapello River, light trap, 28-VI-70, Gene Harrell, (SUBLETTE), 6 males; San Miguel Co., 7800', at light, 11.VII.70, J.E. Sublette, (SUBLETTE), 2 males. New York. Tompkins Co., Ellis Hollow, light trap, 15 June 1963, C.O. Berg, (USNM), 11 males; Chautauqua Lake, VII-57, E.C. Bay, (USNM), 1 male; Letchworth St. Park, light trap, 10-14 June 1963, W.W. Wirth, (USNM), 1 male. Ontario. Erosoma Co., Speed River, coll. 2.V.1971, em. 10.V.1971, A.R. Sponis, (CNC), 1 reared male, 3 reared females; same data except 2.V.1971,

1 reared male pupa. Oregon. Salem, Willamette R., 22 May 1963, K. Goeden-light, (USNM), 1 male; Aumsville, 10.VI.1963, K. Goeden-light, (USNM), 1 male; same data except 22 March 1963, 1 male.

Pennsylvania. Crawford Co., Linesville Creek, 21.V.1969, A.R.

Soponis, 1 reared female pupa; same data except no date, 3 reared male pupae; 1 reared female pupa; same locality and collector

12.V.1969, 1 male; 3.VI.1968, at light, 1 male; Crawford Co.,

Linesville Creek, 4 May 71, W.P. Coffman, L.C.P. #4, (PITT), 6

pupal ex.; same data except 6 May 71, 3 pupal ex.; 30 May 71,

L.C.P. #1, 1 pupal ex.; 16 Oct. 71, L.C.P. #6, 2 pupal ex.;

Gladwyne, VI.15.53, S.S. Roback (ANSP No. 24A7 18), 1 reared

female, misident. paradoreus. Virginia. Falls Church, light

trap, HBA, 7.V.1960, W.W. Wirth, (USNM), 1 male. Yukon Territory.

Mackenzie Delta, Caribou Bar Creek, Det. 73-772, CC6-1Y280772,

28-07-72, no collector. (FWI), 1 male; same data except CC6-2Y280772Su,

1 male, 1 pupa with larval ex..

Orthocladus (Orthocladus) groenlandensis Goethghebuer

Fig. 51

Orthocladus (Dactyloccladius) groenlandensis Goethghebuer, 1933a,

p. 26, fig. 8.

Orthocladus (Dactyloccladius) groenlandiensis Goethghebuer,

Andersen, 1937, p. 65. (misspelling)

Orthocladus (Dactyloccladius) groenlandicus Goethghebuer,

Henriksen, 1939, p. 73. (misspelling)

Orthocladus (Orthocladus) groenlandensis Goethghebuer, Goethghebuer,

1942a, p. 45, fig. 65.

Orthocladus groenlandensis Goethghebuer, Sublette and Sublette,

1965, p. 156.

Goethghebuer (1933a) described this species based on a single male from eastern Greenland. He placed O. groenlandensis in the subgenus O. (Dactylocladius) based on the relative position of the crossveins fCu to rm (V.R.), and the development of the empodium. Later, Goethghebuer (1942a) synonymized the subgenus Dactylocladius with the subgenus Orthocladius. The species O. groenlandensis was then placed in O. (Orthocladius), with which I concur. I have examined the holotype specimen, in which the genitalia is distorted. The figure of the genitalia given by Goethghebuer (1933a) resembles more closely that of O. knuthi than it does the holotype specimen of O. groenlandensis. The males of these two species can be distinguished on the basis of the development of the anal lobe of the wing, and the development of the basal lobe and the shape of the basal median lobes of the gonocoxite. The male of O. groenlandensis can be identified in the key given by Andersen (1937), who used the characters in the original description. The name of this species has been misspelled twice. The female and immature stages of O. groenlandensis are unknown.

Holotype Male

Color. Dark brown; halteres golden; scutal stripes distinct, merging posteriorly.

Length (mm). Body 3600, thorax 1275, abdomen 2325.

Head. Interocular distance 310 mm. Temporals 14, verticals 13, postorbitals 1. A.R. 1.70. Antennal flagellomere lengths (mm): 1st-12th 1100, 13th 1875. Clypeus rectangular, with 12 setae. Palpal segment lengths (mm): 35, 65, 150, 150, 210.

Thorax: Anteprenotal lobe wide medially, robust.

Lateral anteprenotals 5, acrostichals 10, prealars 5, dorsocentrals 8, uniserial; scutellars 9, uniserial. Anapleural suture length 320 μ . Mesonotal pit as in O. oliveri.

Wing. Length 2825 μ , width 800 μ . L/W.R. 3.53.

Moderately punctate: Anal lobe folded under, appears slightly rounded and produced. V.R. 1.02. Stem vein with 1 seta, R with 4, squama with 17. Costa extended beyond R4+5, apex well distal to apex of Cul. R2+3 ending about 1/3 distance between R1 and R4+5.

Legs. Hind tibial comb composed of 28 setae. Fore leg damaged, 2 spines present on each of first two tarsal segments of mid leg, hind leg damaged.

Leg lengths (μ) and proportions:

	F	T	Ta1	Ta2	Ta3	Ta4	Ta5	L.R.	B.V.	S.V.
Fore	900	1125	---	---	---	---	---	---	---	---
Mid	1000	1025	525	300	250	---	---	0.51	---	3.85
Hind	1025	1175	---	---	---	---	---	---	---	---

Hopopygium (Fig. 51). Gonocoxite length 280 μ , gonostylus length 140 μ . H.R. 2.00. H.V. 2.57. Lateral margin of tergite IX with group of 7 setae. Anal point medium in length. Virga present. Basal median lobes of gonocoxite triangular. Basal lobe with dorsal part robust, ventral part hidden below. Gonostylus distorted.

Remarks. The male of Orthocladus (O.) groenlandensis closely resembles the male of O. pardecoratus in hypopygial features; groenlandensis can be distinguished from pardecoratus

by the less well rounded anal lobe of the wing.

MATERIAL EXAMINED

Holotype. Male, Hoels oksp., 1930 Hetgrønland, Aug.
623. (GL 2788 Z.M. Oslo).

Orthocladius (Orthocladius) hazensis n. sp.

Fig. 52

Holotype Male

Color. Dark brown; halteres golden; scutal stripes distinct, merging posteriorly.

Length (mμ). Body 4075, thorax 1150, abdomen 2925.

Head. Interocular distance 300 mμ. Temporals 9, verticals 8, postorbitals 1. A.R. 1.69. Antennal flagellomere lengths (mμ): 1st-12th 1075, 13th 1825. Clypeus rectangular, with 6 setae. Palpal segment lengths (mμ): 40, 55, 135, 110, 150.

Thorax. Anteprenotal lobe jutting out medially, robust. Lateral anteprenotals 6, acrostichals 12, prealars 6, dorsocentrals 9, uniserial; scutellars 12, uniserial. Anapleural suture length 290 mμ. Mesonotal pit as in O. oliveri.

Wing. Length 2600 mμ, width 700 mμ. L/W.R. 3.71. Finely punctate. Anal lobe strongly rounded, and produced. V.R. 1.04. Stem vein with 1 seta, R with 5, squama with 19. Costa not extended beyond R4+5, apex slightly distal to apex of Cul. R2+3 ending about 1/3 distance between R1 and R4+5.

Legs. Hind tibial comb composed of 11 setae. Spines absent on fore leg, 2 on each of first two tarsal segments of mid leg, 2 on first tarsal segment of hind leg.

Leg lengths ($m\mu$) and proportions:

	F	T	Ta1	Ta2	Ta3	Ta4	Ta5	L.R.	B.V.	S.V.
Fore	825	1000	725	400	275	150	125	0.72	2.51	2.68
Mid	875	875	450	250	200	125	125	0.51	3.88	3.14
Hind	950	1075	600	325	275	125	125	0.55	3.37	3.08

Hypopygium (Fig. 52). Gonocoxite length 270 $m\mu$, gonostylus length 110 $m\mu$. H.R. 2.45. H.V. 3.70. Lateral margin of tergite IX with group of 8 setae. Anal point medium in length. Virga present. Basal median lobes of gonocoxite narrowly triangular. Basal lobe with dorsal part robust, and ventral part extended well below. Gonostylus robust, with distal end obtuse.

Remarks. The male of Orthocladius (Orthocladius) hazensis closely resembles the male of O. pardecoratus in hypopygial features; hazensis can be distinguished from pardecoratus by the more robust development of the basal lobe of the gonocoxite, and the robust gonostylus with the obtuse distal end.

O. hazensis n. sp.

VARIABLE	SAMPLE SIZE	MEAN	RANGE		VARIANCE
			MIN	MAX	
WING	9	2647.22	2375.00	2750.00	.1273 x 10 ⁵
ARM	10	1025.00	925.00	1075.00	.1806 x 10 ⁴
AFCU	10	1107.50	1000.00	1150.00	.1674 x 10 ⁴
R	10	5.90	2.00	8.00	.3433 x 10 ¹
SQUM	10	20.10	16.00	25.00	.6989 x 10 ¹
P1	10	42.00	35.00	50.00	.2889 x 10 ²
P2	10	69.00	55.00	80.00	.6000 x 10 ²
P3	10	142.00	130.00	155.00	.6222 x 10 ²
P4	10	113.50	105.00	125.00	.4472 x 10 ²
P5	10	157.50	140.00	175.00	.1403 x 10 ³
EYE	7	308.57	300.00	330.00	.1393 x 10 ³

VARIABLE	SAMPLE SIZE	MEAN	RANGE		VARIANCE
			MIN	MAX	
VERT	9	9.89	8.00	12.00	.1861 x 10 ¹
ETM	9	2.00	1.00	3.00	.7500 x 10 ⁰
CLYP	10	7.70	6.00	10.00	.1567 x 10 ¹
PR0L	10	6.60	5.00	9.00	.1156 x 10 ¹
AC	10	11.00	7.00	16.00	.8889 x 10 ¹
DC	10	8.60	6.00	11.00	.2711 x 10 ¹
PA	10	4.40	3.00	6.00	.7111 x 10 ⁰
SC	10	9.80	8.00	12.00	.1733 x 10 ¹
ANSU	10	322.00	290.00	340.00	.3733 x 10 ³
ANT3	10	432.00	410.00	470.00	.3511 x 10 ³
ANTT	10	787.00	710.00	840.00	.1601 x 10 ⁴
BASI	10	266.00	240.00	280.00	.1600 x 10 ³
DISI	10	119.00	110.00	130.00	.9889 x 10 ²
FF	10	837.50	750.00	925.00	.2535 x 10 ⁴
FT	10	1027.50	950.00	1100.00	.2701 x 10 ⁴
FTA1	10	720.00	625.00	775.00	.2472 x 10 ⁴
FTA2	10	417.50	400.00	450.00	.2847 x 10 ³
FTA3	10	272.50	225.00	300.00	.4792 x 10 ³
FTA4	10	170.00	150.00	200.00	.2500 x 10 ³
FTA5	10	125.00	100.00	150.00	.1389 x 10 ³
MF	10	895.00	825.00	1000.00	.2889 x 10 ⁴
MT	10	925.00	825.00	1000.00	.2778 x 10 ⁴
MTA1	10	447.50	400.00	500.00	.7569 x 10 ³
MTA2	10	272.50	250.00	300.00	.3403 x 10 ³
MTA3	10	195.00	150.00	225.00	.3889 x 10 ³
MTA4	10	115.00	100.00	125.00	.1667 x 10 ³
MTA5	10	127.50	125.00	150.00	.6250 x 10 ²
HF	10	972.50	900.00	1050.00	.2424 x 10 ⁴
HT	10	1117.50	1025.00	1225.00	.3201 x 10 ⁴
HTA1	10	610.00	550.00	650.00	.7222 x 10 ³
HTA2	10	337.50	300.00	375.00	.5903 x 10 ³
HTA3	10	257.50	225.00	300.00	.4236 x 10 ³
HTA4	10	137.50	125.00	150.00	.1736 x 10 ³
HTA5	10	137.50	125.00	150.00	.1736 x 10 ³

VARIABLE	SAMPLE SIZE	MEAN	RANGE		VARIANCE
			MIN	MAX	
COMB	10	10.20	9.00	12.00	.8444 x 10 ⁰
TH	9	1219.44	1125.00	1300.00	.4653 x 10 ⁴
AB	10	2807.50	2625.00	3025.00	.2376 x 10 ⁵
WW	10	770.00	700.00	825.00	.1778 x 10 ⁴
WR	9	3.43	3.27	3.71	.1439 x 10 ⁻¹
BL	9	4016.67	3750.00	4275.00	.4062 x 10 ⁵
AR	10	1.82	1.66	2.00	.1476 x 10 ⁻¹
VR	10	1.08	1.05	1.10	.3095 x 10 ⁻³
HR	10	2.25	2.08	2.56	.3504 x 10 ⁻¹
HV	9	3.43	2.96	3.82	.9019 x 10 ⁻¹
FLR	10	.70	.66	.72	.3883 x 10 ⁻³
FSV	10	2.59	2.52	2.73	.5920 x 10 ⁻²
FBV	10	2.63	2.55	2.75	.4491 x 10 ⁻²
MLR	10	.48	.45	.51	.3820 x 10 ⁻³
MSV	10	4.07	3.89	4.29	.2093 x 10 ⁻¹
MBV	10	3.20	3.10	3.38	.7075 x 10 ⁻²
HLR	10	.55	.51	.56	.2117 x 10 ⁻³
HSV	10	3.43	3.33	3.64	.7890 x 10 ⁻²
HBV	10	3.11	2.97	3.24	.7771 x 10 ⁻²
BR	9	2.30	2.08	2.54	.1761 x 10 ⁻¹

TYPE MATERIAL

Holotype: Male, Hazen Camp, Ellesmere I., N.W.T.,

N.E. 235, 14.VIII.1961, D.R. Oliver (CNC), L.F. 7.11.62. Paratypes (9).

Northwest Territories. Southampton Is., Duke of York

Bay, VIII.19.1952, P.R. Ehrlich, (CNC), 1 male; Ellesmere I.,

Hazen Camp, N.E. 235, 14.VIII.1961, D.R. Oliver, (CNC), 4 males;

same data except N.E. 215, 11.VIII.1961; 2 males; N.E. 215, 93.

L.F., 20.II.62, no collector, 1 male; N.E. 215, 92, L.F., 20.II.62, no collector, 1 male.

Orthocladius (Orthocladius) hellenthali Sublette and Sublette

Figs. 26, 146

Orthocladius (Orthocladius) hellenthali Sublette and Sublette, 1974.Holotype Male

Color. Brown; halteres golden; scutal stripes distinct, not merging posteriorly.

Length (mu). Body 3000, thorax 1000, abdomen 2000.

Head. Flattened. Interocular distance 200 mu.

Temporals 11, verticals 11, postorbitals 0. A.R. 0.95. Antennal flagellomere lengths (mu): 1st-12th 1125, 13th 1075. Palpal segment lengths (mu): 30, 50, 85, 80, 125.

Thorax. Anteprenotal lobe narrowed medially, not robust. Lateral anteprenotals 4, acrostichals 7, prealars 3, dorsocentrals 6, uniserial; scutellars 5, uniserial. Anapleural suture length 250 mu. No mesonotal pit.

Wing. Length 1825 mu, width 625 mu. L/W.R. 2.92. Moderately punctate. Anal lobe slightly rounded, almost straight, and not produced, V.R. 1.11. Stem vein with 1 seta, R with 6, squama with 10. Costa not extended beyond R4+5, apex slightly distal to apex of Cul. R2+3 ending about 1/3 distance between R1 and R4+5.

Legs. Hind tibial comb composed of 11 setae. Spines absent on fore, mid, and hind legs.

Leg lengths (mu) and proportions:

	F	T	Ta1	Ta2	Ta3	Ta4	Ta5	L.R.	B.V.	S.V.
Fore	600	750	475	325	200	150	100	0.63	2.35	2.84
Mid	650	650	300	175	125b	75	100	0.46	3.36	4.33
Hind	725	775	425	225	175	125	100	0.54	3.08	3.52

Hypopygium (Fig. 26). Gonocoxite length 180 μ ,
gonostylus length 80 μ . H.R. 2.25. H.V. 3.75. Lateral margin
of tergite IX with group of 5 setae. Anal point medium in length.
Virga present. Basal median lobes of gonocoxite triangular.
Basal lobe with dorsal part noselike, ventral part hidden below.

Remarks. The male of Orthocladius (O.) hellenthali
closely resembles the males of O. carlatus and O. curtiseta in
hypopygial features; hellenthali can be distinguished from them
by the robust dorsocentral setae, the lack of tarsal spines on
the legs, and the sharp anal point. The female and immature stages
of O. hellenthali are unknown.

O. hellenthali Sublette and Sublette

VARIABLE	SAMPLE SIZE	MEAN	RANGE		VARIANCE
			MIN	MAX	
WING	9	1797.22	1425.00	1975.00	.2538 x 10 ⁵
ARM	9	652.78	500.00	725.00	.4757 x 10 ⁴
AFCU	8	737.50	575.00	800.00	.5536 x 10 ⁴
R	9	5.55	3.00	8.00	.2778 x 10 ¹
SQUM	9	9.89	7.00	12.00	.2861 x 10 ¹
P1	9	29.44	25.00	35.00	.9028 x 10 ¹
P2	9	42.78	35.00	50.00	.2569 x 10 ²
P3	9	90.00	80.00	100.00	.7500 x 10 ²
P4	9	80.00	70.00	85.00	.1875 x 10 ²
P5	8	123.75	105.00	135.00	.8393 x 10 ²
EYE	7	207.86	185.00	225.00	.2655 x 10 ³
VERT	9	10.67	9.00	13.00	.1500 x 10 ¹
ETM	9	0.00	0.00	0.00	.0000
CLYP	9	7.00	4.00	9.00	.3000 x 10 ¹
PROL	9	3.55	2.00	5.00	.1278 x 10 ¹
AC	9	9.67	5.00	15.00	.1200 x 10 ²
DC	9	6.55	5.00	10.00	.2028 x 10 ¹
PA	9	3.00	3.00	3.00	.0000

VARIABLE	SAMPLE SIZE	MEAN	RANGE		VARIANCE
			MIN	MAX	
SC	9	6.44	5.00	8.00	.1278 x 10 ¹
ANSU	8	232.50	180.00	250.00	.5071 x 10 ³
ANT3	9	437.78	340.00	500.00	.1894 x 10 ⁴
ANTT	8	411.25	220.00	510.00	.7555 x 10 ⁴
BASI	8	181.25	160.00	200.00	.1554 x 10 ³
DISI	8	78.75	70.00	90.00	.4107 x 10 ²
FF	9	600.00	450.00	725.00	.5938 x 10 ⁴
FT	9	741.67	525.00	825.00	.8281 x 10 ⁴
FTA1	9	461.11	325.00	525.00	.3611 x 10 ⁴
FTA2	9	316.67	200.00	375.00	.2656 x 10 ⁴
FTA3	9	208.33	150.00	250.00	.9375 x 10 ³
FTA4	9	147.22	100.00	175.00	.3819 x 10 ³
FTA5	9	97.22	75.00	100.00	.6944 x 10 ²
MF	9	622.22	475.00	700.00	.3976 x 10 ⁴
MT	9	641.67	450.00	700.00	.6250 x 10 ⁴
MTA1	9	308.33	225.00	350.00	.1406 x 10 ⁴
MTA2	9	186.11	150.00	225.00	.4861 x 10 ³
MTA3	9	147.22	100.00	175.00	.5382 x 10 ³
MTA4	9	97.22	75.00	125.00	.2257 x 10 ³
MTA5	9	88.89	50.00	100.00	.3299 x 10 ³
HF	9	666.67	500.00	750.00	.7187 x 10 ⁴
HT	9	761.11	525.00	850.00	.9392 x 10 ⁴
HTA1	9	411.11	275.00	450.00	.2986 x 10 ⁴
HTA2	9	241.67	175.00	275.00	.9375 x 10 ³
HTA3	9	188.89	150.00	225.00	.4861 x 10 ³
HTA4	9	122.22	100.00	150.00	.2257 x 10 ³
HTA5	9	100.00	75.00	125.00	.1562 x 10 ³
COMB	9	10.11	9.00	12.00	.1361 x 10 ¹
TH	6	887.50	700.00	1000.00	.1269 x 10 ⁵
AB	9	1916.67	1250.00	2200.00	.7687 x 10 ⁵
WW	8	556.25	400.00	625.00	.5491 x 10 ⁴
WR	8	3.22	2.92	3.56	.5921 x 10 ⁻¹
BL	6	2804.17	1950.00	3025.00	.1771 x 10 ⁶
AR	8	.94	.65	1.05	.1740 x 10 ⁻¹

VARIABLE	SAMPLE SIZE	MEAN	RANGE		VARIANCE
			MIN	MAX	
VR	8	1.14	1.11	1.21	$.8318 \times 10^{-3}$
HR	8	2.30	2.22	2.43	$.5910 \times 10^{-2}$
HV	5	3.54	2.79	4.21	$.2794 \times 10^0$
FLR	9	.62	.59	.64	$.2883 \times 10^{-3}$
FSV	9	2.91	2.84	3.00	$.4583 \times 10^{-2}$
FBV	9	2.35	2.23	2.48	$.4217 \times 10^{-2}$
MLR	9	.48	.44	.50	$.5222 \times 10^{-3}$
MSV	9	4.11	3.86	4.33	$.2562 \times 10^{-1}$
MBV	9	3.04	2.68	3.37	$.3676 \times 10^{-1}$
HLR	9	.54	.52	.55	$.1040 \times 10^{-3}$
HSV	9	3.48	3.19	3.73	$.2229 \times 10^{-1}$
HBV	9	2.81	2.60	3.08	$.1847 \times 10^{-1}$
BR	6	2.16	1.79	2.67	$.1064 \times 10^0$

MATERIAL EXAMINED (Fig. 146)

Holotype. Male, Sonora Pass, Mono Co., California, 8500 ft., light trap, 18-VII-68, R.A. Hellenthal, (SUBLETTE).

Paratypes. Same data as holotype, 3 males; same data as holotype except Levet Creek, 8000', 2 males.

Alaska. Anchorage, jeep trap, 1 Sept. 1964, K. Sommerman, (USNM), 1 male. California. Mono Co., Sonora Pass, Levet Creek, 8000', July 18, 1968, lt. trap, Ronald A. Hellenthal, (MINN), 1 male. North West Territories. S. Nahanni R., $61^{\circ} 38' N$, $125^{\circ} 48' W$, 5-VI-1973, D.R. Oliver, (CNC), 1 male.

Orthocladius (Orthocladius) knabeni Goethghebuer

Orthocladius (Dactylocladius) knabeni Goethghebuer, 1933a, p. 26, fig. 10. Andersen, 1937, p. 65.

Orthocladius knabeni Goethghebuer, Goethghebuer, 1940, p. 60.

Sublette and Sublette, 1965, p. 156.

Orthocladius (Orthocladius) knabeni Goethghebuer, Goethghebuer,
1942a, p. 47, fig. 70.

"Orthocladius" knabeni Goethghebuer, Fittkau, Schlee and Reiss,
1967, p. 363.

Goethghebuer (1933a) described this species based on two males from Greenland, and provided a good figure of the male genitalia. Andersen (1937) included this species in his key. He identified a male and female as O. knabeni, and gave a description of the pupa that he found with the adults; Andersen assumed that it belonged to this species. Goethghebuer (1940) recorded this species from Swedish Lappland, and compared the A.R. of this male specimen with that in the type material. Later, Goethghebuer (1942a) synonymized the subgenus Dactylocladius with the subgenus Orthocladius. The species O. knabeni was then placed in O. (Orthocladius), with which I concur. Goethghebuer (1942a) reproduced the original description in German and the original figure of the male genitalia. Sublette and Sublette (1965) recorded this species from North America. Fittkau, Schlee and Reiss (1967) recorded this species from Europe.

The type material of O. knabeni is missing (pers. comm. D.R. Oliver; A. Lillehammer of University of Oslo). To my knowledge, no other type material exists, although identified specimens of this species may exist. I feel that the original description given by Goethghebuer (1933a) provided an adequate definition of this species. Although I have not found this species in the material from Greenland available for me to study, I consider O. knabeni as a valid species.

Orthocladus (Orthocladus) knuthi n. sp.*

Figs. 50, 72, 78m, 90f

Holotype Male

Color. Dark brown; halteres golden; scutal stripes distinct, merging posteriorly.

Length (mu). Thorax damaged; abdomen 2475.

Head. Interocular distance 295 mu. Temporals 16, verticals 13, postorbitals 3. A.R. 1.70. Antennal flagellomere lengths (mu): 1st-12th 1025, 13th 1750. Clypeus rectangular, with 11 setae. Palpal segment lengths (mu): 45, 55, 130, 100, 155.

Thorax. Anteprenotal lobe jutting out medially, robust. Lateral anteprenotals 5, acrostichals 14, prealars 5, dorsocentrals 11, uniserial; scutellars 8, uniserial. Anapleural suture length 280 mu. Mesonotal pit ds in O. oliveri.

Wing. Length 2325 mu. Finely punctate. Anal lobe strongly rounded, and produced. V.R. 1.05. Stem vein with 1 seta, R with 6, squama with 16. Costa slightly extended beyond R4+5, apex well distal to apex of Cul. R2+3 ending about 1/3 distance between R1 and R4+5.

Legs. Hind tibial comb composed of 11 setae. Spines absent on fore leg, 2 on first tarsal segments of mid and hind legs.

* This species is named after Mr. Eigil Knuth, who greatly aided members of the Canadian Pearyland Expedition.

Leg lengths (mu) and proportions:

	F	T	Ta1	Ta2	Ta3	Ta4	Ta5	L.R.	B.V.	S.V.
Fore	725	900	650	400	250	150	125	0.72	2.45	2.50
Mid	775	775	375	250	175	75	100	0.48	3.20	4.13
Hind	825	975	525	300	225	100	125	0.57	3.10	3.42

Hypopygium (Fig. 50). Gonocoxite length 250 mu, gonostylus length 110 mu. H.R. 2.27. Lateral margin of tergite IX with group of 9 setae. Anal point medium in length. Virga present. Basal median lobes of gonocoxite triangular. Basal lobe with dorsal part long and narrow, ventral part extended slightly below. Gonostylus robust and rounded, with blunt apex.

Remarks. The male of Orthocladus (O.) knuthi closely resembles the male of O. dorenius in hypopygial features; knuthi can be distinguished from dorenius by the shape of the basal median lobes of the gonocoxite.

O. knuthi n. sp.

VARIABLE	SAMPLE SIZE	MEAN	RANGE		VARIANCE
			MIN	MAX	
WING	4	2375.00	2325.00	2400.00	.1250 x 10 ⁴
ARM	4	962.50	925.00	1000.00	.1042 x 10 ⁴
AFCU	4	1006.25	975.00	1025.00	.5729 x 10 ³
R	4	5.50	3.00	7.00	.3000 x 10 ¹
SQUM	4	19.00	16.00	22.00	.6667 x 10 ¹
P1	4	38.75	30.00	45.00	.3958 x 10 ²
P2	4	52.50	45.00	60.00	.4167 x 10 ²
P3	4	128.75	125.00	135.00	.2292 x 10 ²
P4	4	105.00	90.00	120.00	.1667 x 10 ³
P5	4	147.50	125.00	160.00	.2417 x 10 ³
EYE	4	282.50	275.00	295.00	.7500 x 10 ²
VERT	3	12.00	11.00	13.00	.1000 x 10 ¹

VARIABLE	SAMPLE SIZE	MEAN	RANGE		VARIANCE
			MIN	MAX	
ETM	4	2.50	1.00	3.00	.1000 x 10 ¹
CLYP	4	11.00	10.00	13.00	.2000 x 10 ¹
PROL	4	5.75	4.00	8.00	.2917 x 10 ¹
AC	4	13.25	11.00	14.00	.2250 x 10 ¹
DC	4	10.00	9.00	11.00	.1333 x 10 ¹
PA	4	4.75	4.00	5.00	.2500 x 10 ⁰
SC	4	8.00	8.00	8.00	.0000
ANSU	4	282.50	280.00	290.00	.2500 x 10 ²
ANT3	3	440.00	410.00	470.00	.9000 x 10 ³
ANTT	3	693.33	690.00	700.00	.3333 x 10 ²
BASI	4	257.50	240.00	280.00	.2917 x 10 ³
DISI	4	107.50	100.00	110.00	.2500 x 10 ²
FF	4	725.00	675.00	750.00	.1250 x 10 ⁴
FT	4	918.75	900.00	950.00	.5729 x 10 ³
FTA1	4	637.50	625.00	650.00	.2083 x 10 ³
FTA2	4	406.25	400.00	425.00	.1562 x 10 ³
FTA3	4	275.00	250.00	300.00	.4167 x 10 ³
FTA4	4	150.00	150.00	150.00	.0000
FTA5	4	118.75	100.00	125.00	.1562 x 10 ³
MF	4	787.50	775.00	825.00	.6250 x 10 ³
MT	4	800.00	775.00	825.00	.4167 x 10 ³
MTA1	4	381.25	375.00	400.00	.1562 x 10 ³
MTA2	4	250.00	250.00	250.00	.0000
MTA3	4	175.00	175.00	175.00	.0000
MTA4	4	93.75	75.00	100.00	.1562 x 10 ³
MTA5	4	112.50	100.00	125.00	.2083 x 10 ³
HF	4	850.00	825.00	875.00	.4167 x 10 ³
HT	4	993.75	975.00	1025.00	.5729 x 10 ³
HTA1	4	525.00	500.00	550.00	.4167 x 10 ³
HTA2	4	306.25	300.00	325.00	.1562 x 10 ³
HTA3	4	231.25	225.00	250.00	.1562 x 10 ³
HTA4	4	106.25	100.00	125.00	.1562 x 10 ³
HTA5	4	125.00	125.00	125.00	.0000
COMB	4	10.00	8.00	11.00	.2000 x 10 ¹

VARIABLE	SAMPLE SIZE	MEAN	RANGE		VARIANCE
			MIN	MAX	
TH	3	1091.67	1075.00	1100.00	.2083 x 10 ³
AB	4	2506.25	1475.00	2550.00	.9896 x 10 ³
WW	3	741.67	725.00	750.00	.2083 x 10 ³
WR	3	3.23	3.17	3.31	.5655 x 10 ⁻²
BL	3	3608.33	3575.00	3650.00	.1458 x 10 ⁴
AR	3	1.58	1.47	1.71	.1443 x 10 ⁻¹
VR	4	1.05	1.02	1.08	.6686 x 10 ⁻¹
HR	4	2.40	2.18	2.60	.4165 x 10 ⁻¹
HV	3	3.39	3.25	3.65	.5048 x 10 ⁻¹
FLR	4	.69	.66	.72	.7252 x 10 ⁻¹
FSV	4	2.58	2.50	2.72	.9869 x 10 ⁻³
FBV	4	2.40	2.31	2.51	.9697 x 10 ⁻³
MLR	4	.48	.45	.50	.3828 x 10 ⁻³
MSV	4	4.17	3.94	4.40	.3639 x 10 ⁻¹
MBV	4	3.12	3.00	3.21	.7940 x 10 ⁻²
HLR	4	.53	.51	.55	.3577 x 10 ⁻³
HSV	4	3.52	3.36	3.65	.1981 x 10 ⁻¹
HBV	4	3.08	3.00	3.13	.3195 x 10 ⁻²
BR	3	2.31	2.27	2.32	.8191 x 10 ⁻³

Allotype Female (Pupa)

Color. Brown; scutal stripes distinct, merging posteriorly.

Length (mm). Body 4225, thorax 1125, abdomen 3100.

Head. Temporals 13, verticals 10, postorbitals 3. A.R.

0.85. Antennal flagellomere lengths (mm, Fig. 78m): 80, 40, 40, 40, 170. Clypeus large and rectangular, with 10 setae.

Thorax. Anteprenotal lobe jutting out medially, robust. Lateral anteprenotals 5, prealars 6, acrostichals 11, dorsocentrals 10, uniserial; scutellars 11, uniserial. Anapleural suture length 250 mm. Mesonotal pit as in O. oliveri.

Wing. Stem vein with 1 seta, squama with 21.

Lens. Hind tibial comb composed of 11 setae. Spines absent on fore leg, 2 on each of first two tarsal segments of mid leg, 2 on first tarsal segment of hind leg.

Genitalia (Fig. 72). Lateral sternite IX with small area rounded posteriorly, produced posterolaterally; numerous long setae dorsally, shorter setae ventrally, more than 15 setae present. Tergite IX narrow. Spermathecal duct wrinkled for most of length.

Remarks. The female of Orthocladius (O.) knuthi closely resembles the female of O. clarkei and O. dorenius in genitalic features; knuthi can be distinguished from them by the more numerous setae on lateral sternite IX.

Male Pupal Exuvia

Color. Brown.

Length (mu). Abdomen 2925.

Cephalothorax. Setae: frontals 1, robust; postorbitals 1, humerals 3, lateral antepnotals 1, median antepnotals 2, prealars 1, dorsocentrals 4. Thoracic horn (Fig. 90i) slender, same width throughout, and densely covered with moderately developed scalelike spines, length 330 mu. Frontal tubercles prominent, saclike, erect, and brown. Anterior part of notum bumpy along eclosion line.

Abdomen. Anal lobe length 320 mu; heart-shaped, with 7 right and 7 left spurs; spurs long, robust, iciclelike, and directed posteromedially; innermost spurs bifid; longest anal seta length 170 mu. A.L.R. 0.53. Pedes spurii B weakly developed, present on segment II.

Setae present on segments I-VIII;

dorsals	3	4	4	5	5	5	5	2
laterals	1	3	3	3	3	3	4	4
ventrals	1	3	3	3	3	3	3	0

Tergal spine patterns (composite). I: bare; Omm 2, Amm 0. II: elliptical patch posteromedial, with about 54 recurved spines in 3 rows; large patch of coarse spines anterior to recurved spines; Omm 4, Amm 2. III-V: large patch of coarse spines separated by bare line from rectangular patch of anteriorly-directed spines along posterior margin; bare bands laterally; Omm 4, Amm 2. VI: as in III-V, but with large patch reduced in size, and without patch of anteriorly-directed spines; Omm 2, Amm 2. VII: band of fine spines along anterior margin; 2 vertical rectangular patches of fine spines centrally; Omm 2, Amm 2. VIII: band of fine spines along anterior margin; patch of fine spines medial, anterior to 4th dorsal seta; Omm 3, Amm 1. IX: wide band of fine spines along anterior margin.

Sternal spine patterns (composite). I: bare. II, III: band of fine spines along anterior margin, continuous with lateral bands posteriorly. IV: 2 well-spaced patches of fine spines along anterior margin. V: 2 well-spaced patches of fine spines along anterior margin; patch of fine spines along posterior margin medially. VI: as in V, but with medial patch larger. VII, VIII: 2 well-spaced patches of fine spines along anterior margin. IX: bare.

Variation. One specimen has 5 laterals on one side of segment VIII.

Remarks. The pupa of Orthocladus (O.) knuthi closely resembles the pupa of O. doreus; it can be distinguished from doreus by the 4 laterals on segment VIII. The larva of O. knuthi is unknown.

TYPE MATERIAL

Holotype. Male, with pupal exuvia, Nedre Midsommer So, Greenland, coll. 16.VII. emerg. 22.VII.1966, Can. Pearyland Expd. G.P. 30.222, (CNC). Allotype. Female pupa, Nedre Midsommer So, Greenland, 23.VII.1966, Can. Pearyland Expd., G.P. 1-14, (CNC).

Paratypes (6). Greenland. Nedre Midsommer So, G.P. 1.16, 25.July.1966, Can. Pearyland Expd., (CNC), 1 male; same data except G.P. 46.25, 4.VIII.1966, 1 male; G.P. 26.4, 24 July 1966, 1 male. Northwest Territories. Eureka, 2.VIII.1963, J.R. Vockeroth, (CNC), 2 males. Sweden. Hornsund, Spitzbergen, 22.VII.1964, C. Bång, (CNC), 1 male.

Orthocladus (Orthocladus) lapponicus Goethghebuer

Figs. 34, 35, 57, 62, 63, 78f, 90j, 119, 130, 151, 96

Orthocladus lapponicus Goethghebuer, 1940, p. 60, fig. 7.

Thienemann, 1941, p. 178. Welch, 1973, p. 1115.

Orthocladus (Orthocladus) lapponicus Goethghebuer, Goethghebuer, 1942a, p. 48, fig. 72.

"Orthocladus" lapponicus Goethghebuer, Fittkau, Schlee and Reiss, 1967, p. 363.

Goethghebuer (1940) described this species based on a male from Swedish Lapland, and he gave an excellent figure of the male genitalia. Although it is not indicated in the original description, Goethghebuer had two males before him, and he did not

designate a holotype. I am designating these two males as the lectotype and paralectotype of O. lapponicus. In the key given by Goethghebuer (1942a), the type material will run to O. lapponicus. However; this key does not allow one to identify the variants found in my material.

Recently, O. lapponicus has been found in large numbers in Char Lake, N.W.T.. Welch (1973) has provided information on the ecology of this species, and he pointed out that species separation of the adult females and larvae is often difficult and I concur. I have examined the material from Char Lake, and the variation of body length shows that the lectotype is a small representative of this species. I have given a figure of the male genitalia of the lectotype (Fig. 34) and the figure of one of the largest Char Lake specimens for comparison (Fig. 35). The female and immature stages are described here for the first time.

Lectotype Male

Color. Brown; halteres missing; scutal stripes not distinct.

Length. Thorax damaged; abdomen 1775 μ . Body 3 mm (Goethghebuer 1940).

Head. Flattened. Femalelike. Interocular distance 220 μ . Temporals 12, verticals 10, postorbitals 2. Antenna damaged. A.R. 1.18 (Goethghebuer 1940). Clypeus large and rectangular, with 17 setae. Palpal segment lengths (μ): 30, 40, 105, 85, 115.

Thorax. Anteprenotal lobe narrowed medially. Lateral anteprenotals ?; acrostichals 9, prealars 5, dorsocentrals 9,

uniserial; scutellars 13, uniserial. Anapleural suture length 250 μ . Indication of mesonotal pit.

Wing. Length 2100 μ , width 575 μ . L/W.R. 3.65.

Finely punctate. Anal lobe slightly rounded and produced. Stem vein with 1 seta, R with 3, squama with 16. Costa not extended beyond R4+5, apex well distal to apex of Cu1. R2+3 ending about 1/3 distance between R1 and R4+5.

Legs. Hind tibial comb composed of ?11 setae. Fore leg damaged, 2 spines on each of first two tarsal segments of mid leg, 2 on first tarsal segment of hind leg.

	F	T	Ta1	Ta2	Ta3	Ta4	Ta5	L.R.	B.V.	S.V.
Fore	775	900	575	---	---	---	---	0.63	---	---
Mid	750	775	375	225	175	100	125	0.48	3.04	4.06
Hind	825	925	500	300	250	125	125	0.54	2.81	3.50

Hypopygium (Fig. 34). Gonocoxite length 230 μ , gonostylus length 120 μ , H.R. 1.91. Lateral margin of tergite IX with group of ?5 setae. Anal point long. Virga present. Basal median lobes of gonocoxite triangular. Basal lobe with dorsal part short and square, with ventral part extended prominently below. Gonostylus rounded and cuplike.

Variation. Anal point long in material from Greenland, Char Lake, and Lake Hazen; medium in length in material from Baffin Island and Sweden. The basal lobes are weaker in the material from Sweden and Baffin Island, than in the other material. Scutellar setae are biserial in 92% of the material.

Remarks. The male of Orthocladus (O.) lapponicus closely resembles the male of O. oliveri in hypopygial features;

lapponicus can be distinguished from oliveri by the triangular shape of the basal median lobes, the presence of a virga, and the long anal point?

O. lapponicus Goethghebuer

VARIABLE	SAMPLE SIZE	MEAN	RANGE		VARIANCE
			MIN	MAX	
WING	26	2568.27	2150.00	3250.00	.7868 x 10 ⁵
ARM	26	1013.46	825.00	1325.00	.1471 x 10 ⁵
AFCU	26	1026.92	850.00	1300.00	.1500 x 10 ⁵
R	26	7.61	3.00	12.00	.4966 x 10 ¹
SQUM	26	24.31	18.00	36.00	.2062 x 10 ²
P1	26	37.11	25.00	55.00	.4235 x 10 ²
P2	26	51.54	40.00	70.00	.5154 x 10 ²
P3	26	109.04	85.00	150.00	.2080 x 10 ³
P4	25	95.00	75.00	120.00	.1229 x 10 ³
P5	26	146.35	115.00	175.00	.2091 x 10 ³
EYE	24	299.37	265.00	400.00	.9159 x 10 ³
VERT	26	9.69	6.00	13.00	.2701 x 10 ¹
ETM	26	1.50	1.00	3.00	.4200 x 10 ⁰
CLYP	26	11.00	7.00	17.00	.6880 x 10 ¹
PROL	26	6.54	4.00	11.00	.4018 x 10 ¹
AC	26	9.44	6.00	15.00	.4507 x 10 ¹
DC	26	7.69	6.00	13.00	.2861 x 10 ¹
PA	26	4.54	3.00	6.00	.4985 x 10 ⁰
SC	26	15.15	8.00	24.00	.1525 x 10 ²
ANSU	26	300.77	230.00	440.00	.2279 x 10 ⁴
ANT3	26	418.46	350.00	500.00	.1197 x 10 ⁴
ANTT	26	563.08	420.00	750.00	.6974 x 10 ⁴
BASI	26	274.23	230.00	350.00	.9134 x 10 ³
DISI	26	141.54	120.00	180.00	.2135 x 10 ³
FF	26	836.54	675.00	1125.00	.1076 x 10 ⁵
FT	26	966.35	775.00	1275.00	.1430 x 10 ⁵
FTA1	26	638.46	500.00	825.00	.6211 x 10 ⁴
FTA2	26	392.31	300.00	475.00	.2188 x 10 ⁴
FTA3	26	270.19	225.00	325.00	.1201 x 10 ⁴

VARIABLE	SAMPLE SIZE	MEAN	RANGE		VARIANCE
			MIN	MAX	
FTA4	26	173.08	125.00	225.00	.6461 x 10 ³
FTA5	26	132.69	100.00	175.00	.2885 x 10 ³
MF	26	856.73	675.00	1125.00	.1173 x 10 ⁵
MT	26	880.77	675.00	1175.00	.1366 x 10 ⁵
MTA1	26	419.23	325.00	525.00	.2265 x 10 ⁴
MTA2	26	257.69	200.00	325.00	.9885 x 10 ³
MTA3	26	194.23	150.00	250.00	.5154 x 10 ³
MTA4	26	118.27	100.00	150.00	.2779 x 10 ³
MTA5	26	129.81	100.00	150.00	.2010 x 10 ³
HF	26	962.50	775.00	1300.00	.1571 x 10 ⁵
HT	26	1056.73	850.00	1325.00	.1688 x 10 ⁵
HTA1	26	546.15	425.00	700.00	.5535 x 10 ⁴
HTA2	26	325.00	275.00	400.00	.1600 x 10 ⁴
HTA3	26	244.23	200.00	300.00	.9654 x 10 ³
HTA4	26	135.58	75.00	175.00	.5086 x 10 ³
HTA5	26	140.38	100.00	175.00	.3038 x 10 ³
COMB	26	10.58	6.00	15.00	.3614 x 10 ¹
TH	26	1161.54	925.00	1525.00	.2151 x 10 ⁵
AB	26	2787.50	2275.00	3500.00	.1057 x 10 ⁶
WW	26	826.92	700.00	1050.00	.7696 x 10 ⁴
WR	26	3.11	2.86	3.51	.2411 x 10 ⁻¹
BL	26	3949.04	3300.00	5025.00	.1984 x 10 ⁶
AR	26	1.34	1.08	1.74	.2012 x 10 ⁻¹
VR	26	1.01	.98	1.09	.6292 x 10 ⁻³
HR	26	1.94	1.71	2.31	.1787 x 10 ⁻¹
HV	26	2.79	2.47	3.33	.3971 x 10 ⁻¹
FLR	26	.66	.64	.69	.1951 x 10 ⁻³
FSV	26	2.82	2.71	1.96	.4006 x 10 ⁻²
FBV	26	2.52	2.36	2.69	.9583 x 10 ⁻²
MLR	26	.48	.44	.52	.4171 x 10 ⁻³
MSV	26	4.14	3.86	4.44	.2412 x 10 ⁻¹
MBV	26	3.08	2.90	3.24	.1201 x 10 ⁻¹
HLR	26	.52	.47	.67	.1364 x 10 ⁻²
HSV	26	3.71	2.74	4.06	.5524 x 10 ⁻¹
HBV	26	3.04	2.66	3.20	.1309 x 10 ⁻¹
BR	26	2.41	2.07	2.86	.4486 x 10 ⁻¹

Female

Color. Brown; halteres golden; scutal stripes distinct, merging posteriorly.

Length (mμ). Thorax damaged; abdomen 3375.

Head. Interocular distance 345 mμ. Temporals 13, verticals 10, postorbitals 3. A.R. 0.50. Antennal flagellomere lengths (mμ, Fig. 78f): 90, 45, 45, 50, 200. Clypeus large and rectangular, with 27 setae. Palpal segment lengths (mμ): 45, 55, 120, 110, 165.

Thorax. Anteprenotal lobe narrowed medially as in male. Lateral anteprenotals 11, acrostichals 8, prealars 5, dorsocentrals 11, uniserial; scutellars 18, biserial. Anapleural suture length 390 mμ. Mesonotal pit as in O. oliveri.

Wing. Length 3650 mμ, width 1425 mμ. L/W.R. 2.56. Finely punctate. Anal lobe straight proximally, slightly rounded distally, and not produced. V.R. 1.03. Stem vein with 1 seta, R with 17, R1 with 10, R4+5 with 8, squama with 42. Costa not extended beyond R4+5, apex slightly distal to apex of Cul. R2+3 ending about 1/3 distance between R1 and R4+5.

Legs. Hind tibial comb composed of 12 setae. Spines absent on fore leg, 2 on each of first two tarsal segments on mid and hind legs.

Leg lengths (mμ) and proportions:

	F	T	Ta1	Ta2	Ta3	Ta4	Ta5	L.R.	B.V.	S.V.
Fore	925	1125	700	400	300	175	150	0.62	2.68	2.92
Mid	1025	1075	475	275	200	125	150	0.44	3.43	4.42
Hind	1150	1300	675	375	275	150	175	0.51	3.20	3.62

Genitalia (Fig. 62). Lateral sternite IX with long, narrow projection posterolaterally; if distorted (Fig. 63), with posterior margin curved; few long setae proximally, shorter setae distally. Tergite IX narrow. Spermathecal duct wrinkled for most of length.

Variation. There is some variation in the shape of lateral sternite IX, possibly due to slide distortions. Postorbitals not separated by wide gap from verticals.

Remarks. The female of Orthocladus (O.) lapponicus closely resembles the female of O. charensis in genitalic features; lapponicus can be distinguished from charensis by the narrow tergite IX and the wider, more rounded projection of lateral sternite IX. The female of O. lapponicus resembles the female of O. obumbratus when the genitalia is distorted (Fig. 63); lapponicus can be distinguished from obumbratus by the small size of lateral sternite IX.

Male Pupal Exuvia

Color. Pale golden.

Length (mm). Body 4700, cephalothorax 1450, abdomen 3250.

Cephalothorax. Setae: frontals 1, weak; postorbitals 1, humerals 3, lateral antepronotals 1, median antepronotals 2, prealars 1, dorsocentrals 4. Thoracic horn (Fig. 90j) robust with apex tapered and moderately covered with both robust, scalelike and small, pointed spines, length 250 mm. Frontal tubercles not prominent. Anterior part of notum wrinkled along eclosion line.

Abdomen. Anal lobe length 310 mm; heart-shaped, with 6

right and 6 left spurs, spurs small, weak, and iciclelike; longest anal seta length 240 μ . A.L.R. 0.77. Pedes spurii 8 robust, present on segment II.

Setae present on segments I-VIII:

dorsals	4	4	5	5	5	5	5	2
laterals	1	3	3	3	3	3	4	4
ventrals	1	3	3	3	4	4	3	1

Tergal spine patterns (composite). I: bare; Omm 2, Amm 0. II: elliptical patch posteromedial, with about 56 recurved spines in 3 rows; small patch of coarse spines anterior to recurved spines, extended laterally; Omm 2, Amm 1. III-V: large patch of coarse spines separated by bare line from rectangular patch of anteriorly-directed spines along posterior margin; bare bands laterally; Omm 3, Amm 2. VI: as in III-V but with large patch reduced in size and without the patch of anteriorly-directed spines; Omm 2, Amm 2. VII: 2 well-spaced patches of fine spines along anterior margin; 2 well-spaced vertical patches of fine spines centrally; patch of fine spines along posterior margin medially; Omm 1, Amm 0. VIII: band of fine spines along anterior margin; Omm 0, Amm 0. IX: band of fine spines along anterior margin.

Sternal spine patterns (composite). I, II: bare, III, IV: 2 well-spaced patches of fine spines along anterior margin, continuous with narrow lateral bands reaching posterior margin. V: 2 well-spaced patches of fine spines along anterior margin; patch of fine spines along posterior margin medially. VI: as in V, but with medial patch larger. VII, VIII: 2 well-spaced patches

of fine spines along anterior margin. IX: bare.

Variation. Frontals weakly to moderately developed. Area along eclosion line with a few bumps, but never as bumpy as that in O. dorenus.

Remarks. The pupa of Orthocladius (O.) lapponicus closely resembles the pupa of O. dentifer; it can be distinguished from dentifer by the lighter color of the exuvia and the shape of the thoracic horn.

Larva (n = 2)

Color. Body green with head capsule yellow.

Head. Labial plate (Fig. 130c) convex; broad median tooth extended anteriorly, slightly beyond first laterals. Labial plate of 4th instar worn (Fig. 130b). Mandible (Fig. 130a) with outer margin crenulate; brush with 7 setae; apices serrate. Epipharynx (Fig. 119a) with 8 chaetae laterales, 2 chaetae basales, and 3 spinules. Premandible simple, with preapical fissure. A.R. 2.24-2.25. Antennal segment lengths ($m\mu$, Fig. 119b): 65-70, 15-16, 5, 5, 4-5; blade grooved, extended to 4th segment; Lauterborn organs moderately developed. Anal gills triangular.

Variation. Younger instars have a lower A.R. (n = 2): I.15-1.26. Antennal segment lengths ($m\mu$, n = 2): 29-30, 11-14, 5, 3-4, 3-4. The eyespots are absent in the lower instar specimens I examined.

Remarks. The larva of Orthocladius (O.) lapponicus closely resembles the larva of O. charensis; it can be distinguished from charensis by a combination of characters: the triangular anal gills, the 5-segmented antenna, the width of the median tooth

relative to the width of the first laterals of the labial plate, and the green body color. The ecology of these two species differs (Welch 1973).

ECOLOGY

The larvae of O. lapponicus were found in the moss zone (between 4 m. to 10-15 m. deep) in Char Lake, N.W.T. (Welch 1973).

MATERIAL EXAMINED (Fig. 151)

Lectotype. Male, Env. d'Abisko/Lap. Suedoise, 1939, d'Thienemann. R.I. Sc. N.B. 18.073, coll. et det. M. Goethgebuer. Paralectotype. Male, same data as lectotype.

Greenland. Nedre Midsommer So, Can. Peary Land Expd., 25 July 1966, GP. 31.10, (CNC), 1 male; same data except 29 July 1966, GP. 25.5, 2 males; 3.VIII.1966, T7-13, 1 male; 3.VIII.1966, T4-13, 1 male; 4.VIII.1966, GP. 31-15, 1 male; 8.VIII.1966, GP. 31-16, 1 male, GP. 32-8, 1 male; GP. 32-10, 1 male; 26.VII.1966, T7-11, 1 male. Northwest Territories. Baffin Is., Nettiung L., 25.VIII.1956, D.R. Oliver, No. N. 107-3, (CNC), 1 male; same data except 13.VIII.1956, No. N 104-11, 1 male; Hazen Camp, 81° 49' N., 71° 18' W., 31.VII.1961, D.R. Oliver, No. HE. 165, (CNC), 1 male; Cornwallis I., Resolute, Char Lake, (CNC): about 8 m., moss, 11. Aug. 72, H.E. Welch, 1 reared male; 11.5 m., 21.IX.1969, No. 70-32, 111, H.E.W., 11 larvae, Vial 133, 0.5 m. rocky zone, 17.VIII.1969, H.E.W., 1 larva; 13.9.1972, H.E.W., 1 reared female; 20 M., 26.VIII. 1969, No. 70-32.71.10, H.E.W., 1 larva; no date, H.E.W. via M. Charleston, 1 male; 3.Aug. 1968, D.R. Oliver, 52.116-17, 52.116-18, No. 52.116-15, No. 52.116-25, 4 pairs in copula; 20. July 1969, D.R. Oliver, DRO 52. 179, 2 males; 3.VIII.1968, D.R. Oliver, No.

DRO 52-117-1, 1 male; DRO 52-117, 9 males, 2 females; DRO 52-117-2, 1 male; DRO 52-117-3, 1 male; 5.VIII.1963, J.R. Vöckeroth, No. DRO 52-3, 1 male; the following collected by D.R. Oliver and P. Corbet: 26 July 69, Tr 4b-4, 1 male; 4 Aug. 69, Tr 52-124, 9 pupal exuviae; 5 Aug. 69, Tr 10-9, 8 males; 7 Aug. 69, Tr 3a-7, 3 males; Tr 4a-7, 2 males; Tr 5-7, 1 male; Tr 7-7, 3 males; Tr 8-7, 2 males; 12 Aug. 69, Tr 1-8, 1 male; Tr 3-8, 1 male; Tr 4a-8, 2 males; Tr 8-8, 23 males; Tr 9-8, 15 males; Tr 4b-8, 2 females; 15 Aug. 69, Tr 3b-9, 34 males; Tr 4a-9, 8 males; Tr 4b-9, 69 males; 23 Aug. 69, Tr 2-11, 2 males; Tr 3a-11, 2 males; Tr 4a-11, 4 females; Tr 4b-11 #1 08, 1 female; Tr 4b-11 #2 08, 1 male, 1 female; Tr 6-11, 6 males; Tr 8-11 #1, 1 male; Tr 8-11, #2 084, 58 males; Tr 8-11 #4 08, 30 males; Tr 8-11, #7 084, 32 males; Tr 9-11 #2, 38 males; Tr 10-11, 10 males; Cornwallis I., Resolute Lake, 14.VIII.1960, D.R. Oliver, (CNC); 13 males, 5 pupal exuviae; Resolute Bay, 13.VIII.1959, J.A. Downes, No. DRO 52-9, (CNC), 1 male. Sweden. Lappland, Stordalen Station, 7.VII.1958, D.R. Oliver, (CNC), E.54, 35, L.F. 2.10.62, 1 male.

Orthocladus (Orthocladus) mallochi Kieffer

Figs. 40, 41, 68, 78g, 90k, 120, 142, 152

Orthocladus (Orthocladus) lacteipennis Malloch, 1915, p. 524.

Frison, 1927, p. 174.

Orthocladus mallochi Kieffer, 1919b, p. 191, nomen novum for

Orthocladus (Orthocladus) lacteipennis Malloch, 1915, non

Orthocladus lacteipennis Lundström, 1910.

(non) Orthocladus lacteipennis Lundström, 1910, p. 19, fig. 11.

Hydrobaenus lacteipennis (Malloch), Johannsen, 1947, p. 173.

Hydrobaenus (Hydrobaenus) mallochi (Kieffer), Johannsen, 1952, p. 23.

Orthocladius mallochi Kieffer, Sublette and Sublette, 1965, p. 156.

Sublette, 1970, p. 53, fig. 8.

Orthocladius (Orthocladius) cf. lignicola, Coffman, 1973, p. 311
(partim).

Malloch (1915) described this widely distributed species based on a single male from Michigan, under the name O. lacteipennis. Kieffer (1919b) recognized that earlier, Lundström (1910) had used the same name in describing a male of Orthocladius from Finland. Kieffer gave the new name O. mallochi to Malloch's species. As late as 1947 the name O. lacteipennis Malloch was used by Johannsen, apparently without being aware of Kieffer's (1919b) paper. However, Johannsen (1952) referred to Kieffer's synonymy in his key to males of Hydrobaenus.

Sublette (1970) redescribed the pinned holotype male of O. mallochi, and provided a figure of the distorted genitalia which Malloch originally slide-mounted. I agree with Sublette that the male of O. mallochi is very similar to the male of O. obumbratus in hypopygial features. I do find however, a distinct difference in the shape of the basal lobe of the gonocoxite between these two species, but I do not find differences in the shape of the medial struts or in the shape of the anal point. If I am correct in interpreting Sublette's (1970, p. 55) "small cluster of denticles near the ventral confluence of the basistyles" as the spines of the virga, then I must point out that the virga is present in the males of both O. mallochi and O. obumbratus. It is most likely that Sublette did not recognize the virga in the holotype male of O. mallochi since it was pushed out of position. I do not agree

with Sublette (1970) that the dorsocentral setae become 2 to 3 rows posteriorly. The anteprenotal lobe of the holotype is not of equal width throughout as Malloch (1915) described it.

The pupal exuviae of O. mallochi, referred to as O. (Orthocladus) cf. lignicola, were collected in Pennsylvania by Coffman (1973). The female and immature stages of O. mallochi are similar to those of O. obumbratus, and both species sometimes occur together. The female and immature stages of O. mallochi are described here for the first time.

Holotype Male

Color. Brown; halteres absent; scutal stripes distinct, merging posteriorly.

Length (mm). Body 3325, thorax 1050, abdomen 2275.

Head. Absent.

Thorax. Anteprenotal lobe jutting out medially, robust. Lateral anteprenotals 5, acrostichals 14, prealars 4, dorsocentrals 10, uniserial; scutellars 12, uniserial. Anapleural suture length 290 mm. No mesonotal pit.

Wing. Length 1875 mm, width 550 mm. L/W.R. 3.40. Scarcely punctate. Anal lobe well rounded, and produced. V.R. 1.03. Stem vein with 1 seta, R with 4, squama with 19. Costa not extended beyond R4+5, apex slightly distal to apex of Cul. R2+3 ending about 1/3 distance between R1 and R4+5.

Legs. Hind tibial comb composed of 11 setae. Spines absent on fore leg, 2 on each of first two tarsal segments of mid leg, 2 on first tarsal segment of hind leg.

Leg lengths (mu) and proportions:

	F	T	Ta1	Ta2	Ta3	Ta4	Ta5	L.R.	B.V.	S.V.
Fore	675	800	575	300	225	150	125	0.71	2.56	2.56
Mid	750	750	375	200	150	100	---	0.50	---	4.00
Hind	800	900	525	275	225	100	---	0.58	---	3.23

Hypopygium (Figs. 40, 41). Gonocoxite length 200 mu, gonostylus length 100 mu. H.R. 2.00. H.V. 3.32. Lateral margin of tergite IX with group of 8 setae. Anal point medium in length. Virga present. Basal median lobes of gonocoxite triangular. Basal lobe with dorsal part short and square, posterior margin straight, and ventral part slightly extended below. Gonostylus rounded, robust.

Variation. Anal point short to medium in length. Clypeus enlarged and rounded in material from Ontario and N.W.T.. In males of this species, postorbital setae are present.

Remarks. The male of Orthocladus (O.) mallochi closely resembles the male of O. oblidens in hypopygial features; mallochi can be distinguished from oblidens by the more robust and squarer dorsal part of the basal lobe.

O. mallochi Kieffer

VARIABLE	SAMPLE SIZE	MEAN	RANGE		VARIANCE
			MIN	MAX	
WING	12	2412.50	2175.00	2550.00	.1062 x 10 ⁵
ARM	12	981.25	900.00	1050.00	.1946 x 10 ⁴
AFCU	12	1029.17	950.00	1100.00	.2026 x 10 ⁴
R	12	6.00	4.00	8.00	.1454 x 10 ¹
SQUM	12	22.67	17.00	29.00	.1315 x 10 ²
P1	12	40.42	35.00	50.00	.1572 x 10 ²
P2	12	64.17	50.00	75.00	.4470 x 10 ²

VARIABLE	SAMPLE SIZE	MEAN	RANGE		VARIANCE
			MIN	MAX	
P3	12	142.92	130.00	160.00	.9299 x 10 ²
P4	12	126.25	105.00	145.00	.1778 x 10 ³
P5	12	172.50	150.00	200.00	.2477 x 10 ³
EYE	11	296.82	275.00	320.00	.2664 x 10 ³
VERT	12	14.67	10.00	19.00	.8242 x 10 ¹
ETM	12	2.67	1.00	5.00	.1151 x 10 ¹
CLYP	12	15.42	8.00	26.00	.2499 x 10 ²
PROL	12	8.00	4.00	12.00	.3454 x 10 ¹
AC	12	12.92	5.00	21.00	.3608 x 10 ²
DC	12	11.00	7.00	13.00	.3636 x 10 ¹
PA	12	5.08	4.00	6.00	.2651 x 10 ⁰
SC	12	10.23	9.00	14.00	.2904 x 10 ³
ANSU	11	346.36	310.00	370.00	.3654 x 10 ³
ANT3	12	401.67	370.00	450.00	.6515 x 10 ³
ANTT	12	750.00	670.00	820.00	.2491 x 10 ⁴
BASI	12	254.17	200.00	290.00	.4992 x 10 ³
DISI	12	111.67	100.00	120.00	.5151 x 10 ²
FF	12	881.25	800.00	950.00	.1719 x 10 ⁴
FT	12	1072.92	1000.00	1150.00	.1870 x 10 ⁴
FTA1	12	783.33	750.00	825.00	.8333 x 10 ³
FTA2	12	439.58	400.00	500.00	.1529 x 10 ⁴
FTA3	12	308.33	275.00	350.00	.8333 x 10 ³
FTA4	12	187.50	175.00	200.00	.1704 x 10 ³
FTA5	12	133.33	125.00	150.00	.1515 x 10 ³
MF	12	916.67	825.00	950.00	.1629 x 10 ⁴
MT	12	981.25	875.00	1050.00	.2514 x 10 ⁴
MTA1	12	489.58	475.00	500.00	.1657 x 10 ³
MTA2	12	277.08	250.00	300.00	.1657 x 10 ³
MTA3	12	206.25	200.00	225.00	.1278 x 10 ³
MTA4	12	120.82	100.00	125.00	.9470 x 10 ²
MTA5	12	131.25	125.00	150.00	.1278 x 10 ³
HF	12	1002.08	900.00	1050.00	.2552 x 10 ⁴
HT	12	1156.25	1075.00	1225.00	.2287 x 10 ⁴
HTA1	12	662.50	625.00	700.00	.5114 x 10 ³

VARIABLE	SAMPLE SIZE	MEAN	RANGE		VARIANCE
			MIN	MAX	
HTA2	12	364.58	350.00	400.00	.2794 x 10 ³
HTA3	12	279.17	250.00	300.00	.3220 x 10 ³
HTA4	12	141.67	125.00	150.00	.1515 x 10 ³
HTA5	12	143.75	125.00	175.00	.2415 x 10 ³
COMB	12	10.92	10.00	12.00	.6288 x 10 ⁰
TH	9	1286.11	1200.00	1375.00	.2674 x 10 ⁴
AB	12	2891.67	2600.00	3200.00	.3799 x 10 ⁵
WW	12	756.25	725.00	800.00	.6960 x 10 ³
WR	12	3.19	3.00	3.41	.1684 x 10 ⁻³
BL	9	4191.67	3800.00	4525.00	.7016 x 10 ⁵
AR	12	1.88	1.52	2.10	.4227 x 10 ⁻¹
VR	12	1.05	1.02	1.07	.1705 x 10 ⁻³
HR	12	2.29	1.67	2.70	.7604 x 10 ⁻¹
HV	9	3.79	3.17	4.17	.1603 x 10 ⁰
FLR	12	.73	.70	.80	.9504 x 10 ⁻³
FSV	12	2.50	2.27	2.64	.1094 x 10 ⁻¹
FBV	12	2.57	2.23	2.90	.4828 x 10 ⁻¹
MLR	12	.50	.48	.54	.3015 x 10 ⁻³
MSV	12	3.88	3.58	4.00	.1421 x 10 ⁻¹
MBV	12	3.25	3.03	3.45	.1314 x 10 ⁻¹
HLR	12	.57	.54	.60	.4405 x 10 ⁻³
HSV	12	3.26	3.04	3.44	.1370 x 10 ⁻¹
HBV	12	3.04	2.79	3.25	.1616 x 10 ⁻¹
BR	9	2.26	2.10	2.47	.1524 x 10 ⁻¹

Female

Color. Brown; halteres golden; scutal stripes distinct, merging posteriorly.

Length (m_μ). Body 4225, thorax 1300, abdomen 2925.

Head. Interocular distance 275 m_μ. Temporals 11, verticals 10, postorbitals 1. A.R. 0.67. Antennal flagellomere lengths (m_μ, Fig. 78g): 85, 40, 45, 45, 145. Clypeus large and

rectangular, with 15 setae. Palpal segment lengths (mu): 50, 65, 110, 105, 155.

Thorax. Antepronotal lobe jutting out medially as in male, robust. Lateral antepronotals 5, acrostichals 9, prealars 5, dorsocentrals 11, uniserial; scutellars 9, uniserial. Anapleural suture length 280 mu. Mesonotal pit as in O. oliveri.

Wing. Length 2300 mu, width 800 mu. L/W.R. 2.87.

Finely punctate. Anal lobe straight proximally, slightly rounded distally, and not produced. V.R. 1.02. Stem vein with 1 seta, R with 11, R1 with 9, R4+5 with 6, squama with 23. Costa extended beyond R4+5, apex well distal to apex of Cu1. R2+3 ending about 1/5 distance between R1 and R4+5.

Legs. Hind tibial comb composed of 11 setae. Spines absent on fore leg, 2 on each of first two tarsal segments of mid leg, 2 on first tarsal segment of hind leg.

Leg lengths (mu) and proportions:

	F.	T	Ta1	Ta2	Ta3	Ta4	Ta5	L.R.	B.V.	S.V.
Fore	700	825	500	350	250	150	125	0.60	2.31	3.05
Mid	750	750	350	225	175	100	125	0.46	2.96	4.28
Hind	825	875	550	300	225	125	125	0.62	3.22	3.09

Genitalia. (pupa, Fig. 68). Lateral sternite IX with posterior margin rounded, produced posterolaterally; long setae dorsally, with shorter setae ventrally. Tergite IX narrow. Spermathecal duct wrinkled for most of length.

Remarks. The female of Orthocladus (O.) mallochii closely resembles the female of O. obumbratus in genitalic features; mallochii can be distinguished from obumbratus by the more rounded

posterior margin of lateral sternite IX.

Male Pupal Exuvia

Color. Golden.

Length (mμ). Body 6175, cephalothorax 2150, abdomen 4025.

Cephalothorax. Setae: frontals 1; moderately developed; postorbitals 1, humerals 3, lateral anteprenotals 1, median anteprenotals 2, prealars 1, dorsocentrals 4. Thoracic horn (Fig. 90k) robust with apex rounded, and densely covered with robust, scalelike spines, length 470 mμ. Frontal tubercles not prominent. Anterior part of notum wrinkled along eclosion line.

Abdomen. Anal lobe length 410 mμ; heart-shaped, with 3 right and 2 left spurs; spurs long, narrow, and iciclelike; longest anal seta length 210 mμ. A.L.R. 0.51. Pedes spurii B robust, present on segments II, III.

Setae present on segments I-VIII:

dorsals	4	4	5	5	5	5	5	2
laterals	1	3	3	3	3	3	4	4
ventrals	2	3	3	4	3	3	4	1

Tergal spine patterns (composite). I: bare; Omm 5, Amm

0. II: elliptical patch posteromedial, with about 71 recurved

spines in 3 rows; large patch of spines anterior to recurved spines;

Omm 4, Amm 2. III-V: large patch of coarse spines separated by

bare line from rectangular patch of anteriorly-directed spines

along posterior margin; bands of fine spines laterally; Omm 4, Amm

2. VI: as in III-V, but without patch of anteriorly-directed

spines; Omm 4, Amm 2. VII: 2 well-spaced patches of fine spines

along anterior margin continuous with lateral bands reaching 4th dorsal seta; Omm 2, Amm 3. VIII: 2 well-spaced patches of fine spines along anterior margin; Omm 4, Amm 0. IX: band of fine spines along anterior margin.

Sternal spine patterns (composite). I: bare. II, III: fine spines over entire sternite except for bare band posteriorly. IV: band of fine spines along anterior margin, continuous with lateral bands reaching posterior margin. V: band of fine spines along anterior margin; small patch of fine spines along posterior margin medially. VI: as in V, but with medial patch larger. VII, VIII: 2 well-spaced patches of fine spines along anterior margin. IX: bare.

Variation. Frontals moderately to robustly developed. Frontal tubercles, if erect, are not as dark or as robust as those in O. doreus. Thoracic horn more tapered to apex, and spines reduced in number. Area along eclosion-line with small bumps in Carabasset R. specimens.

Remarks. The pupa of Orthocladus (O.) mallochi closely resembles the pupa of O. obumbratus; it can be distinguished from obumbratus by the presence of pedes spurii B on segment III.

Larva (n = 8)

Head. Labial plate (Fig. 142a) convex; broad median tooth extended anteriorly, beyond first laterals; paralabials long and prominent. Mandible (Fig. 142b) with outer margin moderately crenulate; brush with 7 setae, some apices serrate. Epipharynx (Fig. 120a) with 8 chaetae laterales, 2 chaetae basales, 3 spinules. Premandible simple, with preapical notch. A.R. 1.78-2.24.

Antennal segment lengths (mm, Fig. 120b): 45-65, 10-19, 4-6, 3-5, 3-5; blade grooved, extended to tip of 4th segment; Lauterborn organs well developed, robust.

Variation. Mandible with strong to moderate crenulations, never weak. In several specimens, the mandible has a notch on the outer margin. However, this notch does not occur consistently, and probably it is due to wear (see O. wiensi).

Remarks. The larva of Orthocladus (O.) mallochi closely resembles the larva of O. wiensi; it can be distinguished from wiensi by the robust development of the Lauterborn organs.

MATERIAL EXAMINED (Fig. 152)

Holotype. Male, South Haven, Michigan, July 14, 1914, on shore of Lake Michigan, C.A. Hart, (INHS).

California. Santa Clara Co., Uvas Creek Area, 17 Mar 60, Phyllis Stecker, R.E. Stecker, (UID), 1 male; same data except 29 Mar 60-10, 2 males; Shasta Co., Hat Creek Fall, River Mills, 5-I-69, C. Apperson, (SUBLETTE), 1 female pupa, 2 male pupae; Shasta Co., nr. Fall River Mills, drift net, 6-IV-69, C. Apperson, (SUBLETTE), 1 male, 1 male pupa; same data except 3-V-69, 3 male pupae; Shasta Co., nr. Fall River Mills, 6-IV-69, C. Apperson, (SUBLETTE), 1 male; Fresno Co., Fresno, IV-18-56, R.O. Schuster, S66-2818, Cal. Ins. Surv., (SUBLETTE) 1 male; Riverside Co., Hidden Lake, 3 miles N. Arlington, 18-IV-1967, R.D. Sjogren, (SUBLETTE), 1 male; Riv. Co., P.L. Boyd Res. Center, 3.5 mi. S. Palm Desert, #57, XI-27-XII-1969, Malaise, Saul Frommer and R. Worley, (SUBLETTE), 1 male; same data except Marker #37, ex. Pool 83° F, running water, V-9-1969, Saul Frommer and Stuart Hurlbert, (SUBLETTE), 1 male. Colorado. Midway

between Crawford and Hotchkiss Co., at light, 20-VIII-71, M. Beard, (SUBLETTE), 1 male. Idaho. Blaine Co., Deer Cr. at Cayendon Hot Spgs., N.W. of Haily, 11-VII-59, no collector, S65-3319, (SUBLETTE), 1 male; S66-1706, 1 male, 12060 (INHS), 1 male. Illinois. Crawford Co., Robinson, at light, D.W. Webb, (INHS), 1 male. Maine. Carabasset R., 19.VI.1966, coll. Jon Martin, (CNC), 1 male; 3 reared males. Maryland. Montgomery Co., Fairland, light trap, May 1959, A.A. Hubert, (USNM), 2 males. Michigan. S. Haven, 14-VII-14, lake shore, S66-1721, (INHS), 1 male; same data except S66-1724, 1 male, S66-1723, 1 male; Muskegon St. Pk. E.B. Hayden H50-619, 18-VI-50, S64-2333, (UKAN), 1 male; same data except H50-626, S64-2332, 1 male. Montana. Beaver Creek, August, 1913, 6300 ft., S.J. Hunter S64-337, (UKAN), 1 male; Hamilton, 4-IV-60, C.B. Philip, (SUBLETTE), 1 male; Hamilton, outside lab bldg., 19-III-60, C.B. Philip, (SUBLETTE), 1 male. New Mexico. Sandoval Co., Jemez Spgs., 1-20-IV-1965, G. Washburn, (SUBLETTE), 1 male. Northwest Territories. Southampton Is., Duke of York Bay, VIII.17.1952, P.R. Ehrlich, (cnc), 1 male. Ontario. Speed R., 8.V.1968, 1644, (CNC), 1 male; Speed R., 2.V.1968, P. Harper, 1628, (CNC), 1 male; Pr. Edward Co., Sandbanks, 3.VI.1970, H.C. Walther. No. CH532, (CNC), 10 males; same data except J.R. Vockeroth, No. CH533, (CNC), 4 males. Oregon. Aumsville, 22 March 1963, K. Goeden-light, (USNM), 7 males. Pennsylvania. Crawford Co., Linesville Creek, 26.IV.1972, A.R. Soponis, (CNC), 2 males, 1 female, 1 reared female pupa; same data except 1 reared male; same locality except no date, 1 male and 1 reared male pupa; same data except coll. 26.IV.1972, em. 1.V.1972, 6 reared males, 1 female pupa reared; same data except 25.IV.1972,

1 reared female; Limesville Cr., light trap, 4.V.1965, Wm. Coffman, (PITT), LCA 59a, 1 male; same data except LCA 59b, 1 male. Utah, Vernal, 19-VII-41, S64-3047, (MINN), 1 male; Logan Canyon, -VI-46, S65-1357, (ISU), 1 male; Zion Nat'l. Pk., 8.VI.52, S64-2588, (SUBLETTE), 1 male. Washington, Sullivan Lake, Pend Oreille Co., 27 June 1968, light trap, W.W. Wirth, (USNM), 1 male; Benton Co., Hanford Columbia R., 2 Jan. 1952, no collector, (CNC), 3 male pupae; same data except 27 March 1952, 2 male pupae; Columbia R., 3.IV.1952, Davis, Edd 4 F-1, (CNC), 1 male.

Orthocladius (Orthocladius) manitobensis Saether

Figs. 55, 901, 115, 135, 153

Orthocladius (s.str.) manitobensis Saether, 1969, p. 69, figs. 34, 35.

Saether (1969) described this species based on a single reared male specimen from Manitoba. His remarks reveal that O. manitobensis is one of the more difficult species of Orthocladius (Orthocladius) to identify. Saether pointed out that of the six most closely related species in the key of Thienemann (1944), only two have been satisfactorily described. However, he was able to distinguish this species from the others by using the key to adults in Goethghebuer (1942a).

I do not agree with Saether that the male of O. obumbratus has a smaller dorsal part of the basal lobe of the gonocoxite than the male of O. manitobensis. Furthermore, I do not find the male of O. nigritus to be particularly similar to the male of O. manitobensis. Saether (1969) distinguished the pupa of O. obumbratus from the other described pupae of Orthocladius (Orthocladius) on

the basis of the serrate spine of the anal lobe, a character I have found to be individually variable (see O. obumbratus). In fact, the pupae of these two species are difficult to distinguish.

Saether concluded that O. manitobensis is most similar to O. wiensi.

I have examined adult males from Lake Winnipeg, and I have found them to be O. manitobensis. These specimens show a considerable amount of variation in the genitalia, and the Lake Winnipeg material varies considerably from the holotype. The female of O. manitobensis is unknown.

Holotype Male

Color. Brown; halteres golden; scutal stripes not distinct.

Length (mu). Body 3425, thorax 900, abdomen 2525.

Head. Interocular distance 230 mu. Temporals 10, verticals 8, postorbitals 2. A.R. 1.56. Antennal flagellomere lengths (mu): 1st-12th 975, 13th 1525. Clypeus rectangular, with 7 setae. Palpal segment lengths (mu): 35, 55, 115, 100, 140.

Thorax. Anteprenotal lobe wide medially, robust. Lateral anteprenotals 6, acrostichals 11, prealars 4, dorsocentrals 7, uniserial; scutellars 7, uniserial. Anapleural suture length 240 mu. No mesonotal pit.

Wing. Length 1925 mu, width 600 mu. L/W.R. 3.20.

Scarcely punctate. Anal lobe slightly rounded and produced. V.R. 1.06. Stem vein with 1 seta, R with 7, squama with 13. Costa not extended beyond R4+5, apex well distal to apex of Cul. R2+3 ending before midpoint of R1 and R4+5.

Legs. Hind tibial comb composed of 9 setae. Spines absent on fore leg, 2 on each of first two tarsal segments of mid

leg, 2 on first tarsal segment of hind leg.

Leg lengths (mu) and proportions:

	F	T	Ta1	Ta2	Ta3	Ta4	Ta5	L.R.	B.V.	S.V.
Fore	675	825	600	350	250	150	100	0.72	2.21	2.50
Mid	700	750	375	225	150	100	100	0.50	3.17	3.86
Hind	775	875	475	275	225	125	125	0.54	2.83	3.47

Hypopygium (Fig. 55). Gonocoxite length 230 mu, gonostylus length 100 mu. H.R. 2.30. H.V. 3.42. Lateral margin of tergite IX with group of 8 setae. Anal point short. Virga present. Basal median lobes of gonocoxite shortly triangular. Basal lobe with dorsal part short and square, ventral part rounded and slightly extended below. Gonostylus platelike.

Variation. Anal point short to long.

Remarks. The male of Orthocladus (O.) manitobensis closely resembles the male of O. pardecoratus in hypopygial features; manitobensis can be distinguished from pardecoratus by the less robust dorsal part of the basal lobe, and the shape of the basal median lobes of the gonocoxite.

O. manitobensis Saether

VARIABLE	SAMPLE SIZE	MEAN	RANGE		VARIANCE
			MIN	MAX	
WING	39	2114.74	1750.00	2400.00	.2808 x 10 ⁵
ARM	39	850.00	700.00	1000.00	.5132 x 10 ⁴
AFCU	39	916.02	775.00	1050.00	.5279 x 10 ⁴
*R	39	6.21	2.00	9.00	.2378 x 10 ¹
SQUAM	39	18.67	10.00	29.00	.1723 x 10 ²
P1	39	35.51	30.00	45.00	.1552 x 10 ²
P2	39	54.74	40.00	70.00	.3283 x 10 ²
P3	39	121.67	90.00	145.00	.1557 x 10 ³

MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS
STANDARD REFERENCE MATERIAL 1010a
(ANSI and ISO TEST CHART No. 2)

VARIABLE	SAMPLE SIZE	MEAN	RANGE		VARIANCE
			MIN	MAX	
P4	39	105.13	75.00	160.00	.2217 x 10 ³
P5	37	155.27	115.00	195.00	.4485 x 10 ³
EYE	34	259.12	230.00	300.00	.2507 x 10 ³
VERT	39	12.79	8.00	17.00	.3746 x 10 ¹
ETM	39	1.21	1.00	3.00	.2200 x 10 ⁰
CLYP	39	9.59	5.00	13.00	.4301 x 10 ¹
PROL	39	6.13	4.00	11.00	.2167 x 10 ¹
AC	39	12.18	7.00	20.00	.8730 x 10 ¹
DC	39	8.85	5.00	14.00	.2870 x 10 ¹
PA	39	4.85	4.00	7.00	.7652 x 10 ⁰
SC	39	9.23	6.00	12.00	.2919 x 10 ¹
ANSU	39	282.31	220.00	340.00	.8340 x 10 ³
ANT3	39	403.08	300.00	450.00	.7640 x 10 ³
ANTT	39	659.74	560.00	780.00	.2792 x 10 ⁴
BASI	39	236.41	200.00	270.00	.2341 x 10 ³
DISI	39	108.21	90.00	120.00	.6775 x 10 ²
FF	39	767.95	600.00	925.00	.4932 x 10 ⁴
FT	39	916.02	725.00	1050.00	.6628 x 10 ⁴
FTA1	39	682.05	550.00	800.00	.3946 x 10 ⁴
FTA2	39	399.36	325.00	475.00	.1365 x 10 ⁴
FTA3	39	273.08	225.00	325.00	.7034 x 10 ³
FTA4	39	169.87	150.00	200.00	.2362 x 10 ³
FTA5	39	120.51	100.00	150.00	.1603 x 10 ³
MF	39	780.13	575.00	900.00	.5697 x 10 ⁴
MT	39	830.13	675.00	950.00	.5401 x 10 ⁴
MTA1	39	410.26	350.00	475.00	.1438 x 10 ⁴
MTA2	39	244.23	200.00	300.00	.6402 x 10 ³
MTA3	39	183.97	150.00	225.00	.4437 x 10 ³
MTA4	39	113.46	100.00	125.00	.1594 x 10 ³
MTA5	39	116.67	100.00	125.00	.1425 x 10 ³
HF	39	833.97	675.00	950.00	.6332 x 10 ⁴
HT	39	972.85	750.00	1150.00	.9656 x 10 ⁴
HTA1	39	547.44	450.00	650.00	.2921 x 10 ⁴
HTA2	39	308.97	250.00	375.00	.1036 x 10 ⁴

VARIABLE	SAMPLE SIZE	MEAN	RANGE		VARIANCE
			MIN	MAX	
HTA3	39	239.74	200.00	275.00	.5828 x 10 ³
HTA4	39	123.08	100.00	150.00	.2429 x 10 ³
HTA5	38	121.71	100.00	150.00	.1071 x 10 ³
COMB	39	10.90	9.00	14.00	.1094 x 10 ¹
TH	17	1136.76	900.00	1250.00	.6415 x 10 ⁴
AB	38	2488.16	2100.00	3000.00	.4803 x 10 ⁵
WW	39	624.36	525.00	700.00	.2286 x 10 ⁴
WR	39	3.39	3.12	3.86	.2140 x 10 ⁻¹
BL	16	3692.19	3225.00	4250.00	.8481 x 10 ⁵
AR	39	1.64	1.35	2.43	.2974 x 10 ⁻¹
VR	39	1.08	1.03	1.22	.1168 x 10 ⁻²
HR	39	2.19	1.83	2.67	.2436 x 10 ⁻¹
HV	16	3.26	2.87	3.68	.4862 x 10 ⁻¹
FLR	39	.74	.69	.97	.2058 x 10 ⁻²
FSV	39	2.47	2.18	2.96	.1640 x 10 ⁻¹
FBV	39	2.46	2.28	2.71	.9975 x 10 ⁻²
MLR	39	.49	.41	.54	.5701 x 10 ⁻³
MSV	39	3.93	3.63	4.71	.3568 x 10 ⁻¹
MBV	39	3.07	2.67	3.31	.1184 x 10 ⁻¹
HLR	39	.56	.51	.63	.7938 x 10 ⁻³
HSV	39	3.31	2.95	3.62	.2367 x 10 ⁻¹
HBV	38	2.97	2.69	3.24	.1762 x 10 ⁻¹
BR	16	2.26	1.93	2.80	.4716 x 10 ⁻¹

Holotype Pupal Exuvia

Color. Golden.

Length (mu). Body 4075, cephalothorax 1425, abdomen 2650.

Cephalothorax. Setae: frontals 1, moderately developed; postorbitals 1, humerals 3, lateral antepnotals 1, median antepnotals 2, prealars 1, dorsocentrals 4. Thoracic horn (Fig. 901) distorted, appears robust and densely covered with robust,

pointed spines, length 230 μ . Frontal tubercles not prominent. Anterior part of notum bumpy along eclosion line.

Abdomen. Anal lobe length 300 μ ; appears narrowed, with 3 right and ?1 left spur; spurs weak, iciclelike; longest anal seta 150 μ . A.L.R. 0.50. Pedes spurii B moderately developed, present on segment II.

Setae present on segments I-VIII:

dorsals	4	4	4	5	5	5	5	1
laterals	1	3	3	3	3	3	4	4
ventrals	0	3	2	3	3	2	2	1

Tergal spine patterns. I: bare; Omm 2, Ann 2. II: elliptical patch posteromedial, with about 49 recurved spines in 3 rows; horizontal patch of coarse spines anterior to recurved spines and extended laterally; Omm 1, Ann 2. III-V: large patch of coarse spines separated by bare line from rectangular patch of anteriorly-directed spines along posterior margin; bare bands laterally; Omm 1, Ann 2 (III); Omm 3, Ann 2 (IV, V). VI: as in III-V, but with large patch reduced in size and without patch of anteriorly-directed spines; Omm 2, Ann 2. VII: 2 well-spaced patches of fine spines along anterior margin, continuous with large central patch of fine spines posteriorly; Omm 0, Ann 2. VIII: band of fine spines along anterior margin; Omm 0, Ann 0. IX: band of fine spines along anterior margin.

Sternal spine patterns. I: bare. II: 2 well-spaced patches of fine spines along anterior margin, continuous with bands reaching posterior margin. III: as in II but with patch of fine spines along posterior margin medially. IV: 2 well-spaced patches

of fine spines along anterior margin; patch of fine spines along posterior margin medially. V, VI: as in IV but with medial patch smaller. VII, VIII: 2 well-spaced patches of fine spines along anterior margin. IX: bare.

Remarks. The pupa of Orthocladus (O.) manitobensis closely resembles the pupa of O. obumbratus; it can be distinguished from obumbratus by the bumpy area along the eclosion line, and the pointed spines of the thoracic horn.

Holotype Larval Exuvia

Head. Labial plate (Fig. 135b) convex; broad median tooth extended anteriorly, beyond first laterals; paralabials not prominent. Mandible (Fig. 135a) with outer margin weakly crenulate; brush with 7 setae, apices serrate. Epipharynx (Fig. 115a) with 8 chaetae laterales, 2 chaetae basales, 3 spinules. Premandible simple. A.R. 1.83. Antennal segment lengths (mu, Fig. 115b): 55, 16, 5, 5, 4; blade grooved, extended to base of 5th segment; Lauterborn organs weakly developed.

Remarks. The larva of Orthocladus (O.) manitobensis closely resembles the larva of O. obumbratus, and I am unable to distinguish the larvae of these 2 species.

MATERIAL EXAMINED (Fig. 153)

Holotype. Male, reared, stream below dam, Lake Riviera, St. Annes, Man., 19.V.1967, A.L. Hamilton and A.P. Wiens (CNC No. 9984).

Manitoba: Lake Winnipeg (L.T.), coll. S.S. Chang (FRBW): 1½ mi. offshore George Is., 6.IV.1969, No. 15 D, 1 male; 1.5 mi. off George Is., 27.VII.1969, No. 55SSS, 1 male; St. 517, No. 550,

555, 55xx, 1 male each; Matheson Island, 5.VI.1969, No. 32B, 32E, 1 male each; 1 mi. offshore Horse Is., 7.VI.1969, No. 29G, No. 27EE, 1 male each; 29.VII.1969, No. 3700, 59m, 59g, 1 male each; Grand Rapids, Gov't Dock, 8.VI.1969, No. 51KK, 1 male; Grand Rapids, 28.VI.1969, No. 36D, No. 36WW, 1 male each; st. 5, No. 49D, 49KKK, 1 male each, 2 mi. offshore Grand Rapids, 13.VII.1969, No. 58H, 58J, 1 male each; st. 428, No. 38EE, No. 38EEE, No. 38KK, 1 male each; Pine Dock, 10.VII.1969, No. 30B, No. 3922, 1 male each; 31.VII.1969, No. 57uu, 57uu, 57ww, 60sss, 60TTT, 60uuu, 60vvv, 60WS, 1 male each; 2.IX.1969, No. 230, 1 male; George Island, 12.VII.1969, No. 40F, 14D, 1 male each; 1/4 mi. off McCreary Is., 15.VII.1969, No. 310, 315, 31LL, 47, 47m, 1 male each; Gull Hr., 16.VII.1969, No. 45FF, 48K4, 48QQ, 48V4, 48VV, 48W5, 1 male each; Gimli Dock, 24.VII.1969, No. 32B, 1 male; Gov't. Dock, Victoria Beach, 25.VII.1969, No. 42Y, 35PPP, 1 male each, McBeth Hr., 30.VII.1969, No. 33M, 33FFF, 33CCC, 50D, 50II, 1 male each; 7.IX.1969, No. 3B, 3C, 5A, 1 male each; Lake Winnipeg, (L.T.), (FRBW): Beaver Point, 25.VI.1971, N.M. and M.P.M., No. 23H, 23H, 1 male each; 30.VI.1971, S.F. and E.J., No. 26J, 26VVV, 26XXX, 1 male each; Old Fishing Dock, 21.VII.1971, B.A. and J.R., No. 35T, 1 male; Calders Dock, 5.VIII.1971, N.H. and E.J., No. 46H, 1 male; Calders Dock, 16-20.VI.71, M.P.M. and M.R., No. R-95, 1 reared male pupa; 11-17.VI.71, E.J. and M.P.M., No. R-111, 1 reared male; 16-21.VI.71, M.P.M. and M.R., No. R-104, 1 reared male pupa.

Minnesota. Collected by E.F. Cook (MINN): St. Louis Co., Duluth, N.J. Mosquito Trap, FWCPA Lab, July 1, 1970, 1 male; Pipestone Co., Pipestone Nat. Mon., N.J. Mosquito Trap, May 23, 1969, 1 male;

Kandiyohi Co., New London Fish Hat., N.J. Mosquito Trap, Low 570, May 29, 1969, 1 male; Cook Co., Min. F.S., Hovland, N.J. Mosquito Trap, June 9, 1969, 4 males; same data except June 11, 1968, 1 male; Sept. 30, 1968, 1 male; Cook Co., 2 mi. N. Hovland on U.S. 61, N.J. Mosquito Trap, July 16, 1970, 6 males; same data except July 1, 1970, 1 male; July 2, 1970, 1 male; July 8, 1970, 1 male; August 10, 1970, 1 male; St. Louis Co., U. of M. Duluth, N.J. Mosquito Trap, Aug. 6, 1969, 4 males; same data except Aug. 19, 1969, 7 males; Aug. 27, 1969, 2 males; July 31, 1969, 2 males; Aug. 11, 1969, 1 male; July 22, 1969, 2 males; July 10, 1969, 1 male; July 16, 1969, 2 males; June 24, 1969, 1 male; June 17, 1969, 1 male. Northwest Territories. Small stream entering left bank of Mackenzie R., 18 mi. upstream from Ft. Simpson, sweep net, 6 June 1973, D.R. Oliver, CH 869.1, (CNC), 1 male.

Orthocladius (Orthocladius) nigritus Malloch

Figs. 12, 13, 14a, 36, 37, 70, 71, 78h, 90o, 114d, e; 137, 154

Orthocladius (Orthocladius) nigritus Malloch, 1915, p. 525, fig.

3. Frison, 1927, p. 174.

(non) Orthocladius nigritus Goethghebuer, 1938, p. 459, fig. 8.

Goethghebuer, 1942a, p. 51, fig. 82.

Hydrobaenus nigritus (Malloch), Johannsen, 1947, p. 173. Roback,

1957b, p. 11. Cole, 1969, p. 101.

Hydrobaenus (Hydrobaenus) nigritus (Malloch), Johannsen, 1952,

p. 23.

Orthocladius nigritus Malloch, Sublette and Sublette, 1965, p. 156.

Sublette, 1970, p. 55.

Orthocladius (s. s.) nigritus Malloch, Sublette, 1966b, p. 593.

Orthocladus (Orthocladus) sp. 1, Coffman, 1973, p. 311.

Malloch (1915) described this species based on several males and females from Maryland, although in his original description he only mentioned the male. He distinguished the male of O. nigrinus from the male of O. obumbratus by the F.L.R., the hypopygium, and the brown or black color of the halteres. His excellent figure of the male genitalia of O. nigrinus has been the only available figure for this species.

Frison (1927) recorded two paratype males of O. nigrinus in the Illinois Natural History Survey collection. In the literature, the name O. nigrinus has appeared in keys and diagnostic tables of adults, and separation of this species relied on the dark color of the halteres. In pinned specimens of adults, the halteres are dark. However, in slide-mounted material, the halteres are golden with coarse microsetation. Since most of my material of O. nigrinus is slide-mounted, I have been unable to decide whether this character is useful or not.

Sublette (1966b) redescribed the pinned holotype male of O. nigrinus, and he reported that Malloch's original slide mount of the genitalia could not be found. I have made efforts also in vain to locate the holotype genitalia. I would like to thank W.W. Wirth and D.W. Webb for their help in this matter. However, I am convinced, as was Sublette, that the paratype males represent the same species as the holotype male. Sublette (1966b, 1970) placed the male of O. nigrinus in his "obumbratus group". The pupal exuviae of O. nigrinus, referred to as Orthocladus (O.) sp. 1, were collected in Pennsylvania by Coffman (1973). The

female and immature stages are described here for the first time.

Holotype Male

Color. Dark brown; halteres golden; scutal stripes not distinct.

Length. Thorax 1475 μ ; part of abdomen missing. Body 2.5-3 mm (Malloch 1915).

Head. Interocular distance 325 μ . Temporals 12, verticals 12, postorbitals 0. A.R. 1.97; antennae curled. Antennal flagellomere lengths (μ): 1st-12th 1075, 13th 2125. Clypeus rectangular, with 12 setae. Palpal segment lengths (μ): 45, 75, 145, 105, 240.

Thorax. Anteprenotal lobe jutting out medially, robust. Lateral anteprenotals 6, acrostichals 25, prealars 4, dorsocentrals 8, uniserial; scutellars 8, uniserial. Anapleural suture length 370 μ . Indication of mesonotal pit.

Wings (Figs. 12, 14a). Length 2975 μ , width 900 μ . L/W.R. 3.30. Moderately punctate. Anal lobe rounded and produced. V.R. 1.05. Stem vein with 1 seta, ~~4~~ with 7, squama with 28. Costa not extended beyond R4+5, apex well distal to apex of Cu1. R2+3 ending before midpoint of R1 and R4+5.

Legs. Hind tibial comb composed of 11 setae. Spines absent on fore leg, 2 on each of first two tarsal segments of mid leg, 2 on first tarsal segment and 1 on second tarsal segment of hind leg.

Leg lengths (mu) and proportions:

	F	T	Ta1	Ta2	Ta3	Ta4	Ta5	L.R.	B.V.	S.V.
Fore	950	1100	850	550	400	250	150	0.77	2.14	2.41
Mid	1025	1075	575	325	225	150	125	0.53	3.24	3.65
Hind	1125	1350	775	425	350	200	150	0.57	2.88	3.19

Hypopygium (Figs. 36, 37). Lost in holotype, described here for paratype. Gonocoxite length 280 mu, gonostylus length 140 mu. H.R. 2.00. H.V. 4.03. Lateral margin of tergite IX with group of 22 setae. Anal point medium in length. Virga absent. Basal median lobes of gonocoxite triangular. Basal lobe with dorsal part noselike, ventral part slightly extended below. Gonostylus rounded, robust.

Variation. Postorbitals absent in holotype, one paratype male, and the material from Blanche River, Quebec. The virga is present or absent.

Remarks. The male of Orthocladus (O.) nigritus closely resembles the male of O. cooki in hypopygial features; nigritus can be distinguished from cooki by the more robust development of the basal lobe, and the shape of the basal median lobes of the gonocoxite.

O. nigritus Malloch

VARIABLE	SAMPLE SIZE	MEAN	RANGE		VARIANCE
			MIN	MAX	
WING	13	2907.69	2450.00	3400.00	.6389 x 10 ⁵
ARM	13	1201.92	1000.00	1400.00	.1349 x 10 ⁵
AFCU	13	1265.38	1050.00	1450.00	.1308 x 10 ⁵
R	13	5.08	3.00	7.00	.1910 x 10 ¹
SQUM	13	29.31	20.00	41.00	.4273 x 10 ²
P1	13	40.38	30.00	50.00	.3942 x 10 ²

VARIABLE	SAMPLE SIZE	MEAN	RANGE		VARIANCE
			MIN	MAX	
P2	13	66.92	45.00	80.00	.8558 x 10 ²
P3	13	128.46	105.00	145.00	.2224 x 10 ³
P4	11	128.64	110.00	160.00	.2254 x 10 ³
P5	10	184.50	150.00	205.00	.3803 x 10 ³
EYE	12	298.33	255.00	340.00	.9242 x 10 ³
VERT	13	13.08	10.00	17.00	.6077 x 10 ¹
ETM	13	0.00	0.00	0.00	.0000
CLYP	13	9.54	7.00	20.00	.1160 x 10 ²
PROL	13	6.38	4.00	10.00	.5756 x 10 ¹
AC	12	11.17	5.00	15.00	.7970 x 10 ¹
DC	13	9.08	6.00	13.00	.4910 x 10 ¹
PA	13	4.54	4.00	6.00	.6026 x 10 ⁰
SC	13	9.69	5.00	13.00	.6064 x 10 ¹
ANSU	13	361.54	280.00	440.00	.2581 x 10 ⁴
ANT3	11	456.36	330.00	520.00	.3725 x 10 ⁴
ANTT	11	857.27	720.00	960.00	.5922 x 10 ⁴
BASI	13	294.61	250.00	350.00	.8936 x 10 ³
DISI	13	133.08	100.00	150.00	.2564 x 10 ³
FF	13	1001.92	825.00	1150.00	.8590 x 10 ⁴
FT	13	1203.85	1000.00	1425.00	.1363 x 10 ⁵
FTA1	13	809.61	650.00	975.00	.8702 x 10 ⁴
FTA2	13	519.23	425.00	625.00	.2724 x 10 ⁴
FTA3	13	375.00	300.00	425.00	.1354 x 10 ⁴
FTA4	13	232.69	200.00	275.00	.5609 x 10 ³
FTA5	12	143.75	100.00	175.00	.4687 x 10 ³
MF	13	1048.08	850.00	1225.00	.1109 x 10 ⁵
MT	13	1080.77	875.00	1275.00	.1054 x 10 ⁵
MTA1	13	536.54	425.00	625.00	.3189 x 10 ⁴
MTA2	13	309.61	250.00	375.00	.1098 x 10 ⁴
MTA3	13	251.92	200.00	300.00	.7772 x 10 ³
MTA4	13	155.77	125.00	175.00	.2244 x 10 ³
MTA5	13	134.61	100.00	150.00	.2644 x 10 ³
HF	13	1136.54	925.00	1325.00	.1298 x 10 ⁵
HT	13	1278.85	1025.00	1550.00	.1800 x 10 ⁵

VARIABLE	SAMPLE SIZE	MEAN	RANGE		VARIANCE
			MIN	MAX	
HTA1	13	732.69	600.00	850.00	.5144 x 10 ⁴
HTA2	13	411.54	325.00	475.00	.1522 x 10 ⁴
HTA3	13	326.92	275.00	375.00	.9856 x 10 ³
HTA4	12	191.67	150.00	225.00	.3788 x 10 ³
HTA5	12	147.92	125.00	175.00	.2794 x 10 ³
COMB	13	11.00	10.00	13.00	.8333 x 10 ⁰
TH	9	1380.56	1125.00	1800.00	.4653 x 10 ⁵
AB	13	3244.23	2725.00	3975.00	.1336 x 10 ⁶
WW	11	865.91	750.00	925.00	.3159 x 10 ⁴
WR	11	3.28	3.15	3.46	.7205 x 10 ⁻²
BL	9	4497.22	3850.00	5400.00	.2383 x 10 ⁶
AR	11	1.91	1.53	2.61	.1116 x 10 ⁰
VR	13	1.05	1.02	1.09	.3784 x 10 ⁻³
HR	13	2.23	1.93	2.60	.3541 x 10 ⁻¹
HV	9	3.50	3.17	4.05	.8504 x 10 ⁻¹
FLR	13	.67	.54	.72	.1927 x 10 ⁻²
FSV	13	2.74	2.53	3.46	.5412 x 10 ⁻¹
FBV	12	2.37	2.23	2.53	.7892 x 10 ⁻²
MLR	13	.50	.45	.52	.4726 x 10 ⁻³
MSV	13	3.98	3.74	4.39	.3482 x 10 ⁻¹
MBV	13	3.13	2.84	3.32	.1835 x 10 ⁻¹
HLR	13	.57	.54	.60	.3598 x 10 ⁻³
HSV	13	3.30	3.07	3.55	.1626 x 10 ⁻¹
HBV	12	2.92	2.80	3.06	.6271 x 10 ⁻²
BR	9	2.28	1.99	2.57	.5138 x 10 ⁻¹

Paratype Female

Color. Dark brown; halteres brown; scutal stripes distinct, not merging posteriorly.

Length (mm). Thorax 1325; abdomen damaged.

Head. Interocular distance 265 mm. Temporals 11, verticals 11, postorbitals 0. A.R. 0.56. Antennal flagellomere

lengths (mu, Fig. 78h): 95, 50, 55, 50, 140. Clypeus large and rectangular, with 14 setae. Palpal segment lengths (mu): 40, 70, 125, 120, 200.

Thorax. Antepronotal lobe jutting out medially, robust. Lateral antepronotals 6, acrostichals 10, prealars 5, dorsocentrals 9, uniserial; scutellars 10, uniserial. Anapleural suture length 300 mu. No mesonotal pit. Single seta on sternum II.

Wing (Fig. 13). Length 2925 mu, width 1000 mu. L/W.R. 2.92. Moderately punctate. Anal lobe straight proximally, slightly rounded distally, and not produced. Stem vein with 1 seta, R with 13, R1 with 11, R4+5 with 4, squama with 25. Costa not extended beyond R4+5, apex well distal to apex of Cul. R2+3 ending about 1/5 distance between R1 and R4+5.

Legs. Hind tibial comb composed of 10 setae. Spines absent on fore leg, 2 on each of first two tarsal segment of mid leg, 2 on first tarsal segment of hind leg.

Leg lengths (mu) and proportions:

	F	T	Ta1	Ta2	Ta3	Ta4	Ta5	L.R.	B.V.	S.V.
Fore	850	1050	700	425	300	175	125	0.66	2.53	2.71
Mid	900	975	475	250	175	100	125	0.48	3.61	3.94
Hind	1000	1175	675	350	250	150	125	0.57	3.25	3.22

Genitalia (Figs. 70, 71). Lateral sternite IX with posterior margin unevenly curved, produced posterolaterally; numerous long setae dorsally, numerous shorter setae ventrally. Tergite IX narrow. Spermathecal duct wrinkled for most of length.

Remarks. The female of Orthocladus (O.) nigratus closely resembles the female of O. obumbratus in genitalic features;

nigritus can be distinguished from obumbratus by the absence of postorbital setae and the larger size and shape of lateral sternite IX.

Male Pupal Exuvia

Color. Golden.

Length (mm). Abdomen 3650.

Cephalothorax. Setae: frontals 1, weak; postorbitals 1, humerals 3, lateral anteprenotals 1, median anteprenotals 2, prealars 1, dorsocentrals 4. Thoracic horn (Fig. 90o) slender with apex pointed, and sparsely covered with weak, pointed spines, length 260 mm. Frontal tubercles not prominent. Anterior part of notum wrinkled along eclosion line.

Abdomen. Anal lobe length 400 mm; narrowed, without spurs; longest anal seta length 220 mm. A.L.R. 0.55. Pedes spurii B robust, present on segment II.

Setae present on segments I-VIII:

dorsals	4	5	5	5	5	2
lat	3	3	3	3	4	3
ventrals	3	3	3	3	3	1

Tergal spine patterns. I: bare; Omm 1, Ann 0. II: elliptical patch posteromedial, with about 90 recurved spines in 4 rows; rectangular patch of coarse spines anterior to recurved spines; 2 well-spaced patches of fine spines along anterior margin; Omm 4, Ann 0. III-V: large patch of coarse spines separated by bare line from rectangular patch of anteriorly-directed spines along posterior margin; bare bands laterally; Omm 4, Ann 2. VI: as in III-V, but with central patch reduced in size and without

patch of anteriorly-directed spines; Omm 4, Amm 2. VII, VIII:

2 well-spaced patches of fine spines along anterior margin; Omm 2,

Amm 2 (VII), Omm 3, Amm 1 (VIII). IX: band of fine spines along

anterior margin.

Sternal spine patterns. I: bare. II-V: 2 well-spaced

patches of fine spines along anterior margin, continuous with

lateral bands reaching posterior margin. V-VIII: 2 well-spaced

patches of fine spines along anterior margin. IX: bare.

Variation. Frontals moderately to weakly developed.

Tergite II with patch of fine spines. Thoracic horn narrowed

(Otter Lake). Anterior area along eclosion line with few small

bumps (L.C.). Chitinous threads occasionally present on anal lobe.

Remarks. The pupa of Orthocladus (O.) nigrinus closely

resembles the pupa of O. oliveri; it can be distinguished from

oliveri by the absence of spurs on the anal lobe, and the fewer

spines on the thoracic horn.

Larva (n = 3)

Head. Labial plate (Fig. 137b) convex; broad median

tooth extended anteriorly, clearly beyond first laterals;

paralabials not prominent. Mandible (Fig. 137a) with outer margin

moderately crenulate; brush with 27 setae, apices serrate.

Epipharynx (Fig. 114d) with 10 chaetulae laterales, 2 chaetulae

basales, 3 spinules. Premandible simple. A.R. 1.37-1.79.

Antennal segment lengths ($m\mu$, Fig. 114e): 44-62, 14-17, 6-13,

4-6, 4-5; blade grooved, extended to tip of 4th segment; Lauterborn

organs well developed, robust.

Remarks. The larva of Orthocladus (O.) nigrinus

closely resembles the larva of O. dorenus; it can be distinguished from dorenus by the shape of the labial plate.

ECOLOGY

The pupal exuviae of O. nigritus were collected from March to May in Pennsylvania (Coffman 1973). These data, and the material examined here, suggest that the emergence of this species is univoltine.

Males were collected at Blanche River, Quebec, at dusk (30.IV.1970). Males with reduced antennae were collected in copula with normal males on the top of a car or below the swarm. Extensive swarms were found ten feet above the ground, using the edge of the road as a marker. It appeared that males of O. nigritus were swarming below those of O. oliveri.

MATERIAL EXAMINED (Fig. 154)

Holotype. Male, Cabin John Run, Md., Feb. 16, 1913, W.D. Appel, USNM No. 68170. Paratypes. Same data as holotype, 1 female USNM No. 68170; 1 male, slide 2994 (INHS), 1 male slide 2993 (INHS).

Manitoba. Lake Winnipeg, (L.T.) 27 W, 1 mi. off Horse Isl., 7.VI.1969, S.S. Chang, No. 27 W, (FRBW), 1 male. Maryland. Cor. Conduit and Potomac Rds., 5-IV-14, (INHS), S66-1672, 1 male; same data except 12-IV-14, S66-1673, 1 male. Minnesota. Cook Co., F.S. Hovland, N.J. Mosquito Trap, June 9, 1969, E.F. Cook, (MINN), 1 male; St. Cloud, = April 15, 1968, D. Hansen, (HANSEN), 1 male; Lake Co., Two Harbors, 4-VII-38, S64-3578, (MINN), 1 male; same data except S64-3576, 1 male; S64-3577, 1 male. New York. Onondaga Co., Skaneateles, 11.IV.1937, H.H. Ross, (INHS), 1 male. Ontario.

Ottawa, 30.IV.1956, J.R. Vockeroth, (CNC), 1 male; Ottawa,
 Britannia Filtration Plant, 5.V.1971, DRO 70-3, (CNC), 1 male;
 Ottawa, 14.IV.1966, Jon Martin, (CNC), 4 males; same data except
 14.V.1966, 1 male; Ottawa, Woodroffe Beach, 9.V.1971, A.R. Soponis,
 (CNC), 1 male; Ottawa, Rideau R. nr. Billings Bridge, May 8, 1972,
 A.R. Soponis, (CNC), 1 male; same data except 13.V.1972, A.R.
 Soponis and B.T. Kidd, 1 male; Lanark Co., Otter Lake, 6.V.1971,
 A.R. Soponis, (CNC), 3 males, 4 pupal ex.; Jock R. on Goulbourn
 Con. 6 nr. Munster Hamlet, 16.IV.1973, A.R. Soponis, (CNC), 3
 males; Erosoma Co., Speed R., 1.V.1972, A.R. Soponis, (CNC), 1
 male pupa; Bruce Co., Baie du Doré, floating on water, 30.IV.1971,
 A.R. Soponis, (CNC), 1 male pupa. Quebec. Old Chelsea, 28.IV.
 1956, J.R. Vockeroth, (CNC), 1 male; Meach Lake, Gatineau Pk., at
 stream, 20.IV.73, D.R.O., CH 198, 2 males; R. Blanche, N. of
 Perkins, 1.May.1971, D.R. Oliver, (CNC), 1 male pupa; same locality
 except 1.V.1971, D.R. Oliver 70-1, (CNC), 1 male pupa; same
 locality coll. 10.V.1971, em. 23.V.1971, A.R. Soponis, 1 reared
 female; em. 18.V.1971, A.R.S., 1 reared female; 10.V.1971, A.R.S.,
 1 reared male; swarm, 30.IV.1973, A.A. Soponis and B.T. Kidd; 1000
 males; same data except attempting to copulate, 1 male and 1 female;
 7 pairs in copula below swarm or resting on car; R. Petit Blanche,
 S. of Perkins, Brundin net, 9.V.1972, A.R. Soponis and J. Robillard,
 (CNC), 2 male pupae. Saskatchewan. Saskatoon, 27.IV.1949, J.R.
 Vockeroth, (CNC), 1 male; Saskatoon, 1.V.1923, N.J. Atkinson, (CNC),
 1 male. Utah. Wasatch Co., 20 Feb. 54, no collector, (ANSP), 1
 male. Virginia. Dead Run, Fairfax Co., 13.3.15, R.C. Shannon,
 (USNM), 1 male; Dead Run, Mar. 20, 1917, W.L. McAtee, (USNM), 1

male. Wisconsin. Dane Co., 13.IV.1955, Stelzer, (WISC.), 1 male.

Orthocladus (Orthocladus) oblidens (Walker)

Fig. 39

Chironomus oblidens Walker, 1856, p. 180.

Orthocladus oblidens Walker, Kertész, 1902, p. 221. Brundin, 1947, p. 21, fig. 40.

Spaniotoma (Orthocladus) oblidens Walker, Edwards, 1929, p. 345, fig. 6k. Edwards, 1933, p. 619.

Orthocladus (s. str.) oblidens Walker, Goethghebuer, 1932, p. 87, fig. 141. Andersen, 1937, p. 64.

Orthocladus (Orthocladus) oblidens Walker, Goethghebuer, 1942a, p. 52, fig. 84. Fittkau, Schlee and Reiss, 1967, p. 362.

Hydrobaenus (Spaniotoma) Bryophaenocladus oblidens (Walker), Kloet and Hincks, 1945, p. 337.

Hydrobaenus (Orthocladus) oblidens Walker, Coe, 1950, p. 157, fig. 188k.

Orthocladus (s. str.) oblidens (Walker) Edwards, Brundin, 1956, p. 103, fig. 66.

Orthocladus oblidens (Walker), Sublette and Sublette, 1965, p. 156.

Walker (1856) described this species based on a single male from England, and recorded it as rare. The original description is very general and refers mainly to color. It was not until the appearance of the work by Edwards (1929) that a more complete description and a figure of the male genitalia became available. I have examined the pinned holotype specimen of O. oblidens and the genitalia mounted in balsam by Edwards.

It is obvious that Edwards drew his figure from this genitalia which lay tilted in the balsam. We have remounted the genitalia and the rest of the body in balsam, and I have figured the male genitalia in a level position.

Edwards (1929) placed the male of O. oblakens in his Group C (= O. (Orthocladius)), prefacing his key with the remark that the males of the species of this group are difficult to identify, as many of them are intergrading forms. Goethghebuer (1932, 1942a) and Coe (1950) reproduced the figure given by Edwards (1929), and supplied a short diagnosis for this species. Andersen (1937) included O. oblakens in his key.

Brundin (1947) pointed out that Edwards' description of O. oblakens was incomplete, and he gave more characters for this species based on his material from Sweden. However, the A.R. of Brundin's specimens is lower than that in the holotype, and they do not agree with the holotype in that the palpal segments 2 and 3 (my 3 and 4) are hardly longer than the palpal segment 4 (my 5). Brundin provided a figure of the male genitalia of O. oblakens based on his Swedish material. Later, Brundin (1956) recognized O. oblakens as the type species of the genus Orthocladius. He gave a new figure of the male genitalia of O. oblakens, which more clearly shows the basal lobe of the gonocoxite than his earlier figure. However, the dorsal part of the basal lobe is not straight-edged like that in the holotype. Most probably, Brundin did not examine the holotype specimen.

The only record for O. oblakens in North America was for several males and females collected in northern Quebec and the

N.W.T. near Hudson's Straits (Edwards 1933). However, I have not found any North American material to be O. oblidens, and I have not examined any additional material of O. oblidens. I have identified a single male from the Hudson Straits area (Southampton Island) as O. mallochi, which is similar to the holotype male of O. oblidens in hypopygial features. The holotype males of these two species are not difficult to separate. Provisionally I treat O. oblidens and O. mallochi as distinct species. The female and immature stages of O. oblidens have not been described.

Holotype Male

Color. Dark brown; halteres golden; scutal stripes not distinct.

Length. Thorax damaged and part of abdomen missing.

Head. Interocular distance 295 μ . Temporals 17, verticals 15, postorbitals 2. A.R. 2.02. Antennae curled. Antennal flagellomere lengths (μ): 1st-12th 1075, 13th 2175. Clypeus rectangular, with 15 setae. Palpal segment lengths (μ): 45, 70, 145, 125, 190.

Thorax. Anteprenotal lobe wide medially, robust. Lateral anteprenotals 8; acrostichals 10, prealars 6, dorsocentrals 10, uniserial; scutellars 14, uniserial. Anapleural suture damaged. No mesonotal pit.

Wing. Length 3025 μ , width 875 μ . L/W.R. 3.45. Moderately punctate. Anal lobe folded under, appears rounded and produced. V.R. 1.00. Stem vein with 1 seta, R with 10, squama with 31. Costa not extended beyond R4+5, apex well distal to apex of Cul. R2+3 ending before midpoint of R1 and R4+5.

Legs. Hind tibial comb composed of 10 setae. Spines absent on fore leg, 2 on each of first two tarsal segments of mid leg, 2 on first tarsal segment of hind leg.

Leg lengths ($m\mu$) and proportions:

	F	T	Ta1	Ta2	Ta3	Ta4	Ta5	L.R.	B.V.	S.V.
Fore	1000	1200	900	525	350	225	125	0.75	2.53	2.44
Mid	1075	1100	525	325	250	125	125	0.47	3.27	4.14
Hind	1125	1300	750	425	300	150	150	0.57	3.09	3.23

Hypopygium (Fig. 39). Gonocoxite length 250 $m\mu$, gonostylus length 120 $m\mu$. H.R. 2.08. Lateral margin of tergite IX with group of 11 setae. Anal point short. Virga present. Basal median lobes of gonocoxite shortly triangular. Basal lobe with dorsal part short and square, posterior margins straight, and ventral part slightly extended below. Gonostylus robust and rounded, with blunt apex. The virga is out of position in the specimen, although I have figured it in the resting position.

Remarks: The male of Orthocladus (O.) oblidens closely resembles the male of O. mallochi in hypopygial features; oblidens can be distinguished from mallochi by the weaker development of the dorsal part of the basal lobe.

MATERIAL EXAMINED

Holotype. Male, pres. by F. Walker 56-50, (BMNH).

Orthocladus (Orthocladus) obumbratus Johannsen

Figs. 19, 46, 47, 64, 65, 78i, 79, 80a, 90m, 116, 133, 155

Orthocladus obumbratus Johannsen, 1905, p. 281, pl. 30, fig. 11.

Winn and Beaulieu, 1915, p. 116. Cole and Lovett, 1921, p.

212. Malloch, 1923, p. 524. Leonard, 1928, p. 710.

Sublette and Sublette, 1965, p. 156. Sublette, 1966, p. 594.

Sublette, 1970, p. 55. Hudson, 1971, p. 167.

Orthocladus (Orthocladus) obumbratus Johannsen, Malloch, 1915,
p. 524.

Orthocladus obumbratus Johannsen, Petch and Maltais, 1932, p.
24. (misspelling of obumbratus)

Spaniotoma (Orthocladus) obumbrata Johannsen, Johannsen, 1937,
p. 71, pl. 17, figs. 226, 227.

Hydrobaenus obumratus (Johannsen), Johannsen, 1947, p. 174.
(misspelling of obumbratus)

Hydrobaenus (Hydrobaenus) obumbratus (Johannsen), Johannsen, 1952,
p. 23.

Hydrobaenus paradoreus Roback, 1957a, p. 79, figs. 173-178.
(partim)

Hydrobaenus obumbratus (Johannsen), Cole, 1969, p. 101.

Orthocladus paradoreus (Roback), Sublette and Sublette, 1965,
p. 156. Sublette, 1966, p. 594. Sublette, 1967a, p. 316.
Sublette, 1967b, p. 501. Sublette, 1970, p. 55.

Orthocladus (s. s.) obumbratus Johannsen, Sublette, 1967b,
p. 501, figs. 12-14.

Orthocladus (s. str.) cf. obumbratus Johannsen, Saether, 1969,
p. 73.

Orthocladus (Orthocladus) cf. lignicola, Coffman, 1973, p. 311.
(partim)

(non) Hydrobaenus obumbratus (Johannsen), Roback, 1957a, p. 76.

In the literature, the name O. obumbratus has been cited
more than any other North American species of Orthocladus

(Orthocladus). Johannsen (1905) described this common species based on numerous specimens of adult males and females from Ithaca, New York, and Douglass, Alaska. He provided a figure of the male wing of O. obumbratus, and in a short key to the adults he included this species. According to the International Code of Zoological Nomenclature, (Articles 72, 73) the holotype of O. obumbratus was not properly designated by Johannsen (1905), although he did label a pinned male specimen from Ithaca, New York, as the holotype. Later, Sublette (1967b) incorrectly accepted the male labelled by Johannsen as the holotype, and described it. I am designating this specimen as the lectotype of O. obumbratus, and the male and female "paratypes" (syntypes) from Johannsen's (1905) original material as paralectotypes.

Malloch (1915) gave a short diagnosis for the adult of O. obumbratus, based on Johannsen's description. He noted that the hypopygia of species of Orthocladus are almost identical, and that there is little variation (i.e. difference) in the hypopygia between different species. Malloch separated the male of O. lacteipennis (= mallochi) from the male of O. obumbratus on the basis of color, size, and F.L.R.. Malloch (1923) identified males from the Pribiloff Islands as O. obumbratus; I have examined these specimens and find them to be O. obumbratus. Malloch provided a figure of the haired anal point, the only figure available for the male genitalia of O. obumbratus.

Johannsen (1937) collected and described the larvae and pupae of O. obumbratus. I assume that his specimens are reared, judging from his statement in the introduction. However, in his

description of the larva of O. obumbratus, he noted that the labral setae (SI) are digitate and similar to that in "Orthocladius" nivoriundus, a good Trissocladius. Johannsen's (1937) description of the labial plate, mandible, color and habitat of the larva of O. obumbratus would apply to either Orthocladius or Trissocladius. The A.R. is low for a fourth instar larva of O. obumbratus. Since the shape of the SI are diagnostic for these two genera, Johannsen (1937) probably had a Trissocladius larva before him. With the exception of recording spinules at the incisure (pedes spurii A) for sternites III to VI, the pupa of O. obumbratus is correctly described. Roback (1957a) followed Johannsen's (1937) incorrect description of the larva of O. obumbratus in his key to the larvae of Hydrobaenus.

Sublette (1967b) redescribed the pinned holotype (= lectotype) of O. obumbratus, and provided two figures of the distorted male genitalia which he slide-mounted. I interpret the denticles to be the spines of the virga (fig. 14). Sublette placed the male of O. obumbratus close to the male of O. nigrinus on the basis of the characters tabulated for the males of his "obumbratus group". It is interesting that, in his table, the male of O. paradoreus, (= obumbratus) is not as closely placed to the male of O. obumbratus, as is the male of O. nigrinus. However, I have examined the holotype specimen of O. paradoreus (Roback), and I am unable to distinguish this species, in any of its stages, from those in O. obumbratus. Accordingly, the name O. paradoreus (Roback) will become a synonym of O. obumbratus. The ratios and measurements I have recorded for the holotype of

O. paradoreus differ from those of Sublette (1967b), who followed Roback's original description. Based on the literature, the male of the European species O. excavatus Brundin closely resembles the male of O. obumbratus in hypopygial features. I have not examined the type material of O. excavatus. An intersex of O. obumbratus is figured here for the first time (Fig. 45).

Lectotype Male

Color. Brown; halteres golden; scutal stripes not distinct.

Length (m μ). Body 4750, thorax 1525, abdomen 3225.

Head. Interocular distance 320 m μ . Temporals 16, verticals 12, postorbitals 4. A.R. 1.78. Antennal flagellomere lengths (m μ): 1st-12th 1050, 13th 1875. Clypeus large and rectangular, with 21 setae. Palpal segment lengths (m μ): 40, 70, 145, 120, 155.

Thorax. Anteprenotal lobe jutting out medially, robust. Lateral anteprenotals 14, acrostichals 4, prealars 5, dorsocentrals 10, uniserial; scutellars 13, uniserial. Anapleural suture length 400 m μ . No mesonotal pit.

Wing. Length 2725 m μ , width 875 m μ . L/W.R. 3.11. Finely punctate. Anal lobe well rounded, and produced. V.R. 1.06. Stem vein with 1 seta, R with 7, squama with 20. Costa slightly extended beyond R4+5, apex well distal to apex of Cul. R2+3 ending about 1/3 distance between R1 and R4+5.

Legs. Hind tibial comb composed of 10 setae. Spines absent on fore leg, 2 on each of first two tarsal segments of mid leg, 2 on first tarsal segment of hind leg.

Leg lengths ($m\mu$) and proportions:

	F	T	Ta1	Ta2	Ta3	Ta4	Ta5	L.R.	B.V.	S.V.
Fore	875	1175	700	425	350	150	150	0.59	2.55	2.92
Mid	975	1075	525	325	250	125	125	0.48	3.12	3.90
Hind	1075	1275	750	425	325	125	150	0.58	3.02	3.13

Hypopygium (Figs. 19, 46, 47). Gonocoxite length 290 $m\mu$, gonostylus length 110 $m\mu$. H.R. 2.63. H.V. 4.31. Lateral margin of tergite IX with group of 7 setae. Anal point short. Virga present. Basal median lobes of gonocoxite triangular. Basal lobe distorted in holotype, in other specimens dorsal part long and narrow, with ventral part extended below. Gonostylus rounded, platelike.

Variation. Anal point short to medium in length. Basal median lobes of gonocoxite narrowly to broadly triangular.

Remarks. The male of Orthocladus (O.) obumbratus closely resembles the male of O. mallochi in hypopygial features; obumbratus can be distinguished from mallochi by the shape of the basal lobe of the gonocoxite.

O. obumbratus Johannsen

VARIABLE	SAMPLE SIZE	MEAN	RANGE		VARIANCE
			MIN	MAX	
WING	97	2666.75	1975.00	3300.00	.1016 x 10 ⁶
ARM	100	1071.00	775.00	1275.00	.1513 x 10 ⁵
AFCU	98	1127.30	850.00	1375.00	.1715 x 10 ⁵
R	100	6.05	3.00	12.00	.2412 x 10 ¹
SQUM	100	24.45	13.00	36.00	.2364 x 10 ²
P1	99	40.20	30.00	50.00	.2088 x 10 ²
P2	100	62.05	45.00	85.00	.5863 x 10 ²
P3	100	131.50	95.00	185.00	.1755 x 10 ³

VARIABLE	SAMPLE SIZE	MEAN	RANGE		VARIANCE
			MIN	MAX	
P4	94	115.53	85.00	165.00	.1841 x 10 ³
P5	95	169.00	130.00	240.00	.3615 x 10 ³
EYE	88	318.12	255.00	365.00	.5824 x 10 ³
VERT	100	11.37	6.00	17.00	.4074 x 10 ¹
ETM	99	1.83	1.00	5.00	.7355 x 10 ⁰
CLYP	98	14.38	9.00	20.00	.6629 x 10 ¹
PROL	100	5.76	2.00	13.00	.4225 x 10 ¹
AC	100	9.71	1.00	16.00	.1049 x 10 ²
DC	100	9.19	5.00	16.00	.4135 x 10 ¹
PA	100	4.93	4.00	8.00	.5304 x 10 ⁰
SC	98	13.90	8.00	21.00	.9474 x 10 ¹
ANSU	95	354.74	270.00	450.00	.1474 x 10 ⁴
ANT3	96	393.96	320.00	470.00	.6157 x 10 ³
ANTT	96	763.33	590.00	890.00	.5441 x 10 ⁴
BASI	100	279.80	230.00	350.00	.5757 x 10 ³
DISI	100	125.70	90.00	150.00	.1136 x 10 ³
FF	97	897.94	700.00	1125.00	.9227 x 10 ⁴
FT	97	1072.94	800.00	1325.00	.1242 x 10 ⁵
FTA1	99	776.77	550.00	975.00	.7312 x 10 ⁴
FTA2	99	467.42	350.00	575.00	.2582 x 10 ⁴
FTA3	99	336.36	250.00	425.00	.1190 x 10 ⁴
FTA4	99	207.83	150.00	250.00	.6588 x 10 ³
FTA5	96	138.80	100.00	175.00	.2351 x 10 ³
MF	99	942.93	725.00	1150.00	.1052 x 10 ⁵
MT	100	979.25	750.00	1225.00	.1173 x 10 ⁵
MTA1	100	499.00	350.00	600.00	.3471 x 10 ⁴
MTA2	100	299.75	200.00	375.00	.1446 x 10 ⁴
MTA3	100	225.50	150.00	300.00	.9088 x 10 ³
MTA4	100	141.75	100.00	175.00	.3669 x 10 ³
MTA5	98	132.91	100.00	150.00	.2268 x 10 ³
HF	100	1048.50	775.00	1300.00	.1342 x 10 ⁵
HT	100	1189.50	900.00	1450.00	.1753 x 10 ⁵
HTA1	100	689.25	500.00	1000.00	.6948 x 10 ⁴
HTA2	100	395.50	300.00	500.00	.2126 x 10 ⁴

VARIABLE	SAMPLE SIZE	MEAN	RANGE		VARIANCE
			MIN	MAX	
HTA3	100	294.50	200.00	375.00	.1068 x 10 ⁴
HTA4	100	159.25	100.00	200.00	.5133 x 10 ³
HTA5	99	140.91	100.00	175.00	.1844 x 10 ³
COMB	100	10.98	8.00	14.00	.1454 x 10 ¹
TH	31	1354.84	1050.00	1600.00	.2756 x 10 ⁵
AB	98	3085.46	2275.00	3850.00	.9794 x 10 ⁵
WW	95	801.84	600.00	975.00	.9485 x 10 ⁴
WR	93	3.31	3.00	4.12	.2926 x 10 ⁻¹
BL	31	4446.77	3325.00	5350.00	.2986 x 10 ⁶
AR	96	1.94	1.47	2.59	.4066 x 10 ⁻¹
YR	98	1.05	1.00	1.11	.6486 x 10 ⁻³
HR	100	2.23	1.92	2.67	.2643 x 10 ⁻¹
HV	31	3.51	2.90	4.11	.8520 x 10 ⁻¹
FLR	97	.72	.68	.81	.6601 x 10 ⁻³
FSV	96	2.54	2.28	2.77	.7667 x 10 ⁻²
FBV	93	2.39	2.20	2.67	.6815 x 10 ⁻²
MLR	100	.51	.47	.56	.4686 x 10 ⁻³
MSV	99	3.86	3.50	4.29	.2614 x 10 ⁻¹
MBV	97	3.03	2.70	3.36	.1809 x 10 ⁻¹
HLR	100	.58	.53	.83	.1132 x 10 ⁻²
HSV	100	3.25	2.27	3.40	.2220 x 10 ⁻¹
HBV	99	2.96	2.63	3.27	.1194 x 10 ⁻¹
BR	31	2.28	2.06	2.60	.1476 x 10 ⁻¹

Paralectotype Female

Color. Brown; halteres golden; scutal stripes not distinct.

Length. Thorax damaged; abdomen 2050 μ . Body 2.5-3.0 mm (Johannsen 1905).

Head. Interocular distance 300 μ . Temporals 8, verticals 7, postorbitals 1. A.R. 0.67. Antennal flagellomere lengths (μ , Fig. 78f): 80, 40, 50, 45, 145. Clypeus large and

rectangular, with 14 setae. Palpal segment lengths (m μ): 45, 65, 115, 105, 165.

Thorax. Anteprenotal lobe wide medially, robust.

Lateral anteprenotals 9, acrostichals 8, prealars 6, dorsocentrals 10, uniserial; scutellars 13, uniserial. Anapleural suture damaged. No mesonotal pit.

Wing. Length 2300 m μ , width 925 m μ . L/W.R. 2.48.

Moderately punctate. Anal lobe straight proximally, slightly rounded distally, and not produced. V.R. 1.08. Stem vein with 1 seta, R with 10, R2 with 8, R4+5 with 7, squama with 24. Costa slightly extended beyond R4+5, apex well distal to apex of Cul. R2+3 ending about 1/4 distance between R1 and R4+5.

Legs. Hind tibial comb composed of 10 setae. Spines absent on fore leg, 2 on each of first two tarsal segments of mid leg, 2 on first tarsal segment of hind leg.

Leg lengths (m μ) and proportions:

	F	T	Ta1	Ta2	Ta3	Ta4	Ta5	L.R.	B:V.	S.V.
Fore	725	900	625	300	---	125	100	0.69	---	2.60
Mid	750	850	400	---	---	---	---	0.47	---	---
Hind	825	975	575	325	225	100	125	0.58	3.06	3.13

Genitalia (Figs. 64, 65). Lateral sternite IX with posterior margin curved, produced posterolaterally; numerous long setae dorsally, shorter, more numerous setae ventrally. Tergite IX narrow. Spermathecal duct obscured.

Variation. Spermathecal duct wrinkled for most of length. Postorbitals present on other females of this species.

Remarks. The female of Orthocladus (O.) obumbratus.

closely resembles the female of O. mallochi in genitalic features; obumbratus can be distinguished from mallochi by the less rounded posterior margin of lateral sternite IX.

Male Pupal Exuvia

Color. Golden.

Length (m μ). Body 4525, cephalothorax 1425, abdomen 3100.

Cephalothorax. Setae: frontals 1, moderately robust; postorbitals 1, humerals 3, lateral anteprenotals 1, median anteprenotals 2, prealars 1, dorsocentrals 4. Thoracic horn (Figs. 80a, 90m) robust, wide throughout, and densely covered with robust, scalelike spines, length 310 m μ . Frontal tubercles not prominent. Anterior part of notum wrinkled along eclosion line (Fig. 79).

Abdomen. Anal lobe length 320 m μ ; heart-shaped, with 3 left and 3 right posteriorly-directed spurs; spurs robust, iciclelike, and innermost spur bifid; longest anal seta length 190 m μ . A.L.R. 0.59. Pedes spurii B robust, present on segment II.

Setae present on segments I-VIII:

dorsals	4	4	4	5	5	5	5	1
laterals	1	3	3	3	3	3	4	4
ventrals	0	3	3	3	3	3	3	1

Tergal spine patterns (composite). I: bare; Omm 3, Ann 1. II: elliptical patch posteromedial, with about 74 recurved spines in 3 rows; large patch of spines anterior to recurved spines; Omm 4, Ann 1. III-V: large patch of coarse spines

separated by bare line from rectangular patch of anteriorly-directed spines along posterior margin; bare bands laterally; Omm 3, Amm 1. VI: as in III-V, but with large patch reduced in size and without patch of anteriorly-directed spines; Omm 3, Amm 1. VII: 2 well-spaced patches of fine spines along anterior margin; large central patch of fine spines; bare bands laterally and posteriorly; Omm 2, Amm 1. VIII: band of fine spines along anterior margin; patch of fine spines along posterior margin medially; Omm 2, Amm 0. IX: band of fine spines along anterior margin.

Sternal spine patterns (composite). I: bare. II: wide band of fine spines along anterior margin, continuous with lateral bands reaching posterior margin. III: fine spines over entire sternite except for bare band posteriorly. IV: 2 well-spaced patches of fine spines along anterior margin continuous with lateral bands reaching posterior margin. V: 2 well-spaced patches of fine spines along anterior margin; small patch of fine spines along posterior margin medially. VI: as in V, but with medial patch smaller. VIII: 2 well-spaced patches of fine spines along anterior margin. IX: bare.

Variation. Exuvia golden to light brown. Frontals moderately robust to robust. Area along eclosion line with few bumps. Thoracic horn with reduced number of spines, and with apex more strongly tapered. Spurs on anal lobe simple, bifid, or trifid.

Remarks. The pupa of Orthocladus (O.) obumbratus closely resembles the pupae of O. doreus, knuthi, mallochi,

manitobensis, oliveri, and wiensi; obumbratus can be distinguished from these species by a combination of characters: frontals moderately robust, area along eclosion line wrinkled, exuvia golden, frontal tubercle not prominent, the robust, scalelike spines of the thoracic horn, and presence of pedes spurii B on segment II only.

Larva (n = 11)

Head. Labial plate (Fig. 133b) convex; broad median tooth extended anteriorly, beyond first laterals; paralabials not prominent. Mandible (Fig. 133a) with outer margin smooth or weakly crenulate; brush with 7 setae, apices serrate. Epipharynx (Fig. 116a) with 8 chaetulae laterales, 2 chaetulae basales, 3 spinules. Premandible simple, with preapical notch. A.R. 1.71-2.52. Antennal segment lengths (μ , Fig. 116b): 48-65, 12-15, 5-7, 3-5, 5; blade grooved, extended to 4th segment; Lauterborn organs weakly developed.

Remarks. The larva of Orthocladus (O.) obumbratus closely resembles the larva of O. doreus; it can be distinguished from doreus by the weak crenulations of the mandible.

ECOLOGY

The pupal exuviae of O. obumbratus, together with those of O. mallochi and O. oliveri, were collected from November to May in Pennsylvania (Coffman 1973). Although these data do not represent a pure sample of O. obumbratus, judging from the material I have examined, the emergence of this species is probably bivoltine or multivoltine.

Roback (1957a) provided specific information on the

habitats of the larvae of O. obumbratus under the name O. paradoreus.

MATERIAL EXAMINED (Fig. 155)

Lectotype. Male, Apr. '02, Ithaca, N.Y., Cornell U. No. 2355, Slide No. S66-592. Paralectotypes. Same data as lectotype: female, Cornell U. No. 2355; male, Cornell U. No. 2355.1, slide no. S666-594.

Alaska. Kenai Pen., Wildwood-Soldatna, jeep trap, 18 June 1965, K.M. Sommerman, (USNM), 4 males; Kenai Pen., Wildwood-Kasilof, jeep trap 65-8, 28 June 1965, K.M. Sommerman, (USNM), 4 males; Kenai Pen., Johnson L.-Soldatna, jeep trap, 19 June 1965, K.M. Sommerman, (USNM), 7 males; same data except 19 July 1965, 1 male; Kenai Pen., Johnson L.-Soldatna via Kalifonsky Bch., jeep trap 65-18, Aug. 11, 1965, (USNM), K.M. Sommerman, 1 male; Alaska Hwy., Anchorage to Girdwood, jeep trap 22 June 1964, K.M. Sommerman, (USNM), 1 male; Anchorage-Seward Hwy., jeep trap, 25 Aug. 1964. K. Sommerman, (USNM), 1 male; Chitina, 2-IX-53, W.C.F., (USNM), 1 male; St. George Id., Bering Sea, June 17, 1914, GDH Lot No. 37, G. Dallas Hanna, (USNM), 2 males. Alberta. Waterton Nat. Pk., Rowe creek above Hwy., 21.VII.1967, O.A. Saether and A.L. Hamilton, No. A-3-1, (FRBW), 1 reared female. Arizona. Tempe, from Baccharis sp., 1-5-1954, F.F. Bibby 54-2231 No. 308, (USNM), 1 male. Arkansas. Benton Co., Prairie Cr., NW 1/4, S as 2, T19N, R27W, O.A. Hite and L.R. Aggus, 5-11-63, on bridge, (SUBLETTE), 1 male. California. Siskiyou Co., Mt. Shasta City, 21-VI-58, S66-515A, (SUBLETTE), 1 male. Colorado. 1 mi. n. Hotchkiss, Delta Co., at light, 9-VIII-71, M. Beard, (SUBLETTE), 1 male. Idaho. Jerome Co., S64-3661, 22-V-38, no collector, (SUBLETTE),

1 male. Illinois. Oakwood, in shore wash of salt fork, 27.III. 1934, Frison and Ross, (INHS), 1 male, 5 pupal exuviae; Danville, Middle Fork, Vermilion River, N. of Ver. Lake, 26.IV.1967, D.W. Webb, Acc. No. 50404, (INHS), 1 reared male; Crawford Co., Palestine, at light, 7.IV.1969, D.W. Webb, (INHS), 1 male; Lawrence Co., Lawrenceville, at light, 7.IV.1969, D.W. Webb, (INHS), 1 male; Seymour, 13.IV.1932, Frison and Ross, (INHS), 1 male; Clark Co., Marshall, at light, 7.IV.1969, D.W. Webb, (INHS), 1 male; Cumberland Co., Neoga, 18.V.1970, D.W. Webb, (INHS), 1 male; Champaign Co., St. Joseph, 30.IV.1970, D.W. Webb, (INHS), 1 male; Champ. Co., Brownfield Woods, 16-24, XI.1966, R.T. Allen, (INHS), 1 male; Champ. Co., Urbana, South Farm, 15.IV.1970, J. Shaw and N.D. Perry, (INHS), 1 male; Bureau Co., Spring Valley, 11.V.1970, W.E. La Berge, (INHS), 1 male; Champaign Co., Ogden, 30.IV.1970, D.W. Webb, (INHS), 1 male; Oakwood, 24.II.1927, T.H.F., (INHS), 1 male; Crawford Co., West York, at light, 7.IV.1969, D.W. Webb, (INHS), 1 male; Urbana, 29-V-57, J. Kingslover, slide No. P-2940, (SUBLETTE), 1 male; Urbana, 28-V-57, J. Kingslover, Slide No. P-2899, (SUBLETTE), 1 male; Douglas Co., Arcola, 18.V.1970, D.W. Webb, (INHS), 1 male; Vermilion Co., Danville, 30.IV.1970, D.W. Webb, (INHS), 2 males; Kaskaskia R., 2 m. S.E. Sullivan, 9.XI.1967, T. Harris, (INHS), 1 male; Muncie, 24-V-14, S66-1727, no collector, (SUBLETTE), 1 male; Cole Co., Mattoon, 18.V.1970, D.W. Webb, (INHS), 1 male; Champaign Co., Mahomet, Hart Memorial Woods, (INHS): Hart Woods Creek, 26.IV.1967, D.W. Webb, Acc. No. 50441, (INHS), 1 reared female; Acc. No. 50374, 1 reared male; Acc. No. 50373, 1 reared male; Acc. No. 50382, 1 reared male;

Acc. No. 50365, 1 reared male; Champaign Co., 2 mi. NE Champaign, 26.V.1966, D. Graber, (INHS), 1 male; Champaign Co., 3.5 mi. N.E. Mahomet, Black light trap, V-9-11/64, M.W. Sanderson, (SUBLETTE), 1 male; Champaign Co., Nettie Hart Memorial Woods, Mahomet: 11-13-IV-64, (SUBLETTE), 1 male; 25-26.III.1967, M.W. Sanderson (INHS), 1 male; 26-28.III.1967, M.W. Sanderson, (INHS), 1 male; 8-9.XI.1966, M.W. Sanderson, (INHS), 1 male; 13-20.XI.1966, M.W. Sanderson, (INHS), 5 males; 24-30.XI.1966, M.W. Sanderson, (INHS), male and female in copula; 20-III-66, M.W. Sanderson (SUBLETTE), 37 males; III/20-25/66, M.W. Sanderson, (SUBLETTE) 103 males.

Indiana. Lafayette, Ap. 12, 1918, J.M. Aldrich, (USNM), 1 male; Indianapolis, 10-V-28, C.F. Adams S64-1781, (CU), 1 male; Indianapolis, 11-V-28, C.F. Adams S64-1782, (CU), 1 male; Lafayette, swept from wint. wheat, V-16, J.M. Aldrich, (USNM), 1 male; Fountain Co., Covington, 30.IV.1970, D.W. Webb, (INHS), 1 male. Iowa. Beyer, Armili Pnt., Apr. 21, 1941, 570o hypo., (SUBLETTE), 1 male; Davenport, Apr. 21, 1941, U.A. Hauber, No. 570q, (SUBLETTE), 1 male; Allamakee Co., Dorchester, Trout Stream, 20.III.1962, Ross and Stannard, (INHS), 1 male; Colfax, 30-V-63, Donald R. Riley, S66-761, (ISU), 1 male; Ames, 5-8-40, J.A. Rowe, (ISU), 4 males, S66-618, S66-617, S66-619, S66-615; Ames, 5-8-40, J.A. Rowe, S66-624, (ISU), 1 male; 13-V-40, 3 males, W.N. Rice, S66-635, S66-627, S66-629; Ames, 14-IV-40, D.R. Lindsay, S65-1339, (ISU), 1 male; D.T. Jones, 11-IV-41, S65-1308, (ISU), 1 male; 6-V-56, J.A. Carson, S66-622, 1 male; 22-V-40, S66-716, no collector, 1 male; 22-V-40, S66-718, no collector (ISU), 1 male. Kansas. Riley Co., Mar. 27, 1958, E. Quiasit, (KSU), 1 male; Manhattan,

26-II-32, H.M. Smith, (KSU), S66-2594, 1 male; 24-II-59, N. Marston, S66-2650, 1 male; 24-II-59, S66-2651, N. Marston, 1 male; 26-II-32, H.M. Smith, S66-2592, 1 male; 23 Aug., no collector, S66-2591, (KSU), 1 male. Manitoba. Churchill, 7.IX.1949, R. Gwatkin, (CNC), 1 male; L. WPG. (L.T.), coll. S.S. Chang, (FRBW): Matheson Island, 5.VI.1969, No. 21B, 1 male; George Island, 12.VII.1969, No. 40c, 1 male; Grand Rapids, Gov't Dock, 8.VI.1969, No. 51NN, 1 male; 9.VI.1969, No. 51JJ, 1 male; 6½ mi. off Sturgeonskin Pt., 14.VII.1969, No. 46K, 1 male; same locality except Long Point, 4.VII.1969, No. 52B, 1 male; 1 mi. off Horse Island, 7.VI.1969, No. 27W, 3 males; No. 27u, 2 males; No. 27A, 1 male; No. 27, 1 male; No. 20E, 1 male; 9.VI.1969, No. 27JJ, 1 male. Maryland. Montgomery Co., Forest Glen, light trap, 15-IV-1967, W.W. Wirth, (USNM), 4 males; same data except VI.1967, 1 male; V-1968, 1 male; 4 May 1968, 3 males. Massachusetts. Amherst, light trap, 25-V-1939, M.E. Smith, (SUBLETTE), 1 male. Michigan. Crawford Co., Au Sable R., 15-IV-50, S64-2198, (UKAN), 1 male; Epoufette, 15.V.1955, J.R. Vockeroth, (CNC), 1 male. Minnesota. 4 mi. south Afton, S64-3819, May 10, 1941, M.W. Wing, (MINN), 1 male; St. Paul, U. Farm, 30-IV-35, D. Platsch, S64-1584, (MINN), 1 male; Plummer, 19-XI-333, D. Denning, alive off snow, S64-3077, (MINN), 1 male; Plummer, 30-X-33, D. Denning, alive off snow, S64-3078, (MINN), 1 male; Minneapolis, at light, June 4, 1969, D.E. Maschwitz, (MINN), 1 male; Washington Co., May 9, 1936, no collector, S64-1614, (MINN), 1 male; Lakeland Jet, 17-V-33, Donald Pletch, S64-3096, (MINN), 1 male; Ft. Snelling, 27-IV-22, A.A. Nichol, high prairie grass, (MINN), 2 males, S64-3844, S64-3843; St. Anthony Pk., no collector: (MINN), 1 male each:

27-IV-09, S64-2078, 3009, 3011, 3015, 3834; 17-IV-09: S64-2071,
 1076, 2081, 3018; 19-IV-09: S64-2083, 2088, 2091, 3017, S661-3016;
 20-IV-09: S64-2075, 2079, 2093, 3008, 3014; 26-IV-09: S64-3006;
 5-V-09: S64-2089. Polk Co., Red Lake River nr. Crookston, N.J.
 Mosquito Trap, May 6, 1970, E.F. Cook, (MINN), 3 males; same data
 except June 2, 1970, 2 males; Polk Co., Crookston Ex. Sta., N.J.
 Mosquito Trap, Sept. 30, 1968, E.F. Cook, (MINN), 1 male; same
 data except Low 39° F, May 12, 1969, 1 male; May 6, 1969, low
 46° F, 1 male; May 6, 1969, low 46° F, 9 males; lt. trap, April
 29, 1968, 3 males; June 3, 1968, 1 male; Sept. 30, 1968, 1 male;
 Rock Co., Steen, N.J. Mosquito Trap, May 14, 1968, E.F. Cook,
 (MINN), 2 males; same data except May 1, 1968, 2 males; Houston
 Co., Beaver Crk., Valley St. Park, N.J. Mosquito Trap, Oct. 13,
 1970, E.F. Cook, (MINN), 1 male; Wasecoa Co., Waseca Expt. Sta.,
 N.J. Mosquito Trap, May 14, 1968, E.F. Cook, (MINN), 25 males;
 Kandiyohi Co., New London Fish Hat., N.J. Mosquito Trap, Low 41°,
 May 22, 1969, E.F. Cook, (MINN), 1 male; Stevens Co., Morris Expt.
 Sta., N.J. Mosquito Trap, May 29, 1968, E.F. Cook, (MINN), 6 males;
 same data except May 21, 1968, 2 males; Ramsey Co., St. Paul, U
 of M Vacuum Trap, May 28, 1967, Ronald A. Hellenthal, (MINN), 2
 males; same data except May 10, 1968, 2 males; May 18, 1968, 3
 males; May 20, 1968, 2 males; May 21, 1968, 1 male; May 26, 1968,
 1 male; Hubbard Co., Lower LaSalle Lake, N.J. Mosquito Trap, May
 7, 1970, E.F. Cook, (MINN), 7 males; same data except April 27,
 1970, 12 males; Pipestone Co., Pipestone Nat. Mon., N.J. Mosquito
 Trap, May 2, 1969, E.F. Cook, (MINN), 3 males; same data except
 May 23, 1969, 3 males; June 3, 1969, 5 males; June 12, 1969, 1

male; St. Louis Co., U of M Duluth, N.J. Mosquito Trap, Aug. 27, 1969, E.F. Cook, (MINN), 1 male; same data except May 18, 1969, 1 male; June 5, 1968, 1 male; July 10, 1969, 1 male; same data except FWCPA Lab., June 4, 1970, 2 males; July 23, 1970, 1 male; Cook Co., Min. F.S., Hovland, N.J. Mosquito Trap, July 6, 1969, E.F. Cook, (MINN), 1 male; same data except May 18, 1969, 1 male; May 6, 1969, 9 males; June 9, 1969, 6 males; May 13, 1968, 3 males; May 9, 1968, 1 male; April 28, 1968, 1 male; Cook Co., 2 mi. N. Hovland on U.S. 61, N.J. Mosquito Trap, April 30, 1970, E.F. Cook, (MINN), 86 males; same data except May 16, 1970, 10 males; May 10, 1970, 2 males; Sept. 21, 1970, 2 males; July 27, 1970, 1 male; Sept. 9, 1970, 7 males; June 2, 1970, 2 males; April 24, 1970, 1 male. Missouri. Jefferson City, 4-10-35, C.F. Adams, S65-4875, (KSU), 1 male; 4-20-35, C.F. Adams, S65-5019, (KSU), 1 male; Current River, Round Spring, 17.II.1962, 'Ross and Stannard, (INHS), 1 male. Montana. Ft. Peck reservoir, downstream camp over stream, July 25, 1968, Ronald A. Hellenthal, (MINN), 8 males. Nebraska. Choteau Creek, 10 mi. west of Niobrara, June 28, 72, P. Hudson, (HUDSON), 1 reared male, S.D. side of Missouri River. Nevada. Pyramid Lake, 8-IV-1956, I. La Rivera, (A), (USNM), 1 male; 8.III.1956, (USNM), 1 male; Reno, Nov. 4, 1915, H.G. Dyar, (USNM), 1 male. New Brunswick. Northumberland Co., Camy Adams, 8.VI.1962, J. Marshall (CNC), 10 males. New York. Tompkins Co., Ellis Hollow, light trap, 15 June 1963, C.O. Berg, (USNM), 11 males; Ithaca, 12-V-14, S64-1655, (CORN), 1 male. Oklahoma. Cleveland Co., 2.II.1931, R.D. Bird, (AMNH), 2 males. Ontario. Bruce Co., Baie du Doré, 22.IV.1971, B. McKillop, (CNC), 1 reared

reared male; Bruce Co., Baie du Doré, coll. 1.V.1971, em. 10.V. 1971, A.R. Soponis, (CNC), 1 reared male; em. 8.V.1971, 1 reared female; 1.V.1971, 1 intersex; 1 reared male; Bruce Co., Stream #1 nr. Baie du Doré, Brundin net, 30.IV.1971, A.R. Soponis, (CNC), 1 reared male; Jock R. on Goulbourne Con. 6 nr. Munster Hamlet, coll. 23.V.1972, pres. 25.V.1972, A.R. Soponis, (CNC), 2 reared males; coll. 16.IV.1973, pres. 26.IV.1973, A.R.S., 2 reared males; coll. 16.IV.1973, pres. 30.IV.1973, 1 reared male; coll. 14.V.1973, pres. 31.V.1973, 1 reared male; coll. 14.V.1973, pres. 20.V.1973, 1 reared male; coll. 23.V.1972, em. 25.V.1972, 1 reared male; coll. 23.V.1972, pres. 25.V.1972, 2 reared males; coll. 23.V.1972, em. 25.V.1972, 1 reared female; same locality except Brundin net 16.IV.1973, 6 pupal exuviae; Erosoma Co., Speed River, 2.V.1971, em. 9.V.1971, A.R. Soponis, (CNC), 1 reared female; Niagara Glen, 15-VI-1926, G.S. Walley, (CNC), 1 male; Green Cr., coll. 31.V.1967, em. 2.VI.1967, D.R. Oliver, LHS, RDM, (CNC), No. DRO 32-1-3, 1 reared male; same data except No. DRO 32-1-23, 1 reared female; No. DRO 32-1-17, 1 reared female; Dam nr. Waterloo, 2.V.1971, J. Spence, A. Soponis, (CNC), 1 male; Guelph, 1-XI-1955, J.R. Vockeroth, (CNC), 1 male; Ottawa, Brewers Park, 10.Nov.1972, A. Soponis, B. Kidd, (CNC), 1 male; Ottawa, Rideau R. near Brewer's Pk., 31.V.1971, em. 2.VI.71, A.R. Soponis, (CNC), 1 reared male; same data except 31.V.1971, 1 male; Ottawa, 1.VI.1970, A.R. Soponis, (CNC), 1 male; Ottawa, Rideau R., 30.V.1971, A.R. Soponis, (CNC), 1 male; Ottawa, at light, 7.VI.1970, A. Soponis, (CNC), 1 male; Ottawa, Rideau R. banks, 30.V.1971, A.R. Soponis, (CNC), 1 male; Ottawa, Rideau R. banks nr. Carleton U., 3.VI.1971, A.R. Soponis,

(CNC), 1 male; Ottawa, at light, 19-21.IV.1957, J.R. Vockeroth, (CNC), 1 male; Ottawa, Glasshouses of Central Experimental Farm, 28-X-1966, 6-56-5, Jon Martin, (CNC), 1 male; Ottawa, 0.2 Experimental Farm, 20.IV.1960, D.R. Oliver, (CNC), 1 male; Ottawa, mouth of Jock R. 16 S nr. Carleton Lodge, coll. 10.V.1972, em. 14.V.1972, A.R. Soponis, (CNC), 2 reared females; same data except May 8, 1972, A.R. Soponis, 2 pupal exuviae. Oregon. Salem, Willamette R., 22 May 1963, K. Goeden-light, (USNM), 1 male; Wallowa, 20 Sept. 1962, K. Goeden-light, (USNM), 1 male.

Pennsylvania. Crawford Co., Linesville Creek, foam, 30.III.1971, Wm. P. Coffman, (PITT), 1 male; same data except 7.XII.1970, 1 reared male, 2 males; 6.III.1971, 1 male; 30.XI.1970, 1 male; 3.I.1971, 1 male; 30.III.1971, 1 reared male; 30.XI.1970, 1 male; Fairmount Park, Philadelphia, (3A), em. May 11, 1953, S.S. Roback, (ANSP), 1 reared male; grounds of Plymouth Valley Baptist Church, Plymouth Valley, (6A), em. May 13, 1953, S.S. Roback, (ANSP), 1 reared male; Gulph Creek nr. Gulph Mills, (1A), em. April 29, 1953, S.S. Roback, (ANSP), 1 reared male; Tributary of Upper Wissahickon near Spring House, coll. May 19, 1953, em. May 22, 1953, (9), S.S. Roback, (ANSP), 1 reared female. Quebec. Gatineau Pk., Leamy Creek on Mine Rd., Brundin net, 8.V.1972, A.R. Soponis, (CNC), 1 male; Montreal, Ile Ste. HéTene, C-3, 4.6.1965, P.S. Corbet, 2034 to 2039, (CNC), 2 males; Aylmer, light trap, 3 June 1960, C.W. Twinn, (UNSM), 1 male; R. Blanche, 1 mile n. of Perkins, 1.V.1971, D.R. Oliver, 70-1, (CNC), 7 pupal exuviae; 1 reared male; coll. 30.IV.1973, pres. 4.V.1973, A.R. Soponis, (CNC), 1 reared male, 10.V.1971, 1 reared female; coll. 30.IV.1973, pres. 7.V.1973,

1 female pupa, 1 reared female; coll. 9.V.1972, em. 22.V.1972, 1 reared female. Saskatchewan. Carnduff, 27-V-07, Fred Knab, (USNM), 1 male. South Dakota. Yankton, Relief well stream below Gavins Point Dam, April 28, 71, P. Hudson, (FRBW), Nos. 29-32, 40-43, 53, 54, 1 male each; Nos. 24, 39, 42, 44, 1 reared female each; same locality except April 13, 71, No. 13, 1 reared female; Black Hills, Spring creek near Hill City, mountainous stream, April 24, 71, P. Hudson, No. 18, (FRBW), 1 reared male; Lewis and Clark Lake, Tailwaters, algae covered rocks, wings gone, April 20, 71, P. Hudson, No. 14, (FRBW), 1 reared male; Lewis and Clark Lake, Periphyton, June 10/71, P. Hudson, No. 63, (FRBW), 1 reared female; same data except May 10/71, No. 51, 56, 58, 1 reared female each; Lewis and Clark Lake, in plankton net, April 8, 71, P. Hudson, No. 6, (FRBW), 1 reared male; same data except No. 8, 1 reared male; Lewis and Clark Lake, Smartweeds, 4 mi. East of Springfield, June 30, 65, P. Hudson, (HUDSON), 1 male pupa; same data except Ap. 25, 65, 1 reared male, 1 male pupa; Yankton, Lewis and Clark Lake, Smartweed stem covered w/periphyton, 25.IV.1965, Pat Hudson, (HUDSON), 1 reared male; Vermilion, Missouri River Clay County Park, May 22, 72, P. Hudson, (HUDSON), 4 males; Running Water, Missouri River, June 8, 72, P. Hudson, (HUDSON), 4 males; Emanuel Creek, 2 mi. w. Springfield, sweeping near creek and springs, Ap. 21, 1973, P. Hudson, (HUDSON), 1 male; Pickston, Ft. Randall Dam, Tailwater, Nov. 10, 71, P. Hudson, (HUDSON), 5 males; Pickston, Lake Francis Case, St. Francis Bay, light trap, 2-9.VI.1971, P. Hudson, (HUDSON), 2 males; same data except 21-26.V.1971, 1 male; 26/V-2, VI.1971, 2 males; 2-9.VI.1971, 1 male;

5-14.V.1971, 1 male; Yankton, Lake Yankton, Gavins Pt. Nat. Fish Hatchery, 17.III.1971, P. Hudson, No. 17, (FRBW), 1 reared male; Platte, Lake Francis Case, Platte Bay, May 25-June 1, 67, Pat Hudson, (MINN), 7 males; same data except (1-8)-IV-67, 1 male; (11-18)-V-67, Pat Hudson, S69-1293, (FRBW), 1 male; (4-11)-V-67, (FRBW), 1 male; Yankton, Marne Creek, 12.III.1972, Pat Hudson, (HUDSON), 3 reared males; Yankton, NCRI Lab window, April 3-6, 71, P. Hudson, No. 33, (FRBW), 1 male; same data except No. 35, 1 male; Yankton, Gavins Pt. Fish Hatchery, March 21, 72, P. Hudson, (HUDSON), 2 males; Yankton Co., Yankton, Gavins Pt. Fish Hatchery, Ed's Creek, April 5, 1969, Patrick Hudson, (HUDSON), 1 male; Yankton, Marne Creek, 12.III.1972, Pat Hudson, (HUDSON), 3 reared females; Yankton Co., Yankton, Gavins Point Dam, light trap, Apr. 30-May 6, 1969, (MINN), 15 males; same data except May 13-20, 1969, 14 males; May 6-13, 1969, 8 males; April 23-30, 1969, 4 males; Oct. 21-Nov. 14, 1969, 2 males; June 10-17, 1969, 9 males; May 27-June 4, 1969, 16 males; May 20-27, 1969, 4 males; Yankton, Lewis and Clark Lake, Gavins Pt. Dam, May 27-June 4, 69, P. Hudson, (HUDSON), 1 male; same data except May 20-27, 69, 1 male; June 4-10, 69, 1 male; Ap. 30-May 6, 69, 1 male; June 10-12, 69, 1 male; Yankton Co., Yankton, Gavins Pt. Fish Hatchery, April 9, 1968, Patrick Hudson, (MINN), 4 males; same data except March 23-April 19, 1969, 2 males; March 23, 1968, 5 males; April 15-25, 1969, 12 males.

Texas. Red River, N. of Denison, 12-IV-1960, J.E. Sublette, (SUBLETTE), 2 reared females; same data except just below Texona Dam, 10-IV-60, 2 males; 4.5 mi. SE Denison, 10-IV-60, JES, (SUBLETTE), 2 males; Denison, Roadside Prk., North; small stream, 10-IV-60,

JES, (SUBLETTE), 1 male pupa. Utah. Salt Lake Co., Murray, light, 13.VI.52, no collector, S65-309, (SUBLETTE), 1 male. Vermont. Arlington, Route 313, 4.IV.1965, J.G. and R.A. Morse, (CORN), 2 males. Virginia. Blacksburg, light trap, April 1960, D.H. Messersmith, (USNM), 4 males; Falls Church, Holmes Run, light trap, 25.IV.1961, W.W. Wirth, (USNM), 1 male; Giles Co., Sinking Creek, Rt. 460, on bridge, 8.I.1966, S.E. Neft (INHS), 1 male.

Orthocladus (Orthocladus) oliveri n. sp.

Figs. 5, 42, 76, 78j, 90n, 91c, d; 92, 117, 131, 156

Adult males of this species were confused as O. wiensi by Hudson (1971, p. 167). The pupal exuviae of O. oliveri, referred to as O. (O.) cf. lignicola, were collected in Pennsylvania by Coffman (1973, p. 167).

Holotype Male

Color. Dark brown; halteres golden; scutal stripes not distinct.

Length (mu). Body 4975, thorax 1575, abdomen 3400.

Head. Interocular distance 340 mu. Temporals 17, verticals 13, postorbitals 4. A.R. 2.46. Clypeus rectangular, with 13 setae. Antennal flagellomere lengths (mu): 1st-12th 975, 13th 2400. Palpal segment lengths (mu): 40, 55, 95, 90, 145.

Thorax. Anteprenotal lobe jutting out medially, robust. Lateral anteprenotals 6, acrostichals 9, prealars 6, dorsocentrals 13, uniserial; scutellars 12, uniserial. Anapleural suture length 410 mu. Mesonotal oval pit anterior to scutellum in mesonotal groove (see Remarks).

Wing. Length 3150 mu, width 850 mu, L/W.R. 3.70.

Finely punctate. Anal lobe well rounded, and produced. V.R. 1.12. Stem vein with 1 seta, R with 7, squama with 25. Costa not extended beyond R4+5, apex well distal to apex of Cul. R2+3 ending before midpoint of R1 and R4+5.

Legs. Hind tibial comb composed of 12 setae. Spines absent on fore leg, 2 on first tarsal segment and 1 on second tarsal segment of mid leg, 2 on first tarsal segment of hind leg. Leg lengths ($m\mu$) and proportions:

	F	T	Ta1	Ta2	Ta3	Ta4	Ta5	L.R.	B.V.	S.V.
Fore	1025	1275	850	525	375	250	150	0.66	2.42	2.70
Mid	1125	1225	550	325	250	175	150	0.44	3.22	4.27
Hind	1250	1450	750	425	350	200	150	0.51	3.06	3.60

Hypopygium (Fig. 42). Gonocoxite length 300 $m\mu$, gonostylus length 150 $m\mu$. H.R. 2.00. H.V. 3.60. Lateral margin of tergite IX with group of 9 setae. Anal point short. Virga absent. Basal median lobes of gonocoxite collarlike. Basal lobe with dorsal part short and square, with ventral part extended prominently below. Gonostylus rounded, cuplike and robust.

Variation. Anal point short to medium in length. I have seen one specimen with an indication of a virga.

Remarks. The male of Orthocladius (O.) oliveri closely resembles the male of O. trigonalabis in hypopygial features; oliveri can be distinguished from trigonalabis by the smooth gonostylus and the lack of a virga.

In Orthocladius (O.) oliveri an oval pit measures about 100 $m\mu$ long, 20 $m\mu$ wide, and 8 $m\mu$ deep, and occurs on the median line of the scutum, slightly anterior to the scutellum (Fig. 5a).

A magnified view of this area shows the oval pit to be free of microtrichia (Fig. 5b).

Fig. 5c (preserved material) and Fig. 5d (freshly killed material) show cross sections* through the notum in the region of the supraalar callus, at the anterior end of the oval pit. Fig. 5e (preserved material) shows a magnified view of the median line of the scutum, in the area posterior to the oval pit and anterior to the scutellum. The median line is raised in a hump, and is covered with microtrichia. This differs from Fig. 5f, which shows a similar section taken through the oval pit. No microtrichia are present in the pit, and a few cells (? epidermal) can be seen to lie immediately ventral to the pit. There is no indication of the presence of a glandular or sensory organ associated with the pit.

Fig. 5g (freshly killed material) shows a similar section in which the oval pit was dissected at a greater depth than that of the corresponding section of Fig. 5g. Again there is no evidence of a glandular or sensory organ, and the pit is free from microtrichia.

These observations suggest no apparent function of the oval pit. That this structure is a scar, or sculpturing of the cuticle, seems more propable. Whether or not the oval pit was produced upon eclosion of the adult from the pupa has not been determined.

*Stained, semi-thin sections were prepared for histological examination of both live and preserved specimens, for which I would like to thank Dr. J.R. Byers of the BRI. I thank T. Stovell of the Biographics Section for preparing photographs of these sections.

A similar structure called the oval depression is known to occur in the Tanypodinae, as reported by Fittkau (1962). This structure in the Tanypodinae occurs more anteriorly on the median line of the scutum than the corresponding pit in Orthocladus (Orthocladus). Fittkau did not identify the function of the oval depression.

O. oliveri n. sp.

VARIABLE	SAMPLE SIZE	MEAN	RANGE		VARIANCE
			MIN	MAX	
WING	150	2830.50	2075.00	3400.00	.7706 x 10 ⁵
ARM	151	1130.13	800.00	1400.00	.1416 x 10 ⁵
AFCU	151	1203.48	875.00	1475.00	.1416 x 10 ⁵
R	153	7.24	0.00	12.00	.3102 x 10 ¹
SQUM	153	30.82	20.00	50.00	.2632 x 10 ²
P1	153	35.46	25.00	50.00	.2643 x 10 ²
P2	153	54.41	35.00	70.00	.3715 x 10 ²
P3	152	101.45	60.00	130.00	.1260 x 10 ³
P4	151	98.21	75.00	130.00	.1161 x 10 ³
P5	146	131.64	100.00	175.00	.2335 x 10 ³
EYE	145	321.41	255.00	385.00	.5114 x 10 ³
VERT	151	11.92	7.00	19.00	.3914 x 10 ¹
ETM	152	3.35	1.00	9.00	.1712 x 10 ¹
CLYP	152	14.41	8.00	22.00	.7157 x 10 ¹
PROL	153	7.01	2.00	16.00	.7684 x 10 ¹
AC	152	9.37	3.00	17.00	.9004 x 10 ¹
DC	153	12.76	7.00	20.00	.6171 x 10 ¹
PA	153	5.22	3.00	9.00	.1039 x 10 ¹
SC	153	13.80	8.00	24.00	.9084 x 10 ¹
ANSU	153	369.15	290.00	440.00	.1120 x 10 ⁴
ANT3	148	387.85	290.00	440.00	.7436 x 10 ³
ANTT	148	873.72	670.00	1010.00	.5356 x 10 ⁴
BASI	152	287.43	230.00	360.00	.5649 x 10 ³
DISI	153	131.11	100.00	160.00	.2073 x 10 ³

VARIABLE	SAMPLE SIZE	MEAN	RANGE		VARIANCE
			MIN	MAX	
FF	152	959.70	775.00	1225.00	.8163 x 10 ⁴
FT	152	1166.94	850.00	1400.00	.1194 x 10 ⁵
FTA1	148	820.27	600.00	975.00	.6329 x 10 ⁴
FTA2	147	510.03	400.00	625.00	.2240 x 10 ⁴
FTA3	146	351.20	225.00	425.00	.1141 x 10 ⁴
FTA4	146	227.05	175.00	350.00	.5561 x 10 ³
FTA5	145	144.14	100.00	175.00	.2171 x 10 ³
ME	151	1029.47	750.00	1300.00	.1037 x 10 ⁵
MT	153	1104.90	800.00	1400.00	.1197 x 10 ⁵
MTA1	152	559.37	400.00	650.00	.3053 x 10 ⁴
MTA2	151	317.71	225.00	400.00	.9632 x 10 ³
MTA3	148	235.30	175.00	300.00	.5691 x 10 ³
MTA4	148	161.99	125.00	200.00	.2591 x 10 ³
MTA5	146	139.59	100.00	175.00	.2046 x 10 ³
HF	151	1144.87	850.00	1425.00	.1357 x 10 ⁵
HT	150	1334.17	975.00	1625.00	.1839 x 10 ⁵
HTA1	151	750.99	525.00	900.00	.5032 x 10 ⁴
HTA2	149	418.96	275.00	500.00	.1762 x 10 ⁴
HTA3	147	325.17	225.00	475.00	.1100 x 10 ⁴
HTA4	146	190.24	125.00	250.00	.4601 x 10 ³
HTA5	144	152.26	100.00	200.00	.2877 x 10 ³
COMB	148	10.72	8.00	13.00	.1249 x 10 ¹
TH	136	1410.66	1125.00	1675.00	.1526 x 10 ⁵
AB	147	3140.99	2375.00	3725.00	.7962 x 10 ⁵
WW	144	810.07	575.00	1000.00	.6060 x 10 ⁴
WR	143	3.50	2.80	3.81	.2378 x 10 ⁻¹
BL	132	4535.42	3525.00	5350.00	.1442 x 10 ⁶
AR	148	2.31	1.86	2.93	.3164 x 10 ⁻¹
VR	151	1.07	1.00	1.15	.8586 x 10 ⁻³
HR	152	2.21	1.69	2.90	.4090 x 10 ⁻¹
HV	132	3.47	2.72	4.50	.9056 x 10 ⁻¹
FLR	148	.70	.57	.89	.1080 x 10 ⁻²
FSV	148	2.59	2.34	3.17	.1377 x 10 ⁻¹
FBV	145	2.39	2.07	2.61	.9256 x 10 ⁻²

VARIABLE	SAMPLE SIZE	MEAN	RANGE		VARIANCE
			MIN	MAX	
FBV	145	2.39	2.07	2.61	.9256 x 10 ⁻²
MLR	152	.51	.50	.57	.3829 x 10 ⁻³
MSV	150	3.82	3.38	4.30	.2337 x 10 ⁻¹
MBV	146	3.15	2.74	3.59	.1599 x 10 ⁻¹
HLR	149	.56	.49	.64	.5708 x 10 ⁻³
HSV	149	3.30	3.00	3.79	.1825 x 10 ⁻¹
HBV	144	2.96	2.64	3.44	.1334 x 10 ⁻¹
BR	132	2.22	1.95	2.65	.1279 x 10 ⁻¹

Allotype Female

Color. Brown; halteres golden; scutal stripes distinct, not merging posteriorly.

Length (mμ). Body 3575, thorax 1175, abdomen 2400.

Head. Interocular distance 260 mμ. Temporals 4, venticals 3, postorbitals 1. A.R. 0.52. Antennal flagellomere lengths (mμ, Fig. 78j): 80, 45, 50, 45, 115. Clypeus large and rectangular, with 15 setae. Palpal segment lengths (mμ): 35, 40, 75, 60, 115.

Thorax. Anteprenotal lobe jutting out medially, robust as in male. Lateral anteprenotals 5, acrostichals 5, prealars 5, dorsocentrals 8, uniserial; scutellars 12, uniserial. Anapleural suture length 270 mμ. Mesonotal pit as in male.

Wing. Length 2275 mμ, width 900 mμ. L/W.R. 2.52. Moderately punctate. Anal lobe straight proximally, slightly rounded distally, and not produced. V.R. 1.06. Stem vein with 1 seta, R with 11, R1 with 6, R4+5 with 5, squama with 20. Costa extended beyond R4+5, apex well distal to apex of Cu1. R2+3 ending about 1/4 distance between R1 and R4+5.

Legs. Hind tibial comb composed of 9 setae. Spines absent on fore leg, 2 on each of first two tarsal segments of mid leg, 2 on first tarsal segment of hind leg.

Leg lengths (μ) and proportions:

	F	T	Ta1	Ta2	Ta3	Ta4	Ta5	L.R.	B.V.	S.V.
Fore	625	750	475	300	175	125	100	0.63	2.64	2.89
Mid	700	750	350	175	125	75	100	0.46	3.78	4.14
Hind	775	925	500	275	200	100	125	0.54	3.14	3.40

Genitalia (Fig. 76). Lateral sternite IX with posterior margin produced as rectangle posterolaterally; numerous short, stiff setae dorsally and ventrally. Tergite IX narrow. Spermathecal duct wrinkled for most of length.

Variation. Postorbitals vary from many to few. I have examined a single female with one long seta in the midst of the numerous short stiff setae on lateral sternite IX.

Remarks. The female of Orthocladus (O.) oliveri closely resembles the female of O. lapponicus in genitalic features; oliveri can be distinguished from lapponicus by the smaller size and the small stiff setae of lateral sternite IX.

Male Pupal Exuvia

Color. Pale golden.

Length (μ). Body 4950, cephalothorax 1650, abdomen

3300.

Cephalothorax. Setae: frontals 1, moderately developed; postorbitals 1, humerals 3, lateral anteprenotals 1, median anteprenotals 2, prealars 1, dorsocentrals 4. Thoracic horn (Fig. 90n, 91c) robust with apex tapered, and densely covered with small, pointed spines (Fig. 91d), length 340 μ . Frontal tubercles not

prominent. Anterior part of notum wrinkled along eclosion line.

Abdomen. Anal lobe length 350 μ ; heart-shaped with 2 right and 3 left spurs; spurs weak, iciclelike; longest anal seta length 230 μ . A.L.R. 0.65. Pedes spurii B robust, present on segment II.

Setae present on segments I-VIII:

dorsals	3	4	4	5	4	5	4	1
laterals	1	3	3	3	3	3	4	4
ventrals	0	3	3	4	3	3	4	1

Tergal spine patterns (Fig. 92, composite). I: bare; Omm 2, Ann 1. II: elliptical patch posteromedial, with about 38 recurved spines in 3 rows; patch of spines anterior to recurved spines; bare bands laterally; Omm 1, Ann 2. III-V: large patch of coarse spines separated by bare line from rectangular patch of anteriorly-directed spines along posterior margin; bare bands laterally; Omm 3, Ann 2. VI: as in III-V, but with large patch reduced in size and without patch of anteriorly-directed spines; Omm 3, Ann 2. VII: 2 well-spaced patches of fine spines along anterior margin; small patch of fine spines centrally; Omm 2, Ann 2. VIII: 2 well-spaced patches of fine spines along anterior margin; small patch of fine spines along posterior margin medially; Omm 4, Ann 0. IX: band of fine spines along anterior margin.

Sternal spine patterns (composite). I: bare. II: band of fine spines along anterior margin, continuous with one medial and 2 lateral bands reaching posterior margin. III, IV: band of fine spines along anterior margin, continuous with lateral bands reaching posterior margin. V: 2 well-spaced patches of fine

spines along anterior margin; small patch of fine spines along posterior margin medially. VI: as in V, but with medial patch larger. VII, VIII: 2 well-spaced patches of fine spines along anterior margin. IX: bare.

Variation. Anal spurs reduced in size to spikelike points. Area along eclosion line with few bumps.

Remarks. The pupa of Orthocladius (O.) oliveri closely resembles the pupa of O. obumbratus; it can be distinguished from obumbratus by the small pointed spines on the thoracic horn, the pale exuvia, and the more weakly developed spine patterns.

Larva (n = 10)

Color. Body green with head capsule yellow.

Head. Labial plate (Fig. 131b) convex; narrow median tooth extended anteriorly, beyond first laterals; paralabials not prominent. Mandible (Fig. 131a) with outer margin moderately crenulate; brush with 6 setae, apices serrate. Epipharynx (Fig. 117a) with 8 chaetae laterals, 2 chaetae basales, 4 spinules. Premandible bifid. A.R. 2.43-2.88. Antennal segment lengths (μm, Fig. 117b): 62-80, 13-16, 3-5, 3-4, 3-5; blade grooved, extended to tip of 3rd segment; Lauterborn organs moderately developed.

Variation. Mandible with crenulations weakly to moderately developed.

Remarks. The larva of Orthocladius (O.) oliveri closely resembles the larvae of O. charensis and O. lapponicus; oliveri can be distinguished from them by the bifid premandible.

ECOLOGY

Final instar larvae of O. oliveri were associated with

Elodea mats and filamentous green algae clinging to submerged twigs, weeds and branches close to the shore of the Blanche River, one mile north of Perkins, Quebec. The river at the collecting site was about 110 ft. wide, and the bottom consisted of sand and gravel with scattered boulders of about 3 ft. in diameter. At ice breakup the river was about 3 ft. deep near shore and over 8 ft. deep at center.

Emergence of adults occurred soon after ice breakup (2.V.71, 22.V.72, 30.IV.73). Swarming occurred in the late afternoon (1730-1800 hrs., pers. comm. D.R. Oliver) and near dusk (1900-2000 hrs.). Swarms occurred above markers (yellow and black road signs; a sandy patch on a grassy hill; a drain pipe along rock inlay; the edge of the road; a car) located within 40 feet of the river. Swarms were found at the same markers in different years.

Approximately 100 to 200 adults of O. oliveri occurred in swarms about 20 feet above ground, although a brisk wind would cause the swarms to sink to about 3 ft. above ground. When the wind dropped, the swarm would then rise to maintain itself at about 20 feet. If the swarm were disturbed, it would reform within three minutes. Swarms above the car were generally 8 to 10 feet above ground, but could maintain themselves at about 20 feet. Pairs would mate in the swarm and land in copula on top of the car (pers. comm. D.R. Oliver).

The adults of O. oliveri can also be collected in large numbers at black lights.

TYPE MATERIAL (Fig. 156)

Holotype. Male, Quebec, Blanche River 1 mile north of Perkins, 2.V.1971, D.R. Oliver, 70-2, (CNC). Allotype. Reared female, same locality, coll. 30.IV.1973, pres., 3.V.1973, A.R. Soptonis, (CNC).

Paratypes (389). Alabama. Jackson Co., s. edge Scottsboro, 14.XII.1967, H.B. Cunningham, (INHS), 1 male. Arkansas. Benton Co., White River, NW $\frac{1}{4}$, Sec. 19; T20N, R27W, on bridge, 14-II-1963, O.A. Hite and L.R. Aggus, (SUBLETTE), 1 male. Illinois. Texas City, 8.III.1920, T.N.F. and N.H.R., (INHS), 1 male; Shelbyville, Robinson Creek, 9.IV.1932, Ross and Mohr, (INHS), 1 male; Mason Co., Havana, mouth of Spoon R., 22.IV.1898, Acc. No. 24353, no collector, (INHS), 1 male; Iroquois Co., 3 mi. NW Crescent City, 25.IV.1969, Webb and La Berge, (INHS), 1 male; Moultrie Co., Oxbow L., nr. mouth Jonathan Cr., 21.IV.1966, P. Fishman, (INHS), 1 male; Kankakee Co., 5 mi. SE Kankakee, 25.IV.1969, D.W. Webb, (INHS), 1 male; Creek s. of Grayville, 13.III.1936, Frison and Ross, (INHS), 1 male; Champaign Co., 2 mi. s. Philo along creek, 7.IV.1969, D.W. Webb, (INHS), 1 male; Oakwood, #47385, II.24.1927, T.H.F., (INHS), 1 male; Oakwood, #47412, 1937, Frison, (INHS), 1 male; Iroquois Co. 5 mi. E. Clifton on Iroquois River, 25.IV.1969, D.W. Webb, (INHS), 1 male; Stoney Cr., 3 mi. E Oakwood, 23.II.1969, T. Harris, (INHS), 1 male; Moultrie Co., Sullivan, Kaskaskia R., 21.IV.1967, D.W. Webb, (INHS), Acc. No. 50347, 1 male; Mayview, Champ. Co., drainage ditch, 26.IV.1967, D.W. Webb, (INHS), 1 reared female; Charleston, 20.IV.1932, Ross and Mohr, (INHS), male and female in copula; Grand Tower, along ditch, 22-IV-14, S66-1660,

S66-1661, (INHS), 2 males; Havana, river shore, 16-XI-13, S66-1715, (INHS), 1 male; Oakwood, 10.III.1927, Frison, (INHS), 1 male, #47439; Dubois, creek valley, 24-IV-14, (INHS), S66-1677, 1 male; same data except S66-1678, 1 male, S66-1679, 1 male, S66-1682, 1 male; St. Joseph, 3-V-14, S66-1667, 1 male; Champaign Co., Hart Mem. Woods, light trap, IV/11-12/64, M.W. Sanderson, (INHS), 9 males; 3-11.III.1967, 1 male; 20-III-66, 2 males; III/20-25/66, 10 males; 1-2/IV/1967, 1 male; 26-28.III.1967, 6 males; 16-25.III.1967, 3 males; 25-26.III.1967, 2 males; same locality, no collector, 11-13-IV-66, 1 male; Hart Memorial Woods, 3.5 mi. NE Mahomet, 15-16-IV-64, no collector: (INHS), 1 male each: S65-2156, 2158, 2159, 2161, 2164-2154, 2167, 2169, 2172-2175, 2177-2182, 2184-2190, 2192-2196, 2198, 2199, 2200, 22203-2207, 2209-2212; 2239-2241, 2243, 22248, 2250-2252, 2255, 2258-2265, 2269-2271, 2275, 2277-2279, 2282. Indiana. Rogers, White River, 14.III.1936, Frison and Ross, (INHS), 1 male. Iowa. Ames, 1.IV-49, L. Lewis, (MINN), S66-715, 1 male; Ames, 8-V-57, R.M. Phillips, S66-626, (MINN), 1 male; Ames, 7-IV-27, W.W.N., (MINN), S66-616, S66-623, 2 males; Ames, IV.2.1949, J. Laffoon, (ISU), S65-1739, S65-1741, 2 males. Louisiana. Natchitoches, Chivary Dam, 23-II-60, J.E. Sublette, S60-414, (SUBLETTE), 1 male pupa; Many, above poll., 1-III-60, J.E. Sublette, S60-448, (SUBLETTE), 1 male pupa; Many, unpolluted above sewer outfall on weeds, 20-III-58, J.E. Sublette, (SUBLETTE), P-2810, P-2809, 2 males; Many, gravel stream, 10-II-58, J.E. Sublette, (SUBLETTE), P-2645, 1 male; P-2643, P-2647, P-2648, 3 male pupae. Michigan. Hamburg, Ap. 8, 34, G. Steyskal, 2602, (USNM), 1 male; Midland Co., 3-30-57, R.R. Dreisbach, (SUBLETTE), 5 males.

Ann Arbor, 15.IV.50, E.B. Hayden, (UKAN), 1 male each: S64-118-132, 471, 473, 474; same data except the date 22-IV-50: S64-330, 133-139, 2740, 3295A; same data except the date 25-IV-50: S64-614-618, 620-624, 140-141; same data except the date 6-V-50, S64-2362; no collector or date, S66-1713, 1709, ~~1710~~, S66-1712, S66-1699.

Minnesota. Carlton Co., 3-V-41, S64-3732, (MINN), 1 male; Anoka Co., 14-IV-42, S64-3712, (MINN), 1 male; Olmsted Co., no date, no collector, S64-3850, (MINN), 1 male; Kandiyohi Co., New London Fish Hat., N.J. Mosquito Trap, May 9, 1970, E.F. Cook, (MINN), 1 male; Stearns Co., St. Cloud, 8 Dunbar Road, no date, J.E. Nelson, (MINN), 5 males and 1 female. Missouri. Alliance, White water Cr., 6.III. 1958, Ross and Stannard, (INHS), 1 male; Chaston, 9.III.1939, Frison and Mohr, (INHS), 2 males; Christian Co., N. of Highlandville, Finley R. at Riverdale, 11.II.1959, Ross and Stannard, (INHS), 2 males. New York. Genesee Co., Tonawanda Indian Res., dead in huge no. in Tonawanda Creek, 25-III-1961, L.L. Pechuman, (SUBLETTE), 13 males; same data except 25-IV-1961, 1 male. Oklahoma. McClain Co., 14.III.1931, R.D. Bird, (AMNH), 2 males; Meers, Wichita Mts., 9.II. 1961, Ross and Ross, (INHS), 1 male. Ontario. Ottawa, at Woodroffe Beach, Ottawa R., 9.V.1972, A.R. Sponis, (CNC), 4 males; same data except in grass, 5.V.1971, 1 male; Ottawa, Brewer's Park at Bronson, 6:00 P.M. swarm, 16.IV.1973, B.T. Kidd, (CNC), 2 males; Ottawa, Green Creek on Cyrville Rd., coll. 12.V.1972, em. 14.V.1972, A.R. Sponis, (CNC), 1 reared male; Ottawa, mouth of Jock R., 16S, nr. Carleton Lodge, May 8, 1972, A.R. Sponis, (CNC), 1 male; same data except coll. 10.V.1972, em. 14.V.1972, 1 reared male; Jock R. nr. Munster Hamlet, coll. 16.IV.1973, pres. 18.IV.1973, A.R. Sponis,

(CNC), 1 reared male; same data except coll. 7.V.1973, pres. 14.V. 1973, 1 reared female; same data except 7.V.1973, at dusk, 1 male; Ottawa, 14.V.1966, Jon Martin, (CNC), 1 male; Ottawa, 14.IV.1966, Jon Martin, (CNC), 1 male; Merivale, 25.IV.1956, J.R. Vockeroth, (CNC), 1 male; Stormont Co., Berwick, ex. cheese factory, 15.IV. 1963, L.L. Swain, (CNC), 1 male; Erosoma Co., Speed River, 2.V.1971, A.R. Soponis, (CNC), 1 male. Oregon. Aumsville, 22 March 1963, K. Goeden-light, (USNM), 2 males. Pennsylvania. S. Chester Co., Stroud Estate, Rt. 926, E. Branch of White Clay Creek, 10.IV.1971, J.W. Richardson, Jr., A-S, (ANSP), 1 male; Pike Co., Bushkill Creek, 2.IV.1965, Pechuman and Teskey, (CU), 1 male. Quebec. Hull, 5.V.1956, J.R. Vockeroth, (CNC), 1 male; Type locality (CNC): 1.V.1971, D.R. Oliver 70-1, cop. pr., 10 females, 20 males; 2.V. 1971, D.R. Oliver 70-2, 1 cop. pr., 34 males; em. 18.V.1971, A.R. Soponis, 1 male; 22.V.1972, A.R. Soponis and B.T. Kidd, 26 males; 2.V.1972, Brundin net, A.R. Soponis and J. Robillard, 1 male; coll. 22.V.1972, em. 26.V.1972, A.R. Soponis, 1 reared female; coll. 9.V.1972, em. 14.V.1972, A.R. Soponis, 1 reared female; 30. IV.1973, swarm, A.R. Soponis and B.T. Kidd, 29 males; coll. 30.IV. 1973, pres. 3.V.1973; A.R. Soponis, 1 reared male, 1 reared female; coll. 30.IV.1973; pres. 7.V.1973, A.R. Soponis, 1 reared male; coll. 30.IV.1973, pres. 8.V.1973, A.R. Soponis, 1 reared female.

South Dakota. Lewis and Clark Lake, Periphyton, May 10/71, No. 55, P. Hudson, (FRBW), 1 male; Yankton, Eds Creek, Gavins Pt. Nat. Fish Hatchery, Oct. 11, 71, P. Hudson, (HUDSON), 2 males; Turkey Creek, 1 mi. North of Volin, Ap. 2, 72, P. Hudson, (HUDSON), 2 males; Platte, Platte Creek, Lake Francis Case, May 3, 71, P. Hudson,

(HUDSON), 1 male; Vermillion, Missouri River, Clay County Park, May 22, 72, P. Hudson, (HUDSON), 1 male. Texas. Austin, 2-12-00, A.L. Melander Collection 1961, (USNM), 1 male; Red. R.N. of Denison, 10-IV-1960, J.E. Sublette, (SUBLETTE), 3 males; Sabine R., S. of Greenville, 12-IV-1960, J.E. Sublette, (SUBLETTE), 1 male; same data except 10-IV-1960, 4 males; 19-IV-60, 1 male pupa; Sabine R., 5 mi. N. of Greenville, 10-11-1960, J.E. Sublette, (SUBLETTE), 1 male pupa; 4.5 mi. SE of Denison, 10-IV-60, J.E.S., (SUBLETTE), 1 male; 4.4 mi. S. of Denison, 12-IV-60, J.E.S., (SUBLETTE), 1 male, 1 reared male, 1 reared female; 5 mi. N. Greenville, 10-IV-60, J.E.S., (SUBLETTE), 1 male. Wisconsin. Sauk Co., Wisconsin Dells, 15-IV-1968, D.W. Webb, (INHS), 1 male; Sauk Co., Baraboo, 15-IV-1968, D.W. Webb, (INHS), 1 male.

Orthocladius (Orthocladius) pardecoratus n. sp.

Figs. 14f, 53

This new species was treated as O. decoratus by Oliver (1963, p. 173) and Oliver and Danks (1972, p. 1415). The species O. decoratus is poorly defined, and I have not examined the type material. However, based on the literature, O. pardecoratus is distinct from O. decoratus.

Holotype Male

Color. Dark brown; halteres golden; scutal stripes not distinct.

Length (mm). Body 4225, thorax 1225, abdomen 3000.

Head. Interocular distance 330 mm. Temporals 16, verticals 15, postorbitals 1. A.R. 1.56. Antennal flagellomere lengths (mm): 1st-12th 1200; 13th 1875. Clypeus rectangular, with

7 setae. Palpal segment lengths (mu): 40, 65, 160, 120, 200.

Thorax. Anteprenotal lobe jutting out medially, robust. Lateral anteprenotals 8, acrostichals 11, prealars 5, dorsocentrals 9, uniserial; scutellars 10, uniserial. Anapleural suture length 330 mu. Mesonotal pit as in O. oliveri. Sternum II with 1 seta.

Wing. Length 2950 mu, width 800 mu. L/W.R. 3.56.

Finely punctate. Anal lobe strongly rounded, and produced (Fig. 14f). V.R. 1.06. Stem vein with 1 seta, R with 8, squama with 18. Costa not extended beyond R4+5, apex slightly distal to apex of Cul. R2+3 ending about 1/3 distance between R1 and R4+5.

Legs. Hind tibial comb composed of 11 setae. Spines absent on fore leg, 2 on first tarsal segment, and 1 on second tarsal segment of mid leg, 2 on first tarsal segment of hind leg. Leg lengths (mu) and proportions:

	F	F	Ta1	Ta2	Ta3	Ta4	Ta5	L.R.	B.V.	S.V.
Fore	925	1100	800	450	300	200	150	0.72	2.56	2.53
Mid	975	1000	450	300	225	150	125	0.45	3.03	4.38
Hind	1025	1175	650	400	300	150	150	0.55	2.85	3.38

Hypopygium (Fig. 53). Gonocoxite length 260 mu, gonostylus length 120 mu. H.R. 2.16. H.V. 3.52. Lateral margin of tergite IX group of 10 setae. Anal point medium in length. Virga present. Basal median lobes of gonocoxite triangular. Basal lobe with dorsal part robust, ventral part slightly extended below. Gonostylus platelike, with distal part constricted:

Remarks. The male of Orthocladus (O.) paradecoratus closely resembles the male of O. manitobensis in hypopygial features; paradecoratus can be distinguished from manitobensis by the more

robust basal lobe and the shape of the basal median lobes of the gonocoxite.

O. pardecoratus n. sp.

VARIABLE	SAMPLE SIZE	MEAN	RANGE		VARIANCE
			MIN	MAX	
WING	4	2412.50	2200.00	2850.00	.8896 x 10 ⁵
ARM	5	970.00	850.00	1125.00	.1356 x 10 ⁵
AFCU	4	1050.00	925.00	1200.00	.2125 x 10 ⁵
R	5	7.60	5.00	11.00	.5300 x 10 ¹
SQUM	5	16.60	13.00	21.00	.1030 x 10 ²
P1	5	37.00	30.00	45.00	.3250 x 10 ²
P2	5	54.00	45.00	65.00	.5500 x 10 ²
P3	5	139.00	120.00	160.00	.3050 x 10 ³
P4	5	103.00	95.00	120.00	.9500 x 10 ²
P5	5	157.00	125.00	200.00	.8450 x 10 ³
EYE	5	293.00	265.00	330.00	.6950 x 10 ³
VERT	5	12.20	9.00	16.00	.1070 x 10 ²
ETM	5	1.80	1.00	3.00	.7000 x 10 ⁰
CLYP	5	9.00	7.00	11.00	.3500 x 10 ¹
PROL	5	6.00	5.00	8.00	.2000 x 10 ¹
AC	5	12.80	9.00	15.00	.7200 x 10 ¹
DC	5	8.40	7.00	10.00	.1800 x 10 ¹
PA	5	4.60	4.00	6.00	.8000 x 10 ⁰
SC	5	9.40	8.00	11.00	.1800 x 10 ¹
ANSU	5	298.00	250.00	330.00	.1120 x 10 ⁴
ANT3	5	454.00	440.00	480.00	.2300 x 10 ³
ANTT	5	696.00	630.00	760.00	.3230 x 10 ⁴
BASI	5	246.00	230.00	270.00	.3300 x 10 ³
DISI	5	116.00	110.00	120.00	.3000 x 10 ²
FF	5	825.00	750.00	925.00	.8437 x 10 ⁴
FT	5	940.00	850.00	1100.00	.1144 x 10 ⁵
FTA1	5	700.00	625.00	800.00	.6562 x 10 ⁴
FTA2	5	410.00	375.00	450.00	.1437 x 10 ⁴
FTA3	4	275.00	250.00	300.00	.4167 x 10 ³
FTA4	4	181.25	175.00	200.00	.1562 x 10 ³

VARIABLE	SAMPLE SIZE	MEAN	RANGE		VARIANCE
			MIN	MAX	
FTA5	4	131.25	125.00	150.00	.1562 x 10 ³
MF	5	860.00	775.00	975.00	.9250 x 10 ⁴
MT	5	850.00	750.00	1000.00	.1156 x 10 ⁵
MTA1	5	425.00	400.00	475.00	.1250 x 10 ⁴
MTA2	5	270.00	250.00	300.00	.7500 x 10 ³
MTA3	5	225.00	175.00	325.00	.3437 x 10 ⁴
MTA4	5	125.00	100.00	150.00	.3125 x 10 ³
MTA5	5	120.00	100.00	125.00	.1250 x 10 ³
HF	5	905.00	800.00	1025.00	.1044 x 10 ⁵
HT	5	1010.00	900.00	1175.00	.1956 x 10 ⁵
HTA1	5	570.00	525.00	650.00	.3875 x 10 ⁴
HTA2	5	345.00	300.00	400.00	.2625 x 10 ⁴
HTA3	5	265.00	250.00	300.00	.5000 x 10 ³
HTA4	5	135.00	125.00	150.00	.1875 x 10 ³
HTA5	5	140.00	125.00	150.00	.1875 x 10 ³
COMB	5	10.60	9.00	13.00	.2300 x 10 ¹
TH	5	1120.00	1025.00	1225.00	.9500 x 10 ⁴
AB	5	2750.00	2400.00	3000.00	.8469 x 10 ⁵
WW	4	725.00	650.00	800.00	.4167 x 10 ⁴
WR	3	3.39	3.21	3.56	.3032 x 10 ⁻¹
BL	5	3870.00	3450.00	4225.00	.1429 x 10 ⁶
AR	5	1.53	1.40	1.69	.1185 x 10 ⁻¹
VR	4	1.08	1.06	1.09	.3199 x 10 ⁻³
HR	5	2.12	1.92	2.25	.1627 x 10 ⁻¹
HV	5	3.34	2.92	3.59	.8725 x 10 ⁻¹
FLR	5	.74	.73	.77	.3293 x 10 ⁻³
FSV	5	2.52	2.48	2.56	.9341 x 10 ⁻³
FBV	4	2.43	2.33	2.57	.1311 x 10 ⁻¹
MLR	5	.50	.45	.53	.1005 x 10 ⁻²
MSV	5	4.02	3.87	4.39	.4399 x 10 ⁻¹
MBV	5	2.89	2.69	3.04	.2396 x 10 ⁻¹
HLR	5	.57	.54	.58	.3186 x 10 ⁻³
HSV	5	3.35	3.24	3.44	.7995 x 10 ⁻²
HBV	5	2.80	2.70	2.85	.3905 x 10 ⁻²
BR	5	2.45	2.29	2.67	.1963 x 10 ⁻¹

TYPE MATERIAL

Holotype. Male, Hazen Camp, Ellesmere I., N.W.T., 11.VIII.1961, D.R. Oliver, N.E. 215, L.F. 1.10.62, (CNC).

Paratypes (8). Labrador. Astray L., 27.VIII.57, D.R. Oliver, K-387-1, (CNC), 1 pupal ex.. Northwest Territories. Ellesmere I., Hazen Camp, N.E. 235, 14.VIII.1961, D.R. Oliver, (CNC), 1 male; same data except NE 215, 11.VIII.1961, 1 male; N.E. 164, 31.VII.1961, 1 male; N.E. 164, 103, L.F. 23.11.62, no collector, 1 male; Hazen Camp, 81° 49' N., 71° 18' W., 30.VII.1964, R.E. Leech, no. Pond 32, (CNC), 1 male. Sweden. Erken Lake, E. 164, 11.VII.1959, D.R. Oliver, 61-L.F. 30.10.61, (CNC), 1 male. Yukon Territory. Old Crow River, Mackenzie Delta, No. 72-283, OR1Y230871DN, 23.VIII.71, no collector, (CNC), 1 male.

Orthocladus (Orthocladus) robacki n. sp.

Figs. 54, 90p, 112, 134

Specimens of this new species were found in the type material of both O. dorenus (Roback) and O. paradorenus (Roback). The male genitalia, although somewhat distorted in the holotype of O. robacki, agrees with material from New York that I have examined. The larva of O. robacki cannot be distinguished from that of O. bumbratus. I suspect that one of Roback's slides labelled O. dorenus has a mismatched larva, since the pupa and adult clearly belong to O. robacki. The pupal exuviae of O. robacki, referred to as O. (Orthocladus) sp. 5, were collected in Pennsylvania by Coffman (1973, p. 311). The female of O. robacki is unknown.

Holotype Male

Color. Brown; halteres golden; scutal stripes distinct, merging posteriorly.

Length. Thorax and abdomen damaged.

Head. Interocular distance 430 μ . Temporals 13, verticals 11, postorbitals 2. A.R. 1.51. Antennal flagellomere lengths (μ): 1st-12th 1025, 13th 1550. Clypeus rectangular, with 8 setae. Palpal segment lengths (μ): 35, 50, 125, 90, 150.

Thorax. Anteprenotal lobe wide medially, robust. Lateral anteprenotals 9, acrostichals 9, dorsocentrals 9, uniserial; scutellars 4, uniserial. Anapleural suture damaged. No mesonotal pit.

Wing. Length 1950 μ , width 625 μ . L/W.R. 3.12. Scarcely punctate. Anal lobe folded under, appears rounded and produced. V.R. 1.06. Stem vein with 1 seta, R with 7, squama with 20. Costa not extended beyond R4+5, apex slightly distal to apex of Cul. R2+3 ending about 1/3 distance between R1 and R4+5.

Legs. Hind tibial comb composed of 10 setae. Spines absent on fore leg, 2 on each of first two tarsal segments of mid leg, 2 on first tarsal segment of hind leg.

Leg lengths (μ) and proportions:

	F	T	Ta1	Ta2	Ta3	Ta4	Ta5	L.R.	B.V.	S.V.
Fore	725	825	525	400	275	150	100	0.60	2.29	3.04
Mid	750	750	400	225	175	100	100	0.53	3.16	3.75
Hind	800	900	525	300	225	125	125	0.58	3.19	3.71

Hypopygium (Fig. 54). Gonocoxite length 210 μ , gonostylus length 110 μ . H.R. 1.90. Lateral margin of tergite

IX with group of 7 setae. Anal point medium in length. Virga present. Basal median lobes of gonocoxite shortly triangular. Basal lobe with dorsal part short and squared, ventral part slightly extended below. Gonostylus platelike, flat.

Remarks. The male of Orthocladus (O.) robacki closely resembles the male of O. wiensi in hypopygial features; robacki can be distinguished from wiensi by the size of the basal median lobes of the gonocoxite.

O. robacki n. sp.

VARIABLE	SAMPLE SIZE	MEAN	RANGE		VARIANCE
			MIN	MAX	
WING	6	2025.00	1900.00	2175.00	.1325 x 10 ⁵
ARM	6	783.33	750.00	825.00	.9167 x 10 ³
AFCU	6	875.00	800.00	975.00	.3500 x 10 ⁴
R	6	5.33	3.00	7.00	.2667 x 10 ¹
SQUM	6	15.50	12.00	20.00	.1030 x 10 ²
P1	6	29.17	25.00	35.00	.1417 x 10 ²
P2	6	48.33	45.00	55.00	.1667 x 10 ²
P3	5	116.00	105.00	125.00	.1050 x 10 ³
P4	4	98.75	90.00	115.00	.1396 x 10 ³
P5	4	150.00	130.00	170.00	.2667 x 10 ³
EYE	5	246.00	215.00	280.00	.5425 x 10 ³
VERT	5	10.80	9.00	13.00	.3200 x 10 ¹
ETM	6	1.33	1.00	2.00	.2667 x 10 ⁰
CLYP	6	9.33	7.00	12.00	.3067 x 10 ¹
PROL	6	5.50	2.00	9.00	.5100 x 10 ¹
AC	6	8.00	5.00	13.00	.7600 x 10 ¹
DC	6	9.83	9.00	10.00	.1667 x 10 ⁰
PA	5	4.40	4.00	5.00	.3000 x 10 ⁰
SC	6	8.00	4.00	12.00	.7600 x 10 ¹
ANSU	5	280.00	250.00	300.00	.3500 x 10 ³
ANT3	6	393.33	370.00	410.00	.2267 x 10 ³
ANTT	6	630.00	570.00	720.00	.2760 x 10 ⁴

VARIABLE	SAMPLE SIZE	MEAN	RANGE		VARIANCE
			MIN	MAX	
BASI	6	213.33	210.00	220.00	.2667 x 10 ²
DISI	6	103.33	100.00	110.00	.2667 x 10 ²
FF	6	720.83	675.00	775.00	.1604 x 10 ⁴
FT	6	875.00	825.00	925.00	.2000 x 10 ⁴
FTA1	6	637.50	525.00	725.00	.5187 x 10 ⁴
FTA2	6	404.17	375.00	450.00	.1354 x 10 ⁴
FTA3	6	275.00	250.00	300.00	.5000 x 10 ³
FTA4	6	170.83	150.00	200.00	.3542 x 10 ³
FTA5	6	116.67	100.00	125.00	.1667 x 10 ³
MF	6	750.00	675.00	875.00	.4750 x 10 ⁴
MT	6	775.00	700.00	850.00	.2750 x 10 ⁴
MTA1	6	395.83	375.00	425.00	.6042 x 10 ³
MTA2	6	233.33	200.00	275.00	.6667 x 10 ³
MTA3	6	166.67	150.00	175.00	.1667 x 10 ³
MTA4	6	100.00	100.00	100.00	.0000
MTA5	6	104.17	100.00	125.00	.1042 x 10 ³
HF	6	779.17	700.00	850.00	.2604 x 10 ⁴
HT	6	904.17	850.00	950.00	.1354 x 10 ⁴
HTA1	6	525.00	475.00	575.00	.1250 x 10 ⁴
HTA2	6	320.83	275.00	450.00	.4354 x 10 ⁴
HTA3	6	225.00	200.00	250.00	.2500 x 10 ³
HTA4	6	116.67	100.00	125.00	.1667 x 10 ³
HTA5	6	112.50	100.00	125.00	.1875 x 10 ³
COMB	6	9.67	9.00	11.00	.6667 x 10 ⁰
TH	6	1020.83	900.00	1125.00	.9854 x 10 ⁴
AB	5	2345.00	2125.00	2500.00	.2044 x 10 ⁵
WW	3	566.67	525.00	625.00	.2708 x 10 ⁴
WR	3	3.41	3.12	3.62	.6794 x 10 ⁻¹
BL	5	3390.00	3100.00	3600.00	.4050 x 10 ⁵
AR	6	1.60	1.50	1.80	.1180 x 10 ⁻¹
VR	6	1.12	1.06	1.30	.8122 x 10 ⁻²
HR	6	2.07	1.91	2.20	.1007 x 10 ⁻¹
HV	5	3.32	3.10	3.55	.2756 x 10 ⁻¹
FLR	6	.73	.60	.78	.4284 x 10 ⁻²

VARIABLE	SAMPLE SIZE	MEAN	RANGE		VARIANCE
			MIN	MAX	
FSV	6	2.52	2.34	3.05	.6867 x 10 ⁻¹
FBV	6	2.31	2.26	2.36	.1123 x 10 ⁻²
MLR	6	.51	.47	.54	.7090 x 10 ⁻³
MSV	6	3.85	3.65	4.13	.4177 x 10 ⁻¹
MBV	6	3.18	3.04	3.32	.1501 x 10 ⁻¹
HLR	6	.58	.56	.61	.3077 x 10 ⁻³
HSV	6	3.21	3.04	3.38	.1527 x 10 ⁻¹
HBV	6	2.87	2.50	3.15	.5229 x 10 ⁻¹
BR	5	2.25	2.09	2.57	.3513 x 10 ⁻¹

Holotype Pupal Exuvia

Color. Brown.

Length (m μ). Body 4100, cephalothorax 1300, abdomen 2800.

Cephalothorax. Setae: frontals 1, robust; postorbitals 2, humerals 3, lateral anteprenotals 1, median anteprenotals 2, prealars 2, dorsocentrals 4. Thoracic horn (Fig. 90p) slender and well covered with moderately developed, scalelike spines, length 340 m μ . Frontal tubercles not prominent. Anterior part of notum slightly wrinkled, almost smooth, along eclosion line.

Abdomen. Anal lobe length 280 m μ ; heart-shaped with 3 right and 3 left spurs; spurs robust, iciclelike; longest anal seta length 100 m μ . A.L.R. 0.35. Pedes spurii B robust, present on segment II.

Setae present on segments I-VIII:

dorsals	4	3	5	5	5	5	5	1
laterals	1	3	3	3	4	4	4	4
ventrals	0	4	3	3	4	4	3	1

ventrals on III, IV are bifurcate, trifurcate

Tergal spine patterns (composite). I: bare; Omm 1, Amm 1.

II: elliptical patch posteromedial, with about 62 recurved spines in 4 rows; large patch of coarse spines anterior to recurved spines; bare bands laterally; Omm 3, Amm 2. III, IV: large patch of coarse spines separated by bare line from small patch of anteriorly-directed spines along posterior margin; Omm 3, Amm 2. V: as in III, IV, but with patch of anteriorly-directed spines larger; Omm 3, Amm 2. VI: as in III-V, but with large patch reduced in size, and without patch of anteriorly-directed spines; Omm 3, Amm 2. VII: 2 well-spaced patches of fine spines along anterior margin; 2 well-spaced vertical bands of fine spines centrally; Omm 3, Amm 2. VIII: 2 well-spaced patches of fine spines along anterior margin; Omm 3, Amm 0. IX: band of fine spines along anterior margin.

Sternal spine patterns (composite). I: bare. II, III: band of fine spines along posterior margin, continuous with one medial and 2 lateral bands extended anteriorly. IV: 2 well-spaced patches of fine spines along anterior margin, continuous with lateral bands reaching posterior margin. V: 2 well-spaced patches of fine spines along anterior margin; small patch of fine spines along posterior margin medially. VI: as in V, but with medial patch larger. VII, VIII: 2 well-spaced patches of fine spines along anterior margin. IX: bare.

Remarks. The pupa of Orthocladus (O.) robacki closely resembles the pupa of O. clarkei; it can be distinguished from clarkei by the shorter anal setae (lower A.L.R.).

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Larva (n = 2)

Head. Labial plate (Fig. 134a) convex; broad median tooth extended anteriorly, beyond first laterals; median tooth and first laterals lighter shade than other teeth; paralabials not prominent. Mandible (Fig. 134b) with outer margin smooth; brush with 7 setae, apices serrate. Epipharynx (Fig. 112a) with 9 chaetulae laterals, 2 chaetulae basales, 3 spinules. Premandible simple. A.R. 2.04-2.43. Antennal segment lengths (μ , Fig. 112b): 49-56, 11-12, 4, 4, 4; blade grooved, extended to tip of 5th segment; Lauterborn organs weakly developed.

Remarks. The larva of Orthocladius (O.) robacki closely resembles the larva of O. obumbratus, and I am unable to distinguish the larvae of these two species.

TYPE MATERIAL

Holotype. Male, reared, 4A14 13/59 12: Darby Creek at intersection of Sawmill and Darby-Paoli Roads, Pa., May 11, 1953, (4A), S.S. Roback, (ANSP).

Paratypes (7). New York. Tompkins Co., Ellis Hollow, light trap, 15 June 1963, C.O. Berg, (USNM), 4 males; Allegheny State Park, light trap, 28V-3VI, 1963, W.W. Wirth, (USNM), 1 male. Pennsylvania. Crawford Co., Linesville Creek, 30 May 71, Wm. P. Coffman, L.C.P. #6, (PITT), 2 pupal exuviae.

Orthocladius (Orthocladius) smolandicus Brundin

Fig. 25

Orthocladius smolandicus Brundin, 1947, p. 22, fig. 43.

Orthocladius (s. str.) smolandicus Brundin, Brundin, 1956, p. 106.

Orthocladius (Orthocladius) smolandicus Brundin, Fittkau, Schlee,

and Reiss, 1967, p. 362.

Brundin (1947) described this species based on two males from Sweden, without designating a holotype. He distinguished the male of O. smolandicus from the male of O. holsatus Goeth. on the basis of the smaller body size, color, position of the R2+3 vein of the wing, and genitalia. Later Brundin (1956) noted that the numerous, multiserial dorsocentral setae present in males of O. smolandicus will serve to distinguish this species from the males of the other species of O. (Orthocladus). I have not examined the type material of O. smolandicus. Based on Brundin's description and figure of the male genitalia, the two specimens I have examined belong to this species. These specimens have a smaller body size, smaller wing length, fewer dorsocentral setae, and a higher A.R. than the type material. The female and immature stages of O. smolandicus are unknown.

Male

Color. Brown; halteres golden; scutal stripes distinct, not merging posteriorly.

Length ($m\mu$). Thorax damaged; abdomen 2150.

Head. Femalelike. Interocular distance 330 $m\mu$.

Temporals 13, verticals 10, postorbitals 3. A.R. 1.55. Antennal flagellomere lengths ($m\mu$): 1st-12th 900, 13th 1400. Clypeus rectangular, with 17 setae. Palpal segment lengths ($m\mu$): 35, 55, 105, 100, 135.

Thorax. Anteprenotal lobe wide medially, robust. Lateral anteprenotals 8, acrostichals 39, prealars 8, dorsocentrals 18, biserial; scutellars 16, uniserial. Anapleural suture length 290 $m\mu$.

Mesonotal pit as in O. oliveri.

Wing. Length 1775 μ , width 525 μ . L/W.R. 3.38.

Finely punctate. Anal lobe well rounded, and produced. V.R. 1.14.

Stem vein with 2 setae. R with 6, squama with 19. Costa not extended beyond R4+5, apex well distal to apex of Cul. R2+3 ending before midpoint of R1 and R4+5.

Legs. Hind tibial comb composed of 10 setae. Spines absent on fore leg, 2 on each of first two tarsal segments of mid leg, 2 on first tarsal segment of hind leg.

Leg lengths (μ) and proportions:

	F	T	Ta1	Ta2	Ta3	Ta4	Ta5	L.R.	B.V.	S.V.
Fore	675	875	550	375	275	150	100	0.62	2.33	2.81
Mid	700	750	375	200	150	100	100	0.50	3.31	3.86
Hind	700	925	500	300	225	125	125	0.54	2.74	3.25

Hypopygium (Fig. 25). Gonocoxite length 220 μ , gonostylus length 90 μ . H.R. 2.44. Lateral margin of tergite IX with group of 9 setae. Anal point medium in length. Virga absent. Basal median lobes of gonocoxite collarlike. Basal lobe with dorsal part extended straight vertically, with apex rounded, and ventral part hidden below. Gonostylus in folded position.

Variation. Scutellars biserial. Dorsocentrals 24-30 (Brundin 1956).

Remarks. The male of Orthocladus (O.) smolandicus closely resembles the male of O. annectens in hypopygial features; smolandicus can be distinguished from annectens by the numerous, biserial dorsocentral setae.

O. Smolandicus Brundin

VARIABLE	SAMPLE SIZE	MEAN	RANGE		VARIANCE
			MIN	MAX	
WING	2	1812.50	1775.00	1850.00	.2812 x 10 ⁴
ARM	2	725.00	700.00	750.00	.1250 x 10 ⁴
AFCU	2	812.50	800.00	825.00	.3125 x 10 ³
R	2	8.00	6.00	10.00	.8000 x 10 ¹
SQUM	2	19.00	19.00	19.00	.0000
P1	2	35.00	35.00	35.00	.0000
P2	2	57.50	55.00	60.00	.1250 x 10 ²
P3	2	102.50	100.00	105.00	.1250 x 10 ²
P4	2	105.00	100.00	110.00	.5000 x 10 ²
P5	2	132.50	130.00	135.00	.1250 x 10 ²
EYE	2	340.00	330.00	350.00	.2000 x 10 ³
VERT	2	11.50	10.00	13.00	.4500 x 10 ¹
ETM	2	3.00	3.00	3.00	.0000
CLYP	2	17.00	17.00	17.00	.0000
PROL	2	9.50	8.00	11.00	.4500 x 10 ¹
AC	2	38.00	37.00	39.00	.2000 x 10 ¹
DC	2	20.50	18.00	23.00	.1250 x 10 ²
PA	2	8.50	8.00	9.00	.5000 x 10 ⁰
SC	2	16.00	16.00	16.00	.0000
ANSU	2	290.00	290.00	290.00	.0000
ANT3	2	355.00	350.00	360.00	.5000 x 10 ²
ANTT	2	555.00	550.00	560.00	.5000 x 10 ²
BASI	2	220.00	220.00	220.00	.0000
DISI	2	90.00	90.00	90.00	.0000
FF	2	687.50	675.00	700.00	.3125 x 10 ³
FT	2	875.00	875.00	875.00	.0000
FTA1	2	562.50	550.00	575.00	.3125 x 10 ³
FTA2	2	375.00	375.00	375.00	.0000
FTA3	2	275.00	275.00	275.00	.0000
FTA4	2	162.50	150.00	175.00	.3125 x 10 ³
FTA5	2	112.50	100.00	125.00	.3125 x 10 ³
MF	2	712.50	700.00	725.00	.3125 x 10 ³
MT	2	787.50	750.00	825.00	.2812 x 10 ⁴
MTA1	2	387.50	375.00	400.00	.3125 x 10 ³

VARIABLE	SAMPLE SIZE	MEAN	RANGE		VARIANCE
			MIN	MAX	
MTA2	2	212.50	200.00	225.00	.3125 x 10 ³
MTA3	2	150.00	150.00	150.00	.0000
MTA4	2	112.50	100.00	125.00	.3125 x 10 ³
MTA5	2	112.50	100.00	125.00	.3125 x 10 ³
HF	2	725.00	700.00	750.00	.1250 x 10 ⁴
HT	2	962.50	925.00	1000.00	.2812 x 10 ⁴
HTA1	2	500.00	500.00	500.00	.0000
HTA2	2	300.00	300.00	300.00	.0000
HTA3	2	225.00	225.00	225.00	.0000
HTA4	2	137.50	125.00	150.00	.3125 x 10 ³
HTA5	2	125.00	125.00	125.00	.0000
COMB	2	11.00	10.00	12.00	.2000 x 10 ¹
TH	0	0.00	0.00	0.00	.0000
AB	2	2287.50	2150.00	2425.00	.3781 x 10 ⁵
WW	2	537.50	525.00	550.00	.3125 x 10 ³
WR	2	3.37	3.36	3.38	.1500 x 10 ⁻³
BL	0	0.00	0.00	0.00	.0000
AR	2	1.56	1.55	1.57	.1259 x 10 ⁻³
VR	2	1.12	1.10	1.14	.9184 x 10 ⁻³
HR	2	2.44	2.44	2.44	.0000
HV	0	0.00	0.00	0.00	.0000
FLR	2	.64	.63	.66	.4082 x 10 ⁻³
FSV	2	2.78	2.74	2.82	.3125 x 10 ⁻²
FBV	2	2.30	2.26	2.33	.2462 x 10 ⁻²
MLR	2	.49	.48	.50	.1148 x 10 ⁻³
MSV	2	3.87	3.87	3.87	.3505 x 10 ⁻⁴
MBV	2	3.22	3.12	3.32	.1964 x 10 ⁻¹
HLR	2	.52	.50	.54	.8218 x 10 ⁻³
HSV	2	3.37	3.25	3.50	.3125 x 10 ⁻¹
HBV	2	2.78	2.74	2.81	.2490 x 10 ⁻²
BR	0	0.00	0.00	0.00	.0000

MATERIAL EXAMINED

Minnesota. Ramsay Co., Geronimo Lake, Pond, Shoreview,
s.w. $\frac{1}{4}$ sec. 14, R23W, T30N, May 23, 1969, D.E. Maschwitz, (MINN),
1 male; same data except July 29, 1968, 1 male.

Orthocladus (Orthocladus) subletti n. sp.

Figs. 32, 157

Holotype Male

Color. Brown; halteres golden; scutal stripes distinct,
merging posteriorly.

Length (m μ). Body 4200, thorax 1325, abdomen 2875.

Head. Flattened. Interocular distance 285 m μ . Temporals
16, verticals 14, postorbitals 2. A ϕ R. 1.61. Antennal flagellomere
lengths (m μ): 1st-12th 1050, 13th 1700. Clypeus rectangular, with
12 setae. Palpal segment lengths (m μ): 35, 50, 140, 100, 180.

Thorax. Anteprenotals lobe wide medially, robust.
Lateral anteprenotals 5, acrostichals 14, prealars 5, dorsocentrals
11, uniserial; scutellars 12, uniserial. Anapleural suture length
350 m μ . No mesonotal pit.

Wing. Length 2525 m μ , width 800 m μ . L/W.R. 3.15.
Moderately punctate. Anal lobe well rounded, and produced. V.R.
1.04. Stem vein with 1 seta, R with 4, squama with 30. Costa
slightly extended beyond R4+5, apex well distal to apex of Cul.
R2+3 ending before midpoint of R1 and R2+3.

Legs. Hind tibial comb composed of 13 setae. Fore leg
damaged, 2 spines on each of first two tarsal segments of mid leg,
2 on first tarsal segment of hind leg.

Leg lengths (mu) and proportions:

	F	T	Ta1	Ta2	Ta3	Ta4	Ta5	L.R.	B.V.	S.V.
Fore	875	1025	800	---	---	---	---	0.78	---	---
Mid	900	950	475	250	200	125	100	0.50	3.44	3.89
Hind	1000	1200	675	375	275	150	125	0.56	3.10	3.25

Hypopygium (Fig. 32). Gonocoxite length 250 mu, gonostylus length 110 mu. H.R. 2.27. H.V. 3.81. Lateral margin of tergite IX with group of 7 setae. Anal point medium in length. Virga present. Basal median lobes of gonocoxite collarlike. Basal lobe with dorsal part noselike, extended beyond ventral part. Gonostylus in folded position.

Remarks. The male of Orthocladus (O.) subletti closely resembles the male of O. charensis in hypopygial features; subletti can be distinguished from charensis by the lack of setae on vein R4+5 of the wing. The female and immature stages of O. subletti are unknown.

O. subletti n. sp.

VARIABLE	SAMPLE SIZE	MEAN	RANGE		VARIANCE
			MIN	MAX	
WING	4	2575.00	2250.00	3075.00	.1246 x 10 ⁶
ARM	4	1037.50	900.00	1200.00	.1562 x 10 ⁵
AFCU	4	1093.75	975.00	1250.00	.1349 x 10 ⁵
R	5	5.40	4.00	6.00	.8000 x 10 ⁰
SQUM	5	22.80	16.00	30.00	.3520 x 10 ²
P1	5	36.00	30.00	40.00	.1750 x 10 ²
P2	5	55.00	50.00	75.00	.1250 x 10 ³
P3	5	127.00	70.00	155.00	.1095 x 10 ⁴
P4	4	111.25	95.00	135.00	.3229 x 10 ³
P5	3	190.00	170.00	215.00	.5250 x 10 ³
EYE	4	268.75	240.00	300.00	.8062 x 10 ³

VARIABLE	SAMPLE SIZE	MEAN	RANGE		VARIANCE
			MIN	MAX	
VERT	4	16.50	14.00	18.00	.3667 x 10 ¹
ETM	4	3.75	2.00	6.00	.2917 x 10 ¹
CLYP	5	11.20	9.00	14.00	.3700 x 10 ¹
PROL	5	6.00	2.00	9.00	.7500 x 10 ¹
AC	5	14.00	11.00	19.00	.9500 x 10 ¹
DC	5	10.00	7.00	13.00	.5000 x 10 ¹
PA	5	4.60	4.00	5.00	.3000 x 10 ⁰
SC	5	10.60	8.00	13.00	.5800 x 10 ¹
ANSU	5	346.00	290.00	420.00	.2230 x 10 ⁴
ANT3	4	445.00	420.00	480.00	.6333 x 10 ³
ANTT	5	682.00	600.00	790.00	.5120 x 10 ⁴
BASI	5	264.00	250.00	290.00	.3800 x 10 ³
DISI	5	108.00	100.00	120.00	.7000 x 10 ²
FF	4	850.00	775.00	900.00	.2917 x 10 ⁴
FT	3	1100.00	1025.00	1200.00	.8125 x 10 ⁴
FTA1	3	816.67	775.00	875.00	.2708 x 10 ⁴
FTA2	2	475.00	450.00	500.00	.1250 x 10 ⁴
FTA3	2	337.50	325.00	350.00	.3125 x 10 ³
FTA4	2	212.50	200.00	225.00	.3125 x 10 ³
FTA5	2	137.50	125.00	150.00	.3125 x 10 ³
MF	5	880.00	750.00	1075.00	.1669 x 10 ⁵
MT	4	962.50	800.00	1150.00	.2062 x 10 ⁵
MTA1	4	487.50	425.00	575.00	.3958 x 10 ⁴
MTA2	4	262.50	200.00	325.00	.2708 x 10 ⁴
MTA3	4	206.25	175.00	250.00	.9896 x 10 ³
MTA4	4	125.00	100.00	150.00	.4167 x 10 ³
MTA5	4	112.50	100.00	125.00	.2083 x 10 ³
HF	4	1000.00	850.00	1150.00	.1500 x 10 ⁵
HT	4	1181.25	1000.00	1350.00	.2057 x 10 ⁵
HTA1	3	691.67	650.00	750.00	.2708 x 10 ⁴
HTA2	3	375.00	350.00	400.00	.6250 x 10 ³
HTA3	3	291.67	275.00	325.00	.8333 x 10 ³
HTA4	3	175.00	150.00	200.00	.6250 x 10 ³
HTA5	3	133.33	125.00	150.00	.2083 x 10 ³

VARIABLE	SAMPLE SIZE	MEAN	RANGE		VARIANCE
			MIN	MAX	
COMB	4	12.50	10.00	14.00	.3000 x 10 ¹
TH	4	1300.00	1125.00	1500.00	.2458 x 10 ⁵
AB	5	2755.00	2375.00	3350.00	.1461 x 10 ⁶
WW	5	790.00	650.00	1025.00	.2019 x 10 ⁵
WR	4	3.13	3.00	3.27	.1232 x 10 ⁻¹
BL	4	4150.00	3625.00	4850.00	.2729 x 10 ⁶
AR	4	1.58	1.45	1.64	.7231 x 10 ⁻²
VR	4	1.06	1.04	1.08	.3528 x 10 ⁻³
HR	5	2.45	2.27	2.55	.1165 x 10 ⁻¹
HV	4	3.76	3.57	4.04	.4590 x 10 ⁻¹
FLR	3	.74	.72	.78	.1041 x 10 ⁻²
FSV	3	2.42	2.37	2.48	.3252 x 10 ⁻²
FBV	2	2.44	2.43	2.45	.3372 x 10 ⁻³
MLR	4	.51	.50	.53	.2441 x 10 ⁻³
MSV	4	3.83	3.65	3.89	.1446 x 10 ⁻¹
MBV	4	3.35	3.21	3.44	.1320 x 10 ⁻¹
HLR	3	.56	.55	.56	.2341 x 10 ⁻⁴
HSV	3	3.31	3.26	3.35	.2201 x 10 ⁻²
HBV	3	3.06	3.02	3.11	.1845 x 10 ⁻²
BR	4	2.19	2.14	2.23	.1939 x 10 ⁻²

TYPE MATERIAL (Fig. 157)

Holotype. Male, Deer Creek at Carendon Hot Springs, NW of Hailey, Blaine Co., Ida., 11-VII-59, S65-3321, (UID).

Paratypes (11). California. Alpine Co., Woodfords, VI-9-1960, F.E. Strong, (SUBLETTE), 1 male; Shasta Co., Hat Creek, Fall River Mills, 6-I-69, C. Apperson, (SUBLETTE), 1 male.

Colorado. Cameron Pass, 19-VIII-40, S64-3517, (INHS), 1 male; Ft. Collins, 21-IV-58, S66-2705, (KSU), 1 male. Montana. Yellowstone

Co., Yellowstone Riv. at Huntly, 8.VII.52, S64-3621A, (SUBLETTE),

1 male. Idaho. Blaine Co., Deer Cr. at Carendon Hot Spgs. NW of

Haily, 11-VII-69, S65-3323, 1 male; same data except S65-3327, 1 male (UID). Utah. Logan, 25-IX-43, G.F. Knowlton, S64-1346, (INHS), 1 male; same data except S64-1316, (INHS), 1 male; Vernal, light trap, G.F. Knowlton, 19-VII-41, S64-3045, (MINN), 1 male; Logan Canyon, light trap, 21-VII-45, G.F. Knowlton, S64-1294, (INHS), 1 male.

Orthocladus (Orthocladus) trigonolabis Edwards

Figs. 15d, e; 16, 33, 66, 78k, 90q, 158

Orthocladus trigonolabis Edwards, 1924, p. 170, fig. t. Sublette and Sublette, 1965, p. 157.

Orthocladus (s. str.) trigonolabis Edwards, Andersen, 1937, p. 64.

Brundin, 1956, p. 105, fig. 72. Oliver, 1962, p. 9.

Orthocladus aquilonaris Goethghebuer, 1940, p. 63, fig. 11, Brundin (1956) for synonym.

Trichocladus thienemanni Goethghebuer, Thienemann, 1941, p. 217, fig. 34.

Orthocladus (Orthocladus) trigonolabis (Edwards), Fittkau, Schlee, and Reiss, 1967, p. 362.

Orthocladus (Orthocladus) trigonolabis Edwards (aquilonaris Goethghebuer non Thienemann), Saether, 1968, p. 464.

Edwards (1924) described this species based on a male and female from northern Spitzbergen. He figured the male genitalia, but he did not designate a holotype. I have examined the type material, and I am designating the male as the lectotype and the female as the paralectotype.

Andersen (1937) included the male of O. trigonolabis in his key. Brundin (1956) provided an excellent figure of the

male genitalia of this species, based on his material from Sweden. Brundin (1956) synonymized O. aquilonaris Goethghebuer with O. trigonolabis, and pointed out that the pupa of O. trigonolabis was described under the name Trichocladius thienemanni Goethghebuer by Thienemann (1941). Based on the literature and specimens available to me, I agree with Brundin's interpretation. I have not examined the type specimen of O. aquilonaris. Unfortunately, Thienemann's (1941) description of the larva is incomplete, and I have not seen any larvae of this species.

Oliver (1962) summarized the northern distribution of O. trigonolabis and included this species in his key to adults.

Oliver recorded, for this species, that the vein R4+5 ends distal to the apex of vein Cul in the wing. However, O. trigonolabis is the only Orthocladius (Orthocladius) which has the vein R4+5 ending above or proximal to the apex of the vein Cul.

The high altitude specimens of O. trigonolabis from North America agree with characters of the lectotype male, except for the small spur of the mid tibia, which is more developed than that of the lectotype.

The adult male of O. trigonolabis is similar morphologically to members of the subgenus O. (Euorthocladius) in the rounded tip of the anal point, the biserial to multiserial scutellar setae, and the structure of the virga. The paralectotype female has biserial to multiserial scutellar setae, but I have been unable to determine whether the spermathecal ducts are straight as in O. (Orthocladius), or with a loop, as in O. (Euorthocladius). The pupa belongs to O. (Orthocladius). The female genitalia is figured

here for the first time.

Lectotype Male

Color. Dark brown; halteres golden; scutal stripes not distinct.

Length (mu). Thorax damaged; abdomen 3100.

Head. Femalelike. Interocular distance 350 mu. Temporals 11, verticals 11, postorbitals 0. A.R. 1.62. Antennal flagellomere lengths (mu): 1st-12th 1125, 13th 1825. Clypeus rectangular, with 14 setae. Palpal segment lengths (mu): 35, 70, 115, 120, 200.

Thorax. Anteprenotal lobe narrowed medially, not robust. Lateral anteprenotals 11, acrostichals 5, prealars 4, dorsocentrals 12, uniserial; scutellars 16, biserial to multiserial. Anapleural suture damaged. No mesonotal pit.

Wing. Length 2875 mu, width 800 mu. L/W.R. 3.59. Moderately punctate. Anal lobe slightly rounded, and not produced; femalelike. V.R. 1.00. Stem vein with 1 seta, R with 10, squama with 34. Costa not extended beyond R4+5, apex above apex of Cul. R2+3 ending about 1/3 distance between R1 and R4+5.

Legs. Hind tibial comb composed of 13 setae. Spines absent on fore leg, 2 on each of first two tarsal segments and 1 on third tarsal segment of mid leg, 2 on each of first two tarsal segments of hind leg. Spurs of mid tibia not equal in length and resemble those of the hind tibia (Fig. 15d).

Leg lengths (mu) and proportions:

	F	T	Ta1	Ta2	Ta3	Ta4	Ta5	L.R.	B.V.	S.V.
Fore	925	1125	750	450	325	200	150	0.66	2.48	2.73
Mid	950	975	450	275	225	150	150	0.46	2.95	4.27
Hind	1100	1225	650	375	275	175	150	0.53	2.79	3.19

Hypopygium (Figs. 16, 33). Gonocoxite length 290 μ , gonostylus length 110 μ . H.R. 2.63. Lateral margin of tergite IX with group of 14 setae. Anal point short, with rounded apex. Virga present. Basal median lobes of gonocoxite collarlike. Basal lobe with dorsal part short and wide, with posterior margin rounded, and ventral part extended clearly beyond dorsal part. Gonostylus with medial bump along dorsal edge, and medial bump on inner area.

Variation. The head is less femalelike in the material from Wyoming and New Mexico, and the shorter spur on the mid tibia is more developed than that in the lectotype (Fig. 15e). Wing finely punctate; apex of Costa-R4+5 ends slightly proximal to apex of Cul.

Remarks. The male of Orthocladus (O.) trigonalabis closely resembles the male of O. oliveri in hypopygial features; trigonalabis can be distinguished from oliveri by the presence of a virga, the shape of the gonostylus, and the shape of the mid tibial spurs.

O. trigonalabis Edwards

VARIABLE	SAMPLE SIZE	MEAN	RANGE		VARIANCE
			MIN	MAX	
WING	2	2400.00	2375.00	2425.00	.1250 x 10 ⁴
ARM	2	875.00	800.00	950.00	.1125 x 10 ⁵
AFCU	2	1025.00	975.00	1075.00	.5000 x 10 ⁴

VARIABLE	SAMPLE SIZE	MEAN	RANGE		VARIANCE
			MIN	MAX	
R	3	6.00	5.00	7.00	.1000 x 10 ¹
SQUM	3	27.33	22.00	33.00	.3033 x 10 ²
P1	3	35.00	35.00	35.00	.0000
P2	3	60.00	55.00	65.00	.2500 x 10 ²
P3	3	121.67	120.00	125.00	.8333 x 10 ¹
P4	3	118.33	110.00	125.00	.5833 x 10 ²
P5	3	166.67	150.00	185.00	.3083 x 10 ³
EYE	3	321.67	295.00	340.00	.5583 x 10 ³
VERT	3	12.00	12.00	12.00	.0000
ETM	3	0.00	0.00	0.00	.0000
CLYP	3	13.33	13.00	14.00	.3333 x 10 ⁰
PROL	3	7.67	6.00	9.00	.2333 x 10 ¹
AC	3	2.00	2.00	2.00	.0000
DC	3	6.67	6.00	7.00	.3333 x 10 ⁰
PA	3	4.00	4.00	4.00	.0000
SC	3	11.33	11.00	12.00	.3333 x 10 ⁰
ANSU	3	320.00	290.00	350.00	.9000 x 10 ³
ANT3	3	390.00	330.00	430.00	.2800 x 10 ⁴
ANTT	3	693.33	680.00	700.00	.1333 x 10 ³
BASI	3	256.67	250.00	260.00	.3333 x 10 ²
DISI	3	106.67	100.00	110.00	.3333 x 10 ²
FF	3	841.67	775.00	875.00	.3333 x 10 ⁴
FT	3	1000.00	875.00	1075.00	.1187 x 10 ⁵
FTA1	3	641.67	550.00	700.00	.6458 x 10 ⁴
FTA2	3	425.00	375.00	450.00	.1875 x 10 ⁴
FTA3	3	291.67	275.00	300.00	.2083 x 10 ³
FTA4	3	183.33	175.00	200.00	.2083 x 10 ³
FTA5	3	125.00	125.00	125.00	.0000
MF	3	841.67	825.00	875.00	.8333 x 10 ³
MT	3	891.67	825.00	975.00	.5833 x 10 ⁴
MTA1	3	425.00	400.00	450.00	.6250 x 10 ³
MTA2	2	275.00	275.00	275.00	.0000
MTA3	2	212.50	200.00	225.00	.3125 x 10 ³
MTA4	2	150.00	150.00	150.00	.0000

VARIABLE	SAMPLE SIZE	MEAN	RANGE		VARIANCE
			MIN	MAX	
MTA5	2	137.50	125.00	150.00	.3125 x 10 ³
HF	3	958.33	925.00	1000.00	.1458 x 10 ⁴
HT	3	1091.67	1025.00	1150.00	.3958 x 10 ⁴
HTA1	2	625.00	625.00	625.00	.0000
HTA2	2	350.00	350.00	350.00	.0000
HTA3	2	262.50	250.00	275.00	.3125 x 10 ³
HTA4	2	162.50	150.00	175.00	.3125 x 10 ³
HTA5	2	137.50	125.00	150.00	.3125 x 10 ³
COMB	3	10.67	9.00	12.00	.2333 x 10 ¹
TH	2	1212.50	1175.00	1250.00	.2812 x 10 ⁴
AB	3	2725.00	2675.00	2800.00	.4375 x 10 ⁴
WW	1	750.00	750.00	750.00	.0000
WR	1	3.23	3.23	3.23	.0000
BL	2	3900.00	3850.00	3950.00	.5000 x 10 ⁴
AR	3	1.80	1.58	2.12	.7976 x 10 ⁻¹
VR	2	1.17	1.13	1.22	.3799 x 10 ⁻²
HR	3	2.41	2.36	2.50	.6198 x 10 ⁻²
HV	2	3.72	3.59	3.85	.3356 x 10 ⁻¹
FLR	3	.64	.63	.65	.1306 x 10 ⁻³
FSV	3	2.88	2.79	3.00	.1204 x 10 ⁻¹
FBV	3	2.42	2.31	2.52	.1082 x 10 ⁻¹
MLR	3	.48	.46	.49	.1881 x 10 ⁻³
MSV	3	4.08	4.00	4.12	.4694 x 10 ⁻²
MBV	2	2.85	2.74	2.97	.2549 x 10 ⁻¹
HLR	2	.55	.54	.57	.3051 x 10 ⁻³
HSV	2	3.36	3.28	3.44	.1280 x 10 ⁻¹
HBV	2	2.99	2.81	3.17	.6324 x 10 ⁻¹
BR	2	2.22	2.16	2.28	.6797 x 10 ⁻²

Paralectotype Female

Color. Brown; halteres golden; scutal stripes not distinct.

Length (m_u). Body 3600, thorax 1325, abdomen 2275.

Head. Interocular distance 320 m_u. Temporals 12,

verticals 12, postorbitals 0. A.R. 0.56. Antennal flagellomere lengths ($m\mu$, Fig. 78k): 90, 55, 45, 50, 135. Clypeus large and rectangular, with 21 setae. Palpal segment lengths ($m\mu$): 36, 65, 110, 110, 175.

Thorax. Anteprenotal lobe narrowed as in male, and jutting out slightly medially. Lateral anteprenotals 9, acrostichals 7, prealars 5, dorsocentrals 8, uniserial; scutellars 15, biserial to multiserial. Anapleural suture length 300 $m\mu$. No mesonotal pit.

Wing. Length 2925 $m\mu$, width 1175 $m\mu$. L/W.R. 2.48. Moderately punctate. Anal lobe straight proximally, slightly rounded distally, and not produced. V.R. 1.00. Stem vein with 1 seta, R with 13, R1 with 4, R4+5 with 6, squama with 28. Costa not extended beyond R4+5, apex above apex of Cul. R2+3 ending about 1/3 distance between R1 and R4+5.

Legs. Hind tibial comb composed of 11 setae. Spines absent on fore leg, 2 on each of first two tarsal segments of mid and hind legs. Mid tibial spurs as in male.

Leg lengths ($m\mu$) and proportions:

	F	T	Ta1	Ta2	Ta3	Ta4	Ta5	L.R.	B.V.	S.V.
Fore	850	1000	625	400	250	150	125	0.62	2.67	2.96
Mid	900	925	400	250	175	125	100	0.43	3.42	4.56
Hind	1025	1150	650	400	275	150	150	0.56	2.89	3.34

Genitalia (Fig. 66). Lateral sternite IX with small posterior area rounded, produced posterolaterally; armed with bristlelike setae of equal length, and less than 15 present.

Tergite IX broad. Spermathecal duct wrinkled for most of length.

Remarks. The female of Orthocladus (O.) trigonolabis closely resembles the female of O. dorenius and O. clarkei in genitalic features; trigonolabis can be distinguished from them by the broad tergite IX, as well as the wing venation and the size of the mid tibial spurs.

Male Pupal Exuvia*

Color. Pale golden.

Length (mu). Body 3450, cephalothorax (lateral) 1150, abdomen 2300.

Cephalothorax. Setae obscured. Thoracic horn (Fig. 90q) small and slender with apex tapered, length 130 mu. Frontal tubercles not prominent. Anterior part of notum slightly wrinkled along eclosion line.

Abdomen. Anal lobe length 250 mu; narrowed, without spurs; longest anal seta 170 mu. A.L.R. 0.68. Pedes spurii B robust, present on segment II. Abdominal setae obscured.

Tergal spine patterns (composite). I: bare. II: elliptical patch posteromedial, with about 32 recurved spines in 3 rows; large patch of coarse spines anterior to recurved spines. III-V: large patch of coarse spines separated by bare line from rectangular patch of anteriorly-directed spines along posterior margin; bare bands laterally. VI: as in III-V, but with large patch reduced in size and without patch of anteriorly-directed spines. VII-IX: bare.

Sternal spine patterns (composite). In all specimens the sternites appearing bare, except for II, III: 2 well-spaced

*European material from Sweden, in poor condition.

patches of fine spines along anterior margin. VI: as in II, III, but with patch of fine spines along posterior margin medially.

Remarks. The pupa of Orthocladus (O.) trigonolabis closely resembles the pupa of O. charensis; it can be distinguished from charensis by the shape and size of the thoracic horn. It is probable that the spine patterns of the sternites will prove to be similar to those of other Orthocladus (O.) pupae.

ECOLOGY

Until Brundin (1956), O. trigonolabis was recorded only from high latitudes of Europe and North America. This species apparently occurs in the littoral of lakes.

MATERIAL EXAMINED (Fig. 158)

Lectotype. Male, Mert. Coll. Exp. 1923, N. Spitzbergen, Albert Dirkses B. Wijde Bay, A. 133, Aug. 16.1923, C.S. Elton, on boulders by F.W. Lake, 50 feet (BMNH). Paralectotype. Female, same data as lectotype except A. 132, Fly'q over Cassiope tundra, nr. F.W. Lake 50-70 feet (BMNH).

Colorado. Ft. Collins, 13-IV-58, J.E. Sublette, S66-2706, (KSU), 1 male. New Mexico. San Miguel Co., Sapello River, light trap, 28-VI-70, Gene Harrell, (SUBLETTE), 1 male. Northwest Territories. Richards Is., Kidluit Bay, 31-VII-1948, J.R. Vockeroth, (CNC), 1 male; Baker Lake, 10.VIII.1947, Coll. leg. T.N. Freeman, No. E, 74-1, (CNC), 1 male. Norway. Sta. 61, Bear Island Exped., 30.VIII.1957, Coll. Tromsø Museum, (CNC), 1 male. Sweden. Noulja, 5.VII.1958, D.R. Oliver, No. E. 53-6, (CNC), 1 male; same data except 5.VIII.1958, No. DRO E 53-6, 1 male; Abisko, 3.VII.1958, D.R. Oliver, E. 44-2, (CNC), 2 males; Tornetrask Lake, 3.VI.1958,

D.R. Oliver, (E42-3), (CNC), 3 male pupae. Utah. Coalville,
12-VI-54, G.F. Knowlton, S64-3359, (UKAN), 1 male. Wyoming. U. of
Wya., Kroger, Vial #1, (SUBLETTE), 1 male.

Orthocladus (Orthocladus) tryoni n. sp.*

Figs. 14b, e; 43, 90r, 104, 159

The pupal exuviae of this species, referred to as O.
(Orthocladus) sp. 4, were collected in Pennsylvania by Coffman
(1973, p. 311). The female and larva of O. tryoni are unknown.

Holotype Male

Color. Brown; halteres golden; scutal stripes distinct,
not merging posteriorly.

Length (mu). Thorax damaged; abdomen 2575.

Head. Interocular distance 210 mu. Temporals 12,
verticals 11, postorbitals 1. A.R. 1.73. Antennal flagellomere
lengths (mu): 1st-12th 1025, 13th 1775. Clypeus rectangular,
with 6 setae. Palpal segment lengths (mu): 30, 50, 165, 105,
190.

Thorax. Anteprenotal lobe narrowed medially. Lateral
anteprenotals 5, acrostichals 28, prealars 4, dorsocentrals 10,
uniseriate; scutellars 11, uniseriate. Anapleural suture length
310 mu. No mesonotal pit.

Wing. Length 2200 mu, width 650 mu. L/W.R. 3.38.
Moderately punctate. Anal lobe slightly rounded, and not produced
(Fig. 14e). Stem vein with 1 seta, R with 11, squama with 18.
Costa extended (Fig. 14b) beyond R4+5, apex well distal to apex of

*This species is named after the late Dr. C.A. Tryon of the
Pymatuning Laboratory of Ecology, Pennsylvania.

Cul. R2+3 ending about 1/3 distance between R1 and R4+5.

Legs. Hind tibial comb composed of 12 setae. Spines absent on fore leg, 2 on each of first two tarsal segments of mid and hind legs.

Leg lengths (mu) and proportions:

	F	T	Ta1	Ta2	Ta3	Ta4	Ta5	L.R.	B.V.	S.V.
Fore	850	1025	700	475	325	225	125	0.68	2.23	2.67
Mid	850	875	450	250	200	125	100	0.51	3.22	3.83
Hind	875	1050	600	350	275	200	125	0.57	2.65	3.20

Hypopygium (Fig. 43). Gonocoxite length 210 mu, gonostylus length 110 mu. H.R. 1.90. Lateral margin of tergite IX with group of 5 setae. Anal point long. Virga absent. Basal median lobes of gonocoxite collarlike. Basal lobe with dorsal part rounded, ventral part well extended below. Gonostylus flat, platelike.

Remarks. The male of Orthocladus (O.) tryoni closely resembles the male of O. annectens in hypopygial features; tryoni can be distinguished from annectens by the longer anal point, the more robust basal lobe of the hypopygium, and the different lengths of palpal segments 3 and 4.

O. tryoni n. sp.

VARIABLE	SAMPLE SIZE	MEAN	RANGE		VARIANCE
			MIN	MAX	
WING	20	2135.00	1625.00	2675.00	.5470 x 10 ⁵
ARM	20	793.75	625.00	975.00	.6439 x 10 ⁴
AFCU	20	915.00	700.00	1150.00	.9368 x 10 ⁴
R	20	9.80	6.00	13.00	.2905 x 10 ¹
SQUM	20	14.35	10.00	26.00	.2087 x 10 ²
PI	20	34.25	30.00	40.00	.1388 x 10 ²

VARIABLE	SAMPLE SIZE	MEAN	RANGE		VARIANCE
			MIN	MAX	
P2	20	53.75	45.00	65.00	.3125 x 10 ²
P3	20	156.00	135.00	195.00	.2095 x 10 ³
P4	19	115.26	95.00	140.00	.1180 x 10 ³
P5	20	179.25	150.00	220.00	.2955 x 10 ³
EYE	16	223.44	190.00	255.00	.2491 x 10 ³
VERT	18	11.50	8.00	15.00	.3676 x 10 ¹
ETM	14	1.07	0.00	2.00	.2253 x 10 ⁰
CLYP	18	6.00	5.00	8.00	.5882 x 10 ⁰
PROL	18	4.83	3.00	7.00	.1441 x 10 ¹
AC	20	24.70	18.00	31.00	.1506 x 10 ²
DC	20	10.30	6.00	17.00	.6010 x 10 ¹
PA	20	4.85	3.00	8.00	.1187 x 10 ¹
SC	19	10.21	7.00	13.00	.3731 x 10 ¹
ANSU	20	299.50	230.00	360.00	.9208 x 10 ³
ANT3	18	418.33	370.00	520.00	.1544 x 10 ⁴
ANTT	18	697.78	560.00	800.00	.3336 x 10 ⁴
BASI	20	222.50	200.00	280.00	.3039 x 10 ³
DISI	20	103.50	90.00	130.00	.6605 x 10 ²
FF	20	813.75	600.00	1000.00	.6939 x 10 ⁴
FT	20	995.00	775.00	1200.00	.8000 x 10 ⁴
FTA1	20	688.75	525.00	825.00	.3650 x 10 ⁴
FTA2	20	453.75	350.00	525.00	.1465 x 10 ⁴
FTA3	20	313.75	250.00	375.00	.8865 x 10 ³
FTA4	20	210.00	150.00	250.00	.4210 x 10 ³
FTA5	20	122.50	100.00	150.00	.2566 x 10 ³
MF	20	833.75	650.00	1000.00	.6465 x 10 ⁴
MT	20	853.75	650.00	1050.00	.7518 x 10 ⁴
MTA1	20	427.50	325.00	525.00	.1507 x 10 ⁴
MTA2	19	252.63	200.00	325.00	.1034 x 10 ⁴
MTA3	19	190.79	150.00	250.00	.5702 x 10 ³
MTA4	19	131.58	100.00	175.00	.3363 x 10 ³
MTA5	19	105.26	75.00	150.00	.2485 x 10 ³
HF	20	865.00	675.00	1075.00	.8776 x 10 ⁴
HT	20	1031.25	800.00	1250.00	.9465 x 10 ⁴

VARIABLE	SAMPLE SIZE	MEAN	RANGE		VARIANCE
			MIN	MAX	
HTA1	20	598.75	475.00	725.00	.2926 x 10 ⁴
HTA2	20	331.25	275.00	400.00	.1044 x 10 ⁴
HTA3	20	265.00	200.00	325.00	.9497 x 10 ³
HTA4	20	171.25	150.00	200.00	.3470 x 10 ³
HTA5	20	121.25	100.00	175.00	.4128 x 10 ³
COMB	20	10.60	10.00	13.00	.7789 x 10 ⁰
TH	8	1240.62	1100.00	1400.00	.1124 x 10 ⁵
AB	20	2532.50	2150.00	3550.00	.9086 x 10 ⁵
WW	20	648.75	475.00	850.00	.6018 x 10 ⁴
WR	20	3.30	2.96	3.65	.2602 x 10 ⁻¹
BL	8	3856.25	3250.00	4950.00	.2912 x 10 ⁶
AR	18	1.68	1.08	1.84	.4028 x 10 ⁻¹
VR	20	1.15	1.09	1.22	.1014 x 10 ⁻²
HR	20	2.15	1.91	2.40	.1787 x 10 ⁻¹
HV	8	3.65	3.30	4.95	.2976 x 10 ⁰
FLR	20	.69	.65	.72	.3697 x 10 ⁻³
FSV	20	2.63	2.48	2.75	.5301 x 10 ⁻²
FBV	20	2.27	2.17	2.42	.4157 x 10 ⁻²
MLR	20	.50	.45	.53	.3918 x 10 ⁻³
MSV	20	3.95	3.76	4.31	.2253 x 10 ⁻¹
MBV	19	3.13	2.80	3.37	.2446 x 10 ⁻¹
HLR	20	.58	.55	.62	.3326 x 10 ⁻³
HSV	20	3.17	3.00	3.42	.1151 x 10 ⁻¹
HBV	20	2.81	2.66	3.06	.1158 x 10 ⁻¹
BR	8	2.10	1.83	2.54	.4388 x 10 ⁻¹

Male Pupal Exuvia

Color. Brown.

Length (mm). Body 4500, cephalothorax 1450, abdomen

3050.

Cephalothorax. Setae: frontals 1; very weak; postorbital

1, humerals 3, lateral anteprenotals 1, median anteprenotals 2,

prealars 1, dorsocentrals 4. Thoracic horn (Fig. 90r) robust; tapered basally then same width throughout, with apex rounded, and densely covered with small, pointed spines, length 310 μ . Frontal tubercles not prominent. Anterior part of notum wrinkled, and slightly bumpy along eclosion line.

Abdomen. Anal lobe length 360 μ ; drawn into long narrow process (Fig. 104), with 2 right and 4 left spurs, innermost spurs clawlike; longest anal seta length 150 μ . A.L.R. 0.41. Pedes spurii B not well developed, present on segment II.

Setae present on segments I-VIII:

dorsals	1	5	5	5	5	5	5	1
laterals	1	2	3	3	3	3	3	4
ventrals	3	3	3	3	3	3	3	1

Tergal spine patterns. I: bare; Omm 0, Amm 0. II: elliptical patch posteromedial, with about 86 recurved spines in 4 rows; large patch of very coarse spines anterior to recurved spines; Omm 3, Amm 2. III-V: large patch of coarse spines as in II, separated by bare line from rectangular patch of anteriorly-directed spines along posterior margin; Omm 3, Amm 2 (III, IV); Omm 4, Amm 2 (V). VI: as in III-V, but with large patch reduced in size, and without patch of anteriorly-directed spines; Omm 3, Amm 2. VII: 2 well-spaced patches of fine spines along anterior margin; 2 well-spaced patches of coarse spines along posterior margin; Omm 3, Amm 2. VIII: 2 well-spaced patches of fine spines along anterior margin; Omm 0, Amm 0. IX: band of fine spines along anterior margin.

Sternal spine patterns. I: bare. II, III: band of

fine spines along anterior margin, continuous posteriorly as medial peak; bare bands laterally and posteriorly. IV: as in II, III, but with anterior band reduced in size, continuous with lateral bands reaching posterior margin. V, VI: 2 well-spaced patches of fine spines along anterior margin; band of fine spines with medial peak along posterior margin. VII: 2 well-spaced patches of fine spines along anterior margin; 2 well-spaced patches of coarse spines along posterior margin. VIII: 2 well-spaced patches of fine spines along anterior margin. IX: bare.

Variation. Area along eclosion line wrinkled. On tergite VII, the 2 dorsal setae are located more medially (L.C.).

Remarks. The pupa of Orthocladus (O.) tryoni closely resembles the pupa of O. obumbratus; it can be distinguished from obumbratus by the clawlike spur on the anal lobe, and the shape of the anal lobe.

ECOLOGY

The pupal exuviae of O. tryoni were collected from May to July, and in September in Pennsylvania (Coffman 1973). These data, and the material examined here, suggest that the emergence of this species is bivoltine.

TYPE MATERIAL (Fig. 159)

Holotype. Male, Hovland, Cook Co., Minn., Min. F.S., N.J. Mosquito Trap, Oct. 13-19, 1968; E.F. Cook, (MINN).

Paratypes-(31) Alabama. Jackson Co., Sheldon Cave, trap #224, 4-8.IV.67, S. Peck, (CNC), 1 male. Alaska. Palmer-Anchorage Hwy., jeep trap, 22 June 1964, K.M. Sommerman, (USNM), EC, 1 male. California. Mono Co.; nr. Sonora Pass, Elev. 8500',

18-VII-68, R.A. Hellenthal, (SUBLETTE), 1 male. Manitoba. Lake Winnipeg, Matheson Island, (L.T.), 32A, 5-VI-1969, Leg. S.S. Chang, No. 32A, (FRBW), 1 male; Lake Winnipeg, (L.T.), (FRBW), 1 male each: 20-mile creek, 1-IX-71, S.F. and N.H., 12X, 12Y; Aug. 26/71, E.J. and M.R., 58Q, 58GG. Maryland. Montgomery Co., Fairland, light trap, 23 June 1959, A.A. Hubert, (USNM), 1 male. Minnesota. Cook Co., Min. F.S., Hovland, N.J. Mosquito Trap, Oct. 13-19, 1968, E.F. Cook, (MINN), 1 male; same data except Sept. 23, 1968, E.F. Cook, (MINN), MH, 1 male; Koochiching Co., Min. F.S., Little Fk., N.J. Mosquito Trap, Oct. 6, 1969, E.F. Cook, (MINN), MH, 1 male; same data except Sept. 27, 1969, 2 males; Oct. 24, 1970, SES, 1 male; Houston Co., Beaver Crk., Valley St. Park, N.J. Mosquito Trap, Oct. 6, 1970, E.F. Cook, (MINN), SES, 1 male; Hubbard Co., Lower LaSalle Lake, N.J. Mosquito Trap, Sept. 23, 1968, E.F. Cook, (MINN), MH, 1 male. New Hampshire. Mt. Washington, Ammonoosuc R., 13-VI-1967, D.R. Oliver, No. DRO 40-13, (CNC), 1 male pupa. New York. Alleghany State Park, light trap, 28V-3VI, 1963, W.W. Wirth, (USNM), MLA, 1 male. Oregon. Washington Co., North Plains, light trap, 2 June 1963, K. Goeden, (USNM), HG, 2 males. Pennsylvania. Crawford Co., Linesville Cr., 18 June 68, Wm. Coffman, LCA42a, (PITT), 1 male; 4 May 71, L.C.P. #9, 1 pupal ex.; 23 Sept. 70, #8, 1 pupal ex.. Virginia. Falls Church, Holmes Run, light trap, 23. IV.1962, W.W. Wirth, (USNM), 2 males; same data except 17 Oct. 1960, 1 male; 23.IV.1962, CQ, 2 males; May 1962, LLn, 1 male. Wisconsin. Burnett Co., 11 mi. E, 4 mi. S. Siren, light by spring, 2 May 1968, Dean Hansen, (HANSEN), 1 male.

Orthocladus (Orthocladus) wiensi Saether

Figs. 6, 7, 56, 73, 781, 90s, ~~110~~, 143

Orthocladus (s. str.) wiensi Saether, 1969, p. 73, figs. 36, 37.

Orthocladus (Orthocladus) cf. wiensi, Coffman, 1973, p. 311.

(partim)

(non) Orthocladus wiensi Saether, Hudson, 1971, p. 167.

Saether (1969) described this species based on one reared male, and one male and two females with pupal exuviae, from Manitoba. The holotype male of O. wiensi is so similar in hypopygial features to the holotype male of O. manitobensis that Saether suggested that O. wiensi might be a variant of O. manitobensis. However, I have examined numerous specimens of O. manitobensis, and the male of this species is distinct from the male of O. wiensi. I feel that O. wiensi is one of the more difficult species of O. (Orthocladus) to identify. I have found that some males from Minnesota best fit this species.

Holotype Male

Color. Brown; halteres golden; scutal stripes distinct, merging posteriorly.

Length (mu). Body 3725, thorax 1050, abdomen 2675.

Head (Fig. 6). Interocular distance 245 mu. Temporals 17, verticals 14, postorbitals 3. A.R. 1.51. Antennal flagellomere lengths (mu): 1st-12th 975, 13th 1475. Clypeus rectangular, with 12 setae. Palpal segment lengths (mu): 40, 50, 100, 85, 135.

Thorax. Antep~~ronot~~al lobe wide medially, robust. Lateral antep~~ronot~~als 7, acrostichals 14, prealars 6, dorsocentrals 14, uniserial; scutellars 12, uniserial. Anapleural suture length 280 mu.

Indication of mesonotal pit.

Wing. Length 1875 μ , width 600 μ . L/W.R. 3.12.

Scarcely punctate. Anal lobe folded under, appears rounded and produced. V.R. 1.06. Stem vein with 1 seta, R with 5, squama with 17. Costa not extended beyond R4+5, apex well distal to apex of Cu1. R2+3 ending before midpoint of R1 and R4+5.

Legs. Hind tibial comb composed of 10 setae. Spines absent on fore leg, 2 on first tarsal segment and 1 on second tarsal segment of mid leg, 2 on first tarsal segment of hind leg.

Leg lengths (μ) and proportions:

	F	T	Ta1	Ta2	Ta3	Ta4	Ta5	L.R.	B.V.	S.V.
Fore	675	825	525	350	250	150	100	0.63	2.38	2.85
Mid.	675	700	350	250	175	100	100	0.50	2.76	3.92
Hind	725	825	475	300	200	100	125	0.57	2.79	3.26

Hypopygium (Fig. 56). Gonocoxite length 230 μ , gonostylus length 100 μ . H.R. 2.30. H.V. 3.72. Lateral margin of tergite IX with group of 6 setae. Anal point short. Virga present. Basal median lobes of gonocoxite triangular. Basal lobe with dorsal part short, rounded, with ventral part hidden below. Gonostylus flat, platelike.

Remarks. The male of Orthocladus (O.) wiensi closely resembles the male of O. manitobensis in hypopygial features; wiensi can be distinguished from manitobensis by the less well developed basal lobe of the gonocoxite, and the shape of the basal median lobes.

O. wiensi Saether

VARIABLE	SAMPLE SIZE	MEAN	RANGE		VARIANCE
			MIN	MAX	
WING	2	1925.00	1875.00	1975.00	.5000 x 10 ⁴
ARM	2	775.00	750.00	800.00	.1250 x 10 ⁴
AFCU	2	825.00	800.00	850.00	.1250 x 10 ⁴
R	2	5.50	5.00	6.00	.5000 x 10 ⁰
SQUM	2	19.00	17.00	21.00	.8000 x 10 ¹
P1	2	37.50	35.00	40.00	.1250 x 10 ²
P2	2	50.00	50.00	50.00	.0000
P3	2	102.50	100.00	105.00	.1250 x 10 ²
P4	2	85.00	85.00	85.00	.0000
P5	2	130.00	125.00	135.00	.5000 x 10 ²
EYE	2	257.50	245.00	270.00	.3125 x 10 ³
VERT	2	12.00	11.00	13.00	.2000 x 10 ¹
ETM	2	2.50	1.00	4.00	.4500 x 10 ¹
CLYP	2	11.50	11.00	12.00	.5000 x 10 ⁰
PROL	2	8.50	7.00	10.00	.4500 x 10 ¹
AC	2	14.50	14.00	15.00	.5000 x 10 ⁰
DC	2	13.00	12.00	14.00	.2000 x 10 ¹
PA	2	5.50	5.00	6.00	.5000 x 10 ⁰
SC	2	14.00	12.00	16.00	.8000 x 10 ¹
ANSU	2	275.00	270.00	280.00	.5000 x 10 ²
ANT3	2	390.00	390.00	390.00	.0000
ANTT	2	590.00	590.00	590.00	.0000
BASI	2	230.00	230.00	230.00	.0000
DISI	2	100.00	100.00	100.00	.0000
FF	2	687.50	675.00	700.00	.3125 x 10 ³
FT	2	825.00	825.00	825.00	.0000
FTA1	2	537.50	525.00	550.00	.3125 x 10 ³
FTA2	2	362.50	350.00	375.00	.3125 x 10 ³
FTA3	2	250.00	250.00	250.00	.0000
FTA4	2	162.50	150.00	175.00	.3125 x 10 ³
FTA5	2	100.00	100.00	100.00	.0000
MF	2	700.00	675.00	725.00	.1250 x 10 ⁴
MT	2	725.00	700.00	750.00	.1250 x 10 ⁴

VARIABLE	SAMPLE SIZE	MEAN	RANGE		VARIANCE
			MIN	MAX	
MTA1	2	350.00	350.00	350.00	.0000
MTA2	2	237.50	225.00	250.00	.3125 x 10 ³
MTA3	2	162.50	150.00	175.00	.3125 x 10 ³
MTA4	2	87.50	75.00	100.00	.3125 x 10 ³
MTA5	2	100.00	100.00	100.00	.0000
HF	2	737.50	725.00	750.00	.3125 x 10 ³
HT	2	850.00	825.00	875.00	.1250 x 10 ⁴
HTA1	2	475.00	475.00	475.00	.0000
HTA2	2	300.00	300.00	300.00	.0000
HTA3	2	212.50	200.00	225.00	.3125 x 10 ³
HTA4	2	100.00	100.00	100.00	.0000
HTA5	2	125.00	125.00	125.00	.0000
COMB	2	10.00	10.00	10.00	.0000
TH	2	1062.50	1050.00	1075.00	.3125 x 10 ³
AB	2	2537.50	2400.00	2675.00	.3781 x 10 ⁵
WW	2	612.50	600.00	625.00	.3125 x 10 ³
WR	2	3.14	3.12	3.16	.6125 x 10 ⁻³
BL	2	3600.00	3475.00	3725.00	.3125 x 10 ⁵
AR	2	1.51	1.51	1.51	.0000
VR	2	1.06	1.06	1.07	.8672 x 10 ⁻⁵
HR	2	2.30	2.30	2.30	.0000
HV	2	3.60	3.47	3.72	.3125 x 10 ⁻¹
FLR	2	.65	.64	.67	.4591 x 10 ⁻³
FSV	2	2.81	2.77	2.86	.3563 x 10 ⁻²
FBV	2	2.34	2.30	2.38	.2949 x 10 ⁻²
MLR	2	.48	.47	.50	.5556 x 10 ⁻³
MSV	2	4.07	3.93	4.21	.4082 x 10 ⁻¹
MBV	2	3.04	2.76	3.32	.1558 x 10 ⁰
HLR	2	.56	.54	.57	.5412 x 10 ⁻³
HSV	2	3.34	3.26	3.42	.1246 x 10 ⁻¹
HBV	2	2.80	2.79	2.80	.2372 x 10 ⁻⁴
BR	2	2.39	2.23	2.55	.4963 x 10 ⁻¹

Allotype Female

Color. Brown; halteres golden; scutal stripes distinct, not merging posteriorly.

Length (mu). Body 3325, thorax 1150, abdomen 2175.

Head (Fig. 7). Interocular distance 265 mu. Temporals 11, verticals 10, postorbitals 1. A.R. 0.54. Antennal flagellomere lengths (mu, Fig. 781): 75, 40, 45, 45, 115. Clypeus large and rectangular, with 12 setae. Palpal segment lengths (mu): 30, 50, 95, 80, 140.

Thorax. Anteprenotum wide medially, robust, but not as robust as in male. Lateral anteprenotals 10, acrostichals 13, prealars 4, dorsocentrals 11, uniserial; scutellars 10, uniserial. Anapleural suture length 240 mu. Mesonotal pit as in O. oliveri.

Wing. Length 2000 mu, width 700 mu. L/W.R. 2.85. Moderately punctate. Anal lobe straight proximally, slightly rounded distally, and not produced. V.R. 1.06. Stem vein with 1 seta, R with 13, R1 with 9, R4+5 with 5, squama with 18. Costa extended beyond R4+5, apex slightly distal to apex of Cul. R2+3 ending about 1/4 distance between R1 and R4+5.

Legs. Hind tibial comb composed of 10 setae. Spines absent on fore leg, 2 on each of first two tarsal segments of mid leg, 2 on first tarsal segment of hind leg.

Leg lengths (mu) and proportions:

	F	T	Ta1	Ta2	Ta3	Ta4	Ta5	L.R.	B.V.	S.V.
Fore	625	750	475	325	200	125	100	0.63	2.46	2.89
Mid	650	675	325	200	175	100	100	0.48	2.86	4.07
Hind	700	825	425	250	175	100	125	0.51	3.00	3.58

Genitalia (Fig. 73). Lateral sternite IX with posterior margin rounded, produced ball-shaped posterolaterally; few long setae dorsally, shorter, stiff setae ventrally. Tergite IX narrow. Spermathecal duct wrinkled distally.

Remarks. The female of Orthocladus (O.) wiensi closely resembles the female of O. mallochi in genitalic features; wiensi can be distinguished from mallochi by the smaller size and the ball-shaped margin of lateral sternite IX.

Holotype Pupal Exuvia

Color. Brown.

Length (mm). Body 4375, cephalothorax 1375, abdomen 3000.

Cephalothorax. Setae: frontals 1, robust; postorbitals 1, humerals 3, lateral anteprenotals 1, median anteprenotals 2, prealars 1, dorsocentrals 4. Thoracic horn (Fig. 90s) robust, same width throughout and apex pointed, sparsely covered with poorly developed spines, length 340 mm. Frontal tubercles not prominent. Anterior part of notum wrinkled along eclosion line.

Abdomen. Anal lobe length 290 mm; moderately developed, with 23 right and 2 left spurs; spurs weakly developed; longest anal seta length 175 mm. A.L.R. 0.60. Pedes spurii B moderately developed, present on segment II.

Setae present on segments I-VIII:

dorsals	4	4	4	5	5	5	5	1
laterals	1	3	3	3	3	3	4	4
ventrals	0	3	3	3	2	3	3	1

Tergal spine patterns (composite). I: bare; Omm 2, Ann 0. II: elliptical patch posteromedial, with about 47 recurved

spines in 3 rows; large patch of coarse spines anterior to recurved spines; Omm 4, Ann 0. III-V: large patch of coarse spines separated by bare line from rectangular patch of anteriorly-directed spines along posterior margin; bare bands laterally; Omm 3, Ann 2 (III, IV); Omm 4, Ann 2 (V). VI: as in III-V, but with large patch reduced in size and without patch of anteriorly-directed spines; Omm 3, Ann 2. VII: band of fine spines along anterior margin, continuous with 2 well-spaced bands reaching posterior margin; Omm 2, Ann 2. VIII: band of fine spines along anterior margin; patch of fine spines along posterior margin medially; Omm 0, Ann 0. IX: band of fine spines along anterior margin.

Sternal spine patterns (composite). I: bare. II: band of fine spines along anterior margin continuous with narrow lateral bands reaching posterior margin. III, IV: 2 well-spaced patches of fine spines along anterior margin, continuous with wide lateral bands reaching posterior margin. V: 2 well-spaced patches of fine spines along anterior margin; small patch of fine spines along posterior margin medially. VI: as in V, but with medial patch larger. VII, VIII: 2 well-spaced patches of fine spines along anterior margin. IX: bare.

Variation. Thoracic horn densely covered with moderately developed, scalelike spines.

Remarks. The pupa of Orthoeladius (O.) wiensi closely resembles the pupa of O. obumbratus; it can be distinguished from obumbratus by the robust frontal setae and the weak spurs of the anal lobe.

4

1.0

1.1

1.25

1.4

1.6

1.8
2.0
2.2
2.5
2.8
3.2
3.6
4.0

2.8

2.5

3.2

2.2

3.6

2.0

4.0

1.8

MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS
STANDARD REFERENCE MATERIAL 1010a
(ANSI and ISO TEST CHART No. 2)

Holotype Larval Exuvia

Head. Labial plate (Fig. 143a) convex; broad median tooth extended anteriorly, beyond first laterals; paralabials long and prominent. Mandible (Fig. 143b) with outer margin strongly crenulate, with distinct notch opposite 4th tooth; brush with 7 setae. Epipharynx (Fig. 113a) with 8 chaetulae laterales, 2 chaetulae basales, and 3 spinules. Premandible distorted, appears simple, with preapical notch. A.R. 2.24. Antennal segment lengths (μm, Fig. 113b): 56, 15, 4, 3, 3; blade extended to tip of 3rd segment; Lauterborn organs weakly developed.

Remarks. The larva of O. (Orthocladus) wiensi closely resembles the larva of O. mallochi; it can be distinguished from mallochi by the weakly developed Lauterborn organs. I do not consider that the notch on the back of the mandible is a reliable species character in O. wiensi (cf. Saether 1969) since this notch occurs inconsistently in larvae of O. mallochi.

MATERIAL EXAMINED

Holotype. Male, with larval and pupal exuviae, break in beaver dam, current very rapid, tributary to south arm of Seine River, n.e. of Marchand, Man., 19.V.1967, A.L. Hamilton, A.P. Wiens, and B. Hominick, (CNC No. 9985). Allotype. Same data as holotype: Female, with pupal exuvia. Paratypes. Same data as holotype: 2 males, 1 female, each with pupal exuvia.

Minnesota. St. Louis Co., U. of M. Duluth, N.J. Mosquito Trap, June 5, 1968, E.F. Cook, (MINN), 1 male; Cook Co., Min. F.S., Hovland, N.J. Mosquito Trap, June 9, 1969, E.F. Cook, (MINN), 7 males; same data except Sept. 28, 1969, 1 male; Cook Co., 2 mi. N.

Hovland on U.S. 61, N.J. Mosquito Trap, August 24, 1970, E.F. Cook, (MINN), 1 male; same data except Sept. 21, 1970, 1 male; Kandiyohi Co., New London Fish Hat., N.J. Mosquito Trap, May 16, 1970, E.F. Cook, (MINN), 1 male.

Unassigned Species

Orthocladius bifasciatus Malloch

Orthocladius bifasciatus Malloch, 1918, p. 42. Frison, 1927, p. 173. Sublette and Sublette, 1965, p. 156. Sublette, 1970, p. 91, incertae sedis.

Hydrobaenus (Hydrobaenus) bifasciatus (Malloch), Johannsen, 1952, p. 22.

Malloch (1918) described this species based on a female from Illinois, and he did not designate a holotype. He noted that this was the first member of Orthocladius with conspicuously marked wings that he had seen. Frison (1927) listed a lectotype female and a paratype female for O. bifasciatus in his list of insect types in the Illinois Natural History Survey collection. Johannsen (1952) separated the female of O. bifasciatus in his key to adults on the basis of the wing markings and small size.

Sublette (1970) quoted Malloch's original description, and provided a more complete description of the lectotype female. In his diagnosis, Sublette placed O. bifasciatus as incertae sedis, instead of erecting a new genus for this species. He recognized the characters, such as bare eyes, elongate r-m, and sinuate Cul vein of the wing, which separate this species from members of the genera Diplocladius (Kieffer) Brundin and Nasuticladius Freeman. I have examined the pinned lectotype specimen, and I agree with

Sublette that O. bifasciatus is not the same species as O. clepsydrus. I do not consider either of these two species as belonging to the genus Orthocladus, primarily because of the wing markings. I think that Sublette was justified in placing this species in incertae sedis.

Orthocladus clepsydrus Coquillett

Orthocladus clepsydrus Coquillett, 1902, p. 92. Johannsen, 1905, p. 283. Sublette and Sublette, 1965, p. 156. Sublette, 1966, p. 588, fig. 6. (incertae sedis).

Hydrobaenus clepsydrus (Coquillett), Cole, 1969, p. 101.

Coquillett (1902) described this species based on a single female from New Mexico. Johannsen (1905) reproduced Coquillett's original description. Sublette (1966) quoted the original description, and provided a more complete description of the holotype female which included a figure of the wing. Sublette stated that this species appears to belong to the subgenus Orthocladus (Orthocladus), but that its generic position is somewhat doubtful because only the female specimen is available.

I have examined the pinned holotype specimen, and it is not a member of the genus Orthocladus, primarily because of the wing markings and the small size. With the lack of associated immature stages or the male adult, I treat O. clepsydrus as incertae sedis, instead of placing it in a particular genus without good reasons.

Orthocladus (Orthocladus)? currani Sublette

Orthocladus (s.s.) currani Sublette, 1967a, p. 315, fig. 7.

Sublette (1967a) described this species based on a single misidentified paratype male of Camptocladus nerius Curran from

New York. I have examined the holotype male, and the specimen does not quite fit his description in two characters. The color of the slide-mounted specimen is brown, not yellow; and, I do not consider that the anal lobe of the wing is well developed for a species of O. (Orthocladus). Unfortunately, the slide mount of the holotype genitalia has not been located. Sublette (1967a) provided a figure of the distorted holotype genitalia by a drawing reconstruction. However, the characters that I consider important for species recognition, such as the virga and basal median lobes of the gonocoxite, are not represented in this figure. I have not found any males of O. currani in the material available to me. Consequently, I have not included this species in the key to adult males of O. (Orthocladus).

In a table, Sublette (1967a) compared certain characters of the male of O. currani with those in the males of O. carlatus, O. dorenius, and O. paradorenius (= obumbratus). Later, Sublette (1970) did not include O. currani in his "obumbratus group", which included the above species as well as O. obumbratus, O. mallochi, and O. nigrinus.

Orthocladus (Orthocladus) decoratus (Holmgren)

Chironomus decoratus Holmgren, 1869, p. 43.

Orthocladus decoratus (Holmgren), Kertész, 1902, p. 217. Edwards, 1924, p. 169. Remy, 1928, p. 52. Goethghebuer, 1933, p. 26, fig. 11. Sublette and Sublette, 1965, p. 156.

Orthocladus festivus (Holmgren), Edwards, 1922, p. 207, fig. 6.

(partim)

Spaniotoma (Orthocladus) decoratus (Holmgren), Edwards, 1935a, p. 538.

Orthocladius (s. str.) decoratus (Holmgren), Andersen, 1937, p. 64.

Brundin, 1956, p. 104, fig. 68. Saether, 1969, p. 69.

Orthocladius (Orthocladius) decoratus (Holmgren), Fittkau, Schlee,

and Reiss, 1967, p. 362. Henriksen, 1939, p. 75.

(non) Orthocladius decoratus (Holmgren), Edwards, 1922, p. 207.

(non) Orthocladius (s.s.) decoratus (Holmgren), Oliver 1962, p. 8.

Oliver, 1963, p. 177. Oliver and Danks, 1972, p. 1415.

Holmgren (1869) described this species under the name Chironomus decoratus based on one female and two males from Spitzbergen. He recorded this species as rare, and did not designate a holotype. Edwards (1922) identified a single female from Spitzbergen as O. decoratus, and in the same paper he gave a figure of the male genitalia of a specimen he identified as O. festivus. Later, Edwards (1924) examined the type material of O. decoratus, and found that the female was O. petraeus. The female from Spitzbergen that Edwards (1922) identified as O. decoratus was also O. petraeus. Edwards (1924) concluded that the figure he provided for the male of O. festivus (Edwards 1922, fig. 6) correctly represented the genitalia of one of the males of O. decoratus in Holmgren's type material. Edwards did not designate a lectotype.

This figure by Edwards (1922, fig. 6) served as the only available genitalic representation of O. decoratus until Goethghebuer (1933) provided a figure based on his own material from eastern Greenland. Most probably, Goethghebuer did not examine the type material. However, Goethghebuer's figure differs slightly from that of Edwards (1922, fig. 6) in the shape of the basal lobe of

the gonocoxite. In his diagnosis of O. decoratus, Goethghebuer (1933) included characters other than those based on the hypopygium, i.e. the strongly produced anal lobe of the wing, the A.R., and the F.L.R.. Andersen (1937) included O. decoratus in his key. —

Brundin (1956) convinced himself of the identity of O. decoratus after examining the original type material of Holmgren. The figure Brundin gave (fig. 68) of the male genitalia of this species, however, was based on his own material from Sweden. This figure agrees closely with that provided by Goethghebuer (1933). Unfortunately, Brundin did not give any information about the type material, and he did not designate a lectotype. The only character other than those of the hypopygium that Brundin mentioned was the A.R., based on his own material from Sweden, which agrees with that given by Goethghebuer (1933). However, it is not clear that Goethghebuer's diagnosis agrees with the type material in other details.

Oliver (1962) recorded O. decoratus from Bear Island and summarized the northern distribution of this species. In his key to species of Bear Island, Oliver (1962) distinguished O. decoratus from O. consobrinus on the basis of O. decoratus not having a strongly produced anal lobe of the wing. Although this character serves to separate these two species, O. decoratus has a strongly produced anal lobe of the wing for an O. (Orthocladus).

I have examined the specimens from Hazen Camp which Oliver (1963) identified as O. decoratus. These males have a strongly produced anal lobe of the wing, and the genitalia agree with that figured by Edwards (1922). However, I have also examined specimens

from Waterton Lakes Townsite, Alberta, identified by Saether (1969) as O. decoratus. These males have a less strongly produced anal lobe of the wing, and the genitalia agree with that figured by Brundin (1956).

This suggests that Edwards (1922) and Brundin (1956) have treated different species. An examination of Holmgren's original material is needed before the definition of O. decoratus can be clearly established.

Orthocladus glacialis Kieffer

Orthocladus glacialis Kieffer, 1922, p. 15. Sublette and Sublette, 1965, p. 156.

Orthocladus (s. str.) glacialis Kieffer, Andersen, 1937, p. 64.

"Orthocladus" glacialis Kieffer, Fittkau, Schlee, and Reiss, 1967, p. 362.

Kieffer (1922) described this species based on a male from Novaya Zemlya, and he did not give a figure. Andersen (1937) included O. glacialis in his key, using the characters in the original description. Sublette and Sublette (1965) recorded this species from North America, and Fittkau, Schlee, and Reiss (1967) recorded this species from Europe. I have not examined the type material. Oliver (pers. comm.) examined the type material, and thought it to be O. decoratus. Since O. decoratus is in question, I am leaving both names as unassigned.

Orthocladus nanseni Kieffer nomen dubium

Orthocladus nanseni Kieffer, 1926, p. 84. (nomen dubium)

Sublette and Sublette, 1965, p. 156.

5 Orthocladus (s. str.) nanseni Kieffer, Andersen, 1937, p. 63.

Kieffer (1926) described this species based on a female from Greenland. No figure was given, and the original description is incomplete. Andersen (1937) included O. nanseni in his key to adults, based on the original description of Kieffer (1926). It is surprising that Henriksen (1939) did not include O. nanseni in the list of chironomids from Greenland, although he did cite Kieffer's paper. The holotype specimen is missing (pers. comm. D.R. Oliver; Dr. Lillehammer of University of Oslo). To my knowledge, no other type material of O. nanseni exists. Because the original description does not provide an adequate definition of this species, I consider O. nanseni a nomen dubium.

Orthocladus sordens Johannsen nomen dubium

Orthocladus sordens Johannsen, 1905, p. 272, pl. 30, fig. 5.

Johannsen, 1908, p. 284. Sublette, 1967b, p. 500, nomen dubium.

Spaniotoma (Eukiefferiella) sordens (Johannsen), Johannsen, 1937, p. 72.

Hydrobaenus (Eukiefferiella) sordens (Johannsen), Johannsen, 1952, p. 20.

Eukiefferiella sordens (Johannsen), Roback, 1957a, p. 92, figs. 280, 281.

Nanocladus sordens (Johannsen), Dendy and Sublette, 1959, p. 513.

Eukiefferiella? sordens (Johannsen), Sublette, 1964, p. 121.

Nanocladus sordens (Johannsen), Sublette and Sublette, 1965, p. 155.

I do not consider the female of O. sordens as belonging to the genus Orthocladus, primarily on the basis of the wings.

I agree with Sublette (1967b) that this species should be considered a nomen dubium.

VARIATION AND CORRELATION

The recognition of species of Orthocladus has been based primarily on genitalic features of adult males. However, descriptions of species which include detailed accounts of quantitative characters of adults are common in the literature on chironomids (Sublette 1965, 1967a, 1967b, 1970; Saether 1969; Oliver 1970; Hansen 1973). The question arises as to how these quantitative characters (counts, measurements, and ratios) are useful in the recognition of a species, and therefore 65 commonly used characters in the male were investigated to assess their taxonomic value. These 65 characters do not include the genitalic characters used for the identification of species. An explanation of the abbreviations of the characters used are given in Appendix 1, and data concerning the populations of O. obumbratus and O. oliveri are given in Appendix 2.

Variation

A reliable taxonomic character should be one that is relatively non-variable. With this basic premise in mind, the study of variation of characters in Orthocladus is discussed below.

The characters in which the maximum and minimum variance occur within a species are given for 24 species of O. (Orthocladus) (Table I) and for the 4 subgenera of Orthocladus (Table II).

In almost all species and in all subgenera, the maximum variance occurs in the measurement of the body length. This may be partly due to the error in obtaining a precise measurement, and to the fact that measurements of larger structures, such as the body length, vary more than those in smaller structures. If only the

species containing more than 20 specimens are considered (Table I), the minimum variance occurs most frequently in the M.L.R.. These data are concordant with those found by Paasivirta (1972).

The trend of the variance of the investigated characters in O. (Orthocladius) is given in Table III. The trend that occurs from the maximum to the minimum variance follows the order of: measurements of large structures, measurements of small structures, counts, and ratios. Counts are more accurately observed than measurements because counts depend on the presence or absence of structures. This could explain the lower variance found in the counts. The minimum variance of ratios is probably due to a dampening effect on the variance of the measurements involved in the ratios.

In the literature of chironomid taxonomy, the variation of a character is usually expressed by giving the range and mean of the characters. However, the range does not adequately reflect the variation that occurs in nature since this value represents the variation found only within the specimens examined. As new material becomes available, the variation is bound to increase, and hence this leads to guesswork in the identification of species.

Several investigators of chironomids have expressed the variation in terms of percentages calculated in various ways (Townes 1945, 1952; Schlee 1968a, b). Some of these percentages are inadequate since they are based on the range. Lindeberg (1967) found that in sibling species of the Tanytarsus lestagei aggregate, a variation* of 12% in the F.L.R. (based on a large sample size)

$$\text{*variation} = \frac{\text{difference in range}}{\text{mean}}$$

was a good measure of variation within a species. Using this value, Lindeberg sorted mixed samples of Tanytarsus containing more than a single species. The variation, expressed as a percentage, is given for the F.L.R. in species of O. (Orthocladius) (Table IV). Most species, as well as a few populations representing swarm samples of O. oliveri (BF, BL, BR) have a variation higher than 12%. This suggests that, although the 12% level may be a good indicator of variation within each of the species that Lindeberg (1967) investigated, this value is not practical in segregating species of O. (Orthocladius).

In order to compare the variation in different species of chironomids, the coefficient of variability* (CV or V) should be used (cf. Simpson, Roe and Lewontin 1960, p. 90). Few workers on chironomids have expressed the variation in this manner (Lindeberg 1967; Botnariuc et al 1969). Lindeberg (1967) found that the V value of the F.L.R. was useful for the separation of sibling species of the Tanytarsus lestagei aggregate.

The V values for the wing length, the A.R., and the F.L.R. are given for 10 species and 9 populations of two species of O. (Orthocladius) in Table V. These data are concordant with those data reported for asynchronous and sympatric swarms of Cricotopus silvestris Fab. (Botnariuc et al 1969, p. 369). However, these V values of the F.L.R. are higher than those reported in sympatric and synchronous swarms of Tanytarsus palmeni Lind. (Lindeberg 1967, p. 62) and of Cricotopus silvestris Fab. (Botnariuc et al 1969, p. 364). The V values for O. lapponicus and O. tryoni are concordant

* $V = \frac{100s}{\bar{X}}$ where s is the standard deviation and $\bar{X}$ is the mean
(Simpson, Roe and Lewontin 1960, p. 90)

with those values for synchronous and sympatric swarms, and the V value for a swarm sample of O. oliveri (BF) is much higher than the latter. The V values of the species O. obumbratus and O. oliveri are higher than most of the V values of the corresponding populations since nonhomogeneous samples generally have higher V values (Simpson, Roe, and Lewontin 1960, p. 91).

These results suggest that the variation within the species, as shown by samples of asynchronous and sympatric swarms, is similar to the variation found in samples from museum collections which are comprised of specimens from different dates and localities.

Several chironomid workers (Lindeberg 1967; Schlee 1968a; Botnariuc et al 1969; Rosenberg 1971; Paasivirta 1973) have found statistically significant differences in comparable characters from different samples of the same species, but these differences are not taxonomically significant. This suggests that the separation of species in chironomid taxonomy cannot always be accomplished with this type of statistical analysis, and that more sophisticated analysis must be employed in the future.

In conclusion, the majority of quantitative characters investigated here are highly variable, and generally these characters are not useful in the separation of species. However, it is possible that with more sophisticated statistical techniques, species or more probably species groups can be separated by using a combination of these characters. The results of this study agree with those of Schlee (1968a, b) which suggest that species recognition of chironomids must rely primarily on less variable characters found in the male genitalia.

Correlation

A study of the correlations between characters was undertaken to determine if these results would be useful in chironomid taxonomy. Reported correlations, either calculated or inferred without calculation, are not uncommon in the literature of chironomid taxonomy (Townes 1945, 1952; Fittkau 1962; Brundin 1965; Hashimoto 1968; Lindeberg 1967; Schlee 1968b; Botnariuc et al 1969; Rosenberg 1971; Paasivirta 1972). The correlation coefficients presented here were calculated from the same data as that used in the study of variation of characters, i.e. adult males of Orthocladius.

There are two important points to consider in interpreting the results on correlations presented here. First, the probability levels of the correlations depend on the assumption of normally distributed multivariate data. Due to the relatively small sample size, this assumption cannot be tested. However, graphing the data indicates that in all cases under consideration, there is a linear relationship between the variables (characters). This supports the use of correlation as a measure of the interrelationship of the variables.

Second, within a species the several tests of significance of the correlations are not independent, since the several correlations that were calculated are not independent. Therefore, care must be taken not to make any simultaneous inferences on the probabilities of the correlations within a species. For example, the level at which the A.R. is correlated with the wing length, and that at which the A.R. is correlated with the body length, is not at the same level at which the A.R. is correlated with the wing

length and the body length.

The probability levels for ratios are not as reliable as those for measurements and counts of structures. These ratios are studied here because of their wide usage in the taxonomy of chironomids.

The ad hoc approach of plotting mean values of the variables for individual species was used in considering the interrelationships over species, since there is no available statistical method to handle this (pers. comm. B. Reiser).

In the light of these considerations, the probability levels given in the tables should be considered as indicators of the correlations.

Wings

The wing length has been used as an indicator of body size in chironomids (Townes 1945, 1952; Fittkau 1962; Lindeberg 1967; Botnariuc et al 1969; Klötzli et al 1972; Paasivirta 1972). The correlations between the wing length and the body length are given for the subgenera of Orthocladius (Table VI), species of O. (Orthocladius) (Table VIIa), and populations of two species of O. (Orthocladius) (Table VIIIa). The highly positive correlations between the wing length and the body length in nearly all cases under consideration indicate that in Orthocladius, larger individuals have larger wings.

In a regression analysis using the wing length as the standard variable to predict body size (length), the reduction in the percentage sum of squares was 77%. These results indicate that the wing length cannot be used to predict the body size (length).

However, based on the above correlations, the wing length can be considered as an indicator of body size.

Brundin (1965, p. 76) found, without providing a statistical analysis, that within the Podonominae, genera containing larger (body size) species generally have narrower wings than genera containing smaller (body size) species. He also suggested that the corresponding correlation exists at the interspecific level within the genera. The correlations between the wing width and the wing length, and that between the wing width and the body length are given in Tables VI-VIII. The highly positive correlations indicate that in Orthocladus, as wings get longer they tend to become wider. If the wing length is considered as an indicator of body size (length), it can be said that in Orthocladus, there is a tendency for larger individuals to have wider wings, and smaller individuals to have narrower wings. The nearly straight line obtained (Fig. 160) supports this generalization at the interspecific level, which differs from Brundin's (1965) findings.

Anapleural Suture

I suspected that the length of the anapleural suture could be used as an indicator of the body size (length) in Orthocladus. The correlations between the anapleural suture length and the wing length, and that between the anapleural suture length and the body length are given in Tables VI-VIII. The positive correlations indicate that, in Orthocladus, as the body becomes longer, the anapleural suture gets longer. The line obtained (Fig. 161), although not as straight as that in Fig. 160, supports this generalization at the interspecific level.

In a regression analysis using the length of the anapleural suture as the standard variable to predict the body size (length), the reduction in the percentage sum of squares was 75%. These results indicate that the length of the anapleural suture cannot be used to predict the body length. However, based on the above correlations, the anapleural suture length can be considered to be an indicator of the body size (length) in Orthocladius. However, this is apparently not true of other chironomids (Brundin 1956; Schlee 1968; Hansen 1973).

A.R.

Conflicting reports with regard to the relationship of the A.R. to the body length or to the wing length have been given in the literature of chironomids. Most of these studies reported a positive correlation between these variables (Townes 1945, 1952; Botnariuc et al 1969; Paasivirta 1972), while in other studies no correlations between these variables were found (Hashimoto 1968) or both negative and positive correlations were found (Rosenberg 1971).

The correlations between the A.R. and the wing length, and that between the A.R. and the body length are given in Tables VI-VIII. Many of the correlations are positive, and some are negative. In the majority of cases, no correlation exists. There is no trend indicated between the A.R. and the wing length (Fig. 162) at the interspecific level.

However, if the correlations between the length of the basal flagellomeres (ANT3) and the wing length, and that between the length of the apical flagellomere (ANTT) and the wing length

are examined (Tables VI-VIII), a different picture emerges. The highly positive correlations between the length of the apical flagellomere and the body length, and that between the length of the apical flagellomere and the wing length indicate that, in Orthocladus, larger individuals tend to have longer apical flagellomeres. The nearly straight line obtained (Fig. 163) supports this generalization at the interspecific level. However, only in a few species can the correlations between the length of the basal flagellomeres and the wing length be considered high; in most cases, no correlation between these two variables exists. There is no indication of a relationship (Fig. 163) at the interspecific level. These results suggest that ratios made up of dependent variables should not be used in the study of correlation.

F.L.R.

In the literature of chironomids, there have been conflicting reports with regard to the relationship of the F.L.R. to the wing length. Negative correlations between these two variables were found in many works (Townes 1945, 1952; Lindeberg 1963; Fittkau 1962); in other studies no significant correlations were found (Vockeroth 1949; Botnariuc et al 1969; Paasivirta 1972); while in other works both negative and no correlations were found (Lindeberg 1967; Rosenberg 1971).

The correlations between the F.L.R. and the wing length, and that between the F.L.R. and the body length are given in Tables VI-VIII. Some of the correlations are negative and some are positive. In the majority of cases, no correlation exists. There is no trend indicated between the F.L.R. and the wing length

(Fig. 162) at the interspecific level. However, high correlations are seen consistently if the correlations between the fore tibia and the wing length, and that between the fore leg fore tarsus and the wing length are examined (Table VI-VIII). The highly positive correlations in most cases under consideration suggest that, in Orthocladus, larger individuals tend to have longer tibiae and longer fore tarsi of the fore leg. The nearly straight line obtained (Fig. 164) supports this generalization at the interspecific level. These results suggest again that ratios made up of dependent variables cannot be the objects of the study of correlation.

The correlations calculated here appear to provide insight into the value of characters of chironomid taxonomy. The question is how these correlations can occur. There have been several experiments reporting the effect of temperature on the body size of chironomids (Konstantinov 1958; Hashimoto 1968; Paasivirta 1972). In addition, several workers reported seasonal dimorphism in the body size, which is presumably linked with temperature (Reiss 1965; Lindeberg 1967; Hashimoto 1968; Schlee 1968a; Botnariuc et al 1969; Klötzli et al 1971; Rosenberg 1971; Paasivirta 1972; Hirvenoja 1973). In general, higher temperatures result in smaller body sizes, and lower temperatures result in larger body sizes.

Since several characters are correlated with the body size, it is possible that temperature also effects these characters while effecting the body size. There have been conflicting reports on the effects of temperature on the A.R. and on the F.L.R., (Lindeberg 1963, 1967; Reiss 1965; Schlee 1968a; Hashimoto 1968; Botnariuc et al 1969; Paasivirta 1972; Hirvenoja 1973). These are

probably attributed to the fact that these characters are ratios and not direct measurements. The effect of temperature on the body parts themselves should be investigated. No doubt other external factors, such as light, must influence the sizes of structures and hence the correlations. These factors should also be studied in the future.

Conclusion

A statistical investigation of 65 characters in the adult male was undertaken to assess their taxonomic value in the recognition of species of O. (Orthocladius). It is shown here that these characters are highly variable, that some characters vary more than others, and that a reliable estimate of the variation of characters can be obtained, with reasonable assurance, from the study of museum specimens.

In the comparison of variation between different species of chironomids, the coefficient of variability, not the range, should be used. The recognition of species of O. (Orthocladius) must rely primarily on characters found in the male genitalia. The results of this study also suggest that ratios cannot be the objects of the study of correlation, and that the correlations between the body parts themselves should be investigated as taxonomic characters. Further studies dealing with the effect of environmental conditions on the body structures are needed.

The results of this study are in many ways concordant with the results of comparable studies on other genera of chironomids.

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*indicates paper not seen.

Appendix 1

Explanation of Abbreviations Used in Statistical Analysis

AB	- length of abdomen
AC	- number of acrostichal setae
AFCU	- distance from arculus to crossvein fCu of wing
AR	- antennal ratio
ARM	- distance from arculus to crossvein rm of wing
ANSU	- length of anapleural suture
ANT3	- length of flagellomeres 1-12 of antenna
ANTT	- length of flagellomere 13 of antenna
BASI	- length of gonocoxite
BL	- length of body
BR	- body ratio: thorax length/abdomen length
COMB	- number of setae on hind tibial comb of leg
CLYP	- number of clypeal setae
DC	- number of dorsocentral setae
DISI	- length of gonostylus
ETM	- number of postorbital setae
EYE	- interocular distance
FBV	- ratio BV of fore leg
FF	- length of femur of fore leg
FLR	- ratio LR of fore leg
FSV	- ratio SV of fore leg
FT	- length of tibia of fore leg
FTA1	- length of first tarsal segment of fore leg
FTA2	- length of second tarsal segment of fore leg
FTA3	- length of third tarsal segment of fore leg
FTA4	- length of fourth tarsal segment of fore leg
FTA5	- length of fifth tarsal segment of fore leg
HBV	- ratio BV of hind leg
HF	- length of femur of hind leg
HLR	- ratio LR of hind leg
HR	- hypopygial ratio
HSV	- ratio SV of hind leg
HT	- length of tibia of hind leg

HTA1 - length of first tarsal segment of hind leg
HTA2 - length of second tarsal segment of hind leg
HTA3 - length of third tarsal segment of hind leg
HTA4 - length of fourth tarsal segment of hind leg
HTA5 - length of fifth tarsal segment of hind leg
HV - hypopygial value
MBV - ratio BV of mid leg
MF - length of femur of mid leg
MLR - ratio LR of mid leg
MSV - ratio SV of mid leg
MT - length of tibia of mid leg
MTA1 - length of first tarsal segment of mid leg
MTA2 - length of second tarsal segment of mid leg
MTA3 - length of third tarsal segment of mid leg
MTA4 - length of fourth tarsal segment of mid leg
MTA5 - length of fifth tarsal segment of mid leg
P1 - length of first palpal segment
P2 - length of second palpal segment
P3 - length of third palpal segment
P4 - length of fourth palpal segment
P5 - length of fifth palpal segment
PA - number of prealar setae
PROL - number of setae on lateral anteprepronotum
R - number of setae on vein R of wing
SC - number of scutellar setae
SQU - number of setae on squama
TH - length of thorax
VERT - number of vertical setae
VR - venarum ratio
WING - length of wing
WR - wing length/wing width ratio
WW - width of wing

Appendix 2

Populations In Statistical AnalysisO. obumbratus

H: Hart Memorial Woods, Mahomet, Illinois, 20.III.1966,
M.W. Sanderson (black light)

G: Gavins Point Dam, Yankton, South Dakota, April 30-May 6,
1969, P. Hudson (light trap)

MI: 2 mi. N Hovland on U.S. 61, Cook Co., Minnesota, April
30, 1970, E.F. Cook (N.J. Mosquito Trap)

O2: mixed localities and dates exclusive of above

O. oliveri

A: Ann Arbor, Michigan, 15.IV.1950, E.B. Hayden

HA: Hart Memorial Woods, Mahomet, Illinois, 1-2.IV.1967,
M.W. Sanderson (black light)

BF: Blanche River, 1 mile n. of Perkins, Quebec, 2.V.1971,
D.R. Oliver (swarm)

BL: same locality as BF, 22.V.1972, A.R. Soponis and B.T.
Kidd (swarm)

BR: same locality as BF, 30.IV.1973, A.R. Soponis and B.T.
Kidd (swarm)

Table I. Characters in which the maximum and minimum variance occur in species of Orthocladus (Orthocladus).

<u>Species</u>	<u>Maximum</u>	<u>n</u>	<u>Minimum</u>	<u>n</u>
<u>annectens</u>	AB	29	FLR	29
<u>appersoni</u>	BL	10	HLR	10
<u>carlatus</u>	BL	7	MLR	28
<u>charensis</u>	BL	33	MLR	33
<u>clarkei</u>	BL	6	MLR	8
<u>cooki</u>	AB*	17	MLR	17
<u>dentifer</u>	BL	2	MLR	25
<u>dorenus</u>	BL	6	FLR	27
<u>hazensis</u>	BL	9	HLR	10
<u>hellenthali</u>	BL	6	HLR	9
<u>knuthi</u>	BL	3	HLR	4
<u>lapponicus</u>	BL	26	FLR	26
<u>mallochi</u>	BL	9	WR	12
<u>manitobensis</u>	BL	16	MLR	39
<u>nigritus</u>	BL	9	HLR	13
<u>obumbratus</u>	BL	31	MLR	100
<u>oliveri</u>	BL	132	MLR	152
<u>paradecoratus</u>	BL	5	HLR	5
<u>robacki</u>	BL	5	HLR	6
<u>smolandicus</u>	AB*	2	AR	2
<u>subletti</u>	BL	4	MLR	4
<u>trigonolabis</u>	FT	2	FLR	2
<u>tryoni</u>	BL	8	HLR	20
<u>wiensi</u>	BL	2	VR	2

*body length not available

Table II. Characters in which maximum and minimum variance occur in the subgenera of Orthocladus

<u>Subgenus</u>	<u>Maximum</u>	<u>n</u>	<u>Minimum</u>	<u>n</u>
<u>Orthocladus</u>	BL	327	MLR	582
<u>Eudactylocladius</u>	BL	23	MLR	25
<u>Euorthocladus</u>	BL	44	HLR	49
<u>Pogonocladus</u>	BL	10	HLR	25

Table III. Arrangement of characters in order of amount of variance from maximum to minimum in Orthocladius (Orthocladius)

"Large measurements": BL, AB, WING, HT, HF, TH, AFCU, ARM, MT, FT, MF, FF

"Small measurements": ANTT, FTA1, WW, HTA1, MTA1, BASI, MTA2, FTA2, HTA2, ANSU, HTA3, FTA3, ANT3, MTA3, HTA4, EYE, FTA4, DISI, MTA4, P5, HTA5, P3, MTA5, FTA5, P4, P2

"Counts": SQUAMA, P1, AC, SC, CLYP, DC, PROL, VERT, R, ETM, COMB, PA

"Ratios": HV, AR, MSV, HSV, HR, WR, BR, MBV, FSV, HBV, FBV, VR, FLR, HLR, MLR

Table IV. Variation of the F.L.R. expressed as a percentage of the mean in some species and populations of Orthocladius (Orthocladius).

<u>Species</u>	<u>% Mean</u>
<u>annectens</u>	16.9
<u>carlatus</u>	32.8
<u>charensis</u>	26.5
<u>dentifer</u>	14.2
<u>dorenus</u>	14.3
<u>lapponicus</u>	7.6
<u>manitobensis</u>	37.8
<u>tryoni</u>	10.1
<u>obumbratus</u>	18.1
pop. H	18.1
pop. G	7.0
pop. M1	14.9
pop. O2	16.4
<u>oliveri</u>	45.7
pop. BF	34.3
pop. A	7.1
pop. HA	15.5
pop. BL	11.4
pop. BR	15.5

Table V. Coefficients of variability (V) in species of
O. (Orthocladus).

<u>Species</u>	<u>WL</u>	<u>AR</u>	<u>FLR</u>
<u>annectens</u>	10.84	8.64	3.65
<u>carlatus</u>	9.08	6.80	7.64
<u>charensis</u>	5.04	6.99	5.05
<u>dentifer</u>	6.65	1.29	3.74
<u>dorenus</u>	8.86	5.58	3.24
<u>lapponicus</u>	10.92	10.56	2.11
<u>manitobensis</u>	7.92	10.49	6.08
<u>tryoni</u>	10.95	11.98	2.78
<u>obumbratus</u>	11.95	10.38	3.55
pop. H	7.27	7.60	3.78
pop. G	8.58	10.19	2.28
pop. M1	4.32	6.94	3.34
pop. 02	11.75	11.28	3.88
<u>oliveri</u>	9.81	7.70	4.67
pop. A	5.35	7.76	1.92
pop. HA	6.38	3.74	3.47
pop. BF	4.10	5.44	6.20
pop. BL	4.42	5.02	2.70
pop. BR	4.29	4.76	3.07

Table VI. Correlations between variables in subgenera of Orthocladus

Variables	Orthocladus		Euorthocladus		Eudactylociadus		Pogonocladus	
	Correlation	Sample Size	Correlation	Sample Size	Correlation	Sample Size	Correlation	Sample Size
WL-BL	.911***	317	.911***	44	.935***	23	.929***	9
WM-WL	.945***	554	.945***	47	.941***	25	.943***	20
WM-BL	.831***	307	.877***	40	.911***	23	.916***	8
ANSU-WL	.871***	566	.708**	51	.945**	25	.914**	20
ANSU-BL	.915***	326	.843**	44	.940**	23	.834*	10
AR-WL	.682***	554	.059	47	.526**	25	.750***	21
AR-BL	.669***	317	.157	40	.512*	23	.752*	10
ANT3-WL	.168*	555	.798***	48	.737***	25	.205	21
ANT3-BL	.118*	317	.722***	41	.740***	23	.766**	10
ANTT-WL	.876***	555	.750***	47	.861***	25	.732***	21
ANTT-BL	.848***	319	.781***	40	.853***	23	.920***	10
FLR-WL	.181*	566	.485***	51	.541**	25	.038	22
FLR-BL	.178*	319	.269*	44	.458**	23	-.254	10
FT-WL	.932***	570	.902***	51	.944***	25	.902***	22
FT-BL	.933***	324	.947***	44	.920***	23	.896***	10
FTal-WL	.899***	568	.885***	51	.788***	25	.902***	22
FTal-BL	.908***	321	.857***	44	.858***	23	.835**	10

* significant at 5%

** significant at 1%

*** significant at .1%

NA- not available as there are either no or not enough samples with both variables

Table VIIa. Correlations between variables in species of *Orthocladus*

Species	WL-BL	Sample Size	WW-WL	Sample Size	WW-BL	Sample Size
<u>annectens</u>	.665	9	.936***	29	.590	9
<u>appersoni</u>	.799	5	.957*	5	.799	5
<u>carlatus</u>	.622	7	.957***	27	.491	6
<u>charensis</u>	.727***	33	.614***	31	.626***	31
<u>clarkei</u>	.969**	6	.975***	8	.972**	6
<u>cooki</u>	NA		.867***	17	NA	
<u>dentifer</u>	NA		.946***	24	NA	
<u>dorenus</u>	.981***	6	.857***	26	.961**	5
<u>knuthi</u>	.189	3	-.500	3	-.945	3
<u>hazensis</u>	.747*	8	.815	9	.627	9
<u>hellenthalii</u>	.897*	6	.864**	8	.897*	6
<u>lapponicus</u>	.884***	26	.876***	26	.796***	26
<u>mallochi</u>	.769*	11	.470	12	.763	9
<u>manitobensis</u>	.651**	16	.859***	39	.651**	16
<u>nigritus</u>	.828**	9	.936***	11	.828**	9
<u>obumbratus</u>	.893***	28	.912***	93	.783***	93
<u>oliveri</u>	.902***	131	.891	143	.832***	126
<u>paradecoratus</u>	.743	4	.965*	3	.924	4
<u>robacki</u>	.898*	5	.960	3	.898*	5
<u>subletti</u>	.983	3	.987*	4	.996**	4
<u>tryoni</u>	.920**	8	.912***	20	.804*	8

Table VIIb. Correlations between variables in species of Orthocladus (Orthocladus).

Species	ANSU-WL	Sample Size	ANSU-BL	Sample Size	AR-WL	Sample Size	AR-BL	Sample Size
<u>annectens</u>	.742***	29	.811**	9	.086	29	.146	9
<u>appersoni</u>	.946*	5	.481	9	.583	4	.696	8
<u>carlatus</u>	.667***	27	.561	6	.560**	26	.429	7
<u>charensis</u>	.768***	33	.761***	33	.460**	33	.259	33
<u>clarkei</u>	.986***	8	.991***	6	.891**	7	.936**	6
<u>cooki</u>	.417	17	NA		.335	17	NA	
<u>dentifer</u>	.733***	24	NA		.019	24	NA	
<u>dorenus</u>	.864***	27	.926**	6	.356	27	.247	5
<u>knuthi</u>	.471	4	.944	3	-.723	3	NA	
<u>hazensis</u>	.821**	9	.576	9	.394	9	-.195	9
<u>hellenthali</u>	.911**	8	.935**	3	.840**	8	.955**	6
<u>lapponicus</u>	.735***	26	.749***	26	.637***	26	.497*	26
<u>mallochi</u>	.765*	9	.899***	9	.690*	12	.558	9
<u>manitobensis</u>	.794***	39	.706**	16	.322*	39	.182	16
<u>nigritus</u>	.748**	13	.823**	9	.222	11	.599	9
<u>obumbratus</u>	.774***	92	.950***	31	.658***	93	.620***	29
<u>oliveri</u>	.872***	150	.908***	132	.558***	145	.505***	129
<u>paradecoratus</u>	.889	4	.853	5	.761	4	.634	5
<u>robachi</u>	.712	5	.929*	5	.813*	6	.628	5
<u>subletti</u>	.983*	4	.965*	4	.782	4	.970	3
<u>tryoni</u>	.807***	20	.782*	8	-.487*	18	-.310	8

Table VIIc. Correlations between variables in species of Orthocladus (Orthocladus)

Species	ANT3-WL	Sample Size	ANT3-BL	Sample Size	ANTT-WL	Sample Size	ANTT-BL	Sample Size
<u>annectens</u>	.745***	29	.550	9	.785***	29	.720*	9
<u>appersoni</u>	-.127	4	.733	9	.722	4	.894**	8
<u>carlatus</u>	.721***	27	-.487	7	.867***	27	.205	7
<u>charensis</u>	.487**	33	.478**	33	.868***	33	.666***	33
<u>clarkel</u>	.919**	7	.856*	6	.974***	7	.971**	6
<u>cooki</u>	.360	17	NA		.771***	17	NA	
<u>dentifer</u>	.667***	24	NA		.588**	24	NA	
<u>doreus</u>	.749***	26	.970**	5	.926***	26	.956*	5
<u>knuthi</u>	.655	3	NA		-.945	3	NA	
<u>hazensis</u>	.405	9	.681*	9	.779*	8	.307	9
<u>hellenthalii</u>	.963***	9	.894*	6	.929***	8	.956**	6
<u>lapponicus</u>	.831***	26	.798***	26	.923***	26	.803***	26
<u>mallochi</u>	-.363	12	-.257	9	.835***	12	.719*	9
<u>manitobensis</u>	.426**	39	.160	16	.806***	39	.518*	16
<u>nigritus</u>	.289	11	.049	8	.920***	11	.898**	8
<u>obumbratus</u>	.291**	93	.210	29	.876***	93	.777***	29
<u>oliveri</u>	.508***	145	.611***	129	.905***	145	.875***	129
<u>paradecoratus</u>	.887	4	.647	5	.975*	4	.816	5
<u>robacki</u>	.548	6	.922*	5	.918**	6	.830	5
<u>sublettii</u>	.788	4	.810	3	.975*	4	.936	4
<u>tryoni</u>	.788***	18	.690**	5	.058	18	.204	8

Table VIId. Correlations between variables in species of Orthocladus (Orthocladus)

<u>Species</u>	<u>FLR-WL</u>	<u>Sample Size</u>	<u>FLR-BL</u>	<u>Sample Size</u>
<u>annectens</u>	-.575**	27	-.338	7
<u>appersoni</u>	-.406	5	-.012	10
<u>carlatus</u>	-.347*	28	.248	7
<u>charensis</u>	.179	33	-.026	33
<u>clarkei</u>	-.718*	8	-.940**	6
<u>cooki</u>	.074	17	NA	
<u>dentifer</u>	-.020	25	NA	
<u>doreus</u>	-.211	27	-.472	6
<u>knuthi</u>	-.413	4	.356	3
<u>hazensis</u>	.697*	9	.657	9
<u>hellenthalii</u>	.257	9	.042	6
<u>lapponicus</u>	-.067	26	-.065	26
<u>mallochi</u>	-.047	12	-.530	9
<u>manitobensis</u>	.321*	39	.373	16
<u>nigritus</u>	-.155	13	-.243	9
<u>obumbratus</u>	.282**	94	-.094	29
<u>oliveri</u>	.013	147	-.012	130
<u>paradecoratus</u>	-.783	4	.316	5
<u>robacki</u>	.476	6	.833	5
<u>subletti</u>	-.282	3	-.101	3
<u>tryoni</u>	-.137	20	-.284	8

Table VIIe. Correlations between variables in species of *Orthocladus* (*Orthocladus*)

Species	FT-WL	Sample Size	FT-BL	Sample Size	Ftal-WL	Sample Size	Ftal-BL	Sample Size
<u>annectens</u>	.945***	29	.772*	9	.835***	27	.684	7
<u>appersoni</u>	.972**	5	.780**	10	.964**	5	.773**	10
<u>carlatus</u>	.852***	28	.263	7	.643***	28	.492	7
<u>charensis</u>	.776***	33	.621***	33	.786**	33	.488**	33
<u>clarkel</u>	.997***	8	.985***	6	.989***	8	.955***	6
<u>cooki</u>	.736***	17	NA		.680**	17	NA	
<u>dentifer</u>	.807***	25	NA		.660***	25	NA	
<u>doreus</u>	.934***	27	.973**	6	.904***	27	.890*	6
<u>knuthi</u>	.246	4	.327	3	-.408	4	.945	3
<u>hazensis</u>	.692	9	.683	9	.768	9	.759*	9
<u>hellenthalii</u>	.979***	9	.941**	6	.975***	9	.927**	6
<u>lapponicus</u>	.969***	26	.910***	26	.955***	26	.896***	26
<u>mallochi</u>	.593*	12	.792*	9	.592*	12	.504	9
<u>manitobensis</u>	.713***	39	.447	16	.880***	39	.517*	16
<u>nigritus</u>	.922***	13	.820**	9	.701**	13	.708*	9
<u>obumbratus</u>	.834***	94	.903***	29	.860***	96	.834***	31
<u>oliveri</u>	.921***	149	.885***	132	.883***	147	.877***	130
<u>paradecoratus</u>	.989*	4	.825	5	.991**	4	.872	5
<u>robački</u>	.923**	6	.932*	5	.814*	6	.970**	5
<u>sublettii</u>	.924	3	.839	3	.991	3	.999***	3
<u>tryoni</u>	.916***	20	.924***	8	.886***	20	.930***	8

Table VIIIa. Correlations between variables in two-species and nine populations of Orthocladus (Orthocladus)

Population	WL-BL	Sample Size	WW-WL	Sample Size	WW-BL	Sample Size
<u>O. oliveri</u>						
A	.902***	131	.891***	143	.832***	126
HA	.740*	9	.843***	12	.797*	8
BF	.880***	~~24~~	.778***	25	.829***	24
BL	.705***	22	.690***	24	.695***	22
BR	.747***	23	.734***	24	.745***	22
	.757***	25	.625***	25	.704***	25
<u>O. obumbratus</u>						
G	.893***	28	.912***	93	.783***	93
H	NA		.871***	25	NA	
M1	.773**	14	.853***	19	.697***	19
O2	NA		.832***	25	NA	
	.780***	14	.773***	24	.690**	14

Table VIIIb. Correlations between variables in two species and nine populations of Orthocladus (Orthocladus).

<u>Population</u>	<u>ANSU-WL</u>	<u>Sample Size</u>	<u>ANSU-BL</u>	<u>Sample Size</u>	<u>AR-WL</u>	<u>Sample Size</u>	<u>AR-BL</u>	<u>Sample Size</u>
<u>O. oliveri</u>								
A	.872***	150	.908***	132	.558***	145	.505***	129
HA	.840***	13	.797*	9	.103	12	.530	8
BF	.914***	25	.906***	24	.485*	25	.293	24
BL	.561**	25	.642**	22	.391	25	.484*	22
BR	.726***	25	.729***	23	.513*	25	.250	23
	.688***	25	.706***	25	.384*	25	.286	25
<u>O. obumbratus</u>								
G	.774***	92	.950***	31	.658***	93	.620***	29
H	.808***	25	NA		.460*	25	NA	
M1	.777***	23	.892***	16	.488*	19	.340	14
O2	.779***	21	NA		.112	25	NA	
	.693***	23	.913***	15	.672***	24	.447	15

Table VIIIC. Correlations between variables in two species and nine populations of
Orthocladus (Orthocladus)

Population	ANT3-WL	Sample Size	ANT3-BL	Sample Size	ANTT-WL	Sample Size	ANTT-BL	Sample Size
<u>O. oliveri</u>	.508***	145	.611***	129	.905***	145	.875***	129
A	.358	12	.051	8	.712**	12	.607	8
HA	.691***	25	.818***	24	.922***	25	.900***	24
B	.315	25	.034	22	.898***	25	.710***	22
CL	.078	25	.195	23	.829***	25	.566**	23
BF	.443*	25	.401*	25	.754***	25	.620***	25
<u>O. obumbratus</u>	.291**	93	.210	29	.876***	93	.777***	29
G	.346	25	NA		.847***	25	NA	
H	.509*	19	.247	14	.849***	19	.723**	14
M1	.397*	25	NA		.541**	25	NA	
O2	.073	24	.516*	15	.799***	24	.749**	15

Table VIIIId. Correlation between variables in two species and nine populations of Orthocladus (Orthocladus)

Population	FLR-WL	Sample Size	FLR-BL	Sample Size
<u>O. oliveri</u>				
A	.013	147	-.012	130
HA	-.014	11	.169	7
BF	.468*	25	.544**	24
BL	-.302	25	-.514*	22
BR	.343	25	.234	23
	-.477*	25	-.516**	25
<u>O. obumbratus</u>				
G	.282**	94	-.094	29
H	.431*	25	NA	
M1	.029	23	.011	16
O2	-.062	25	NA	
	.320	21	.27*	13

Table VIIIe. Correlations between variables in two species and nine populations of Orthocladus (Orthocladus)

Population	FT-WL	Sample Size	FT-BL	Sample Size	Ftal-WL	Sample Size	Ftal-BL	Sample Size
<u>O. oliveri</u>	.921***	149	.885***	132	.883***	147	.877***	130
A	.917***	13	.695*	9	.915***	11	-.749*	7
HA	.954***	25	.889***	24	.912***	25	.893***	24
BF	.803***	25	.782***	22	.857***	25	.654***	22
BL	.890***	25	.746***	23	.894***	25	.720***	23
BR	.903***	25	.778***	25	.731***	25	.551**	25
<u>O. obumbratus</u>	.834***	94	.903***	29	.860***	96	.834***	31
G	.952***	25	NA		.947***	25	NA	
H	.953***	23	.814***	16	.874***	23	.777***	16
M1	.851***	25	NA		.787***	25	NA	
O2	.688***	21	.830***	13	.728***	23	.729**	15

EXPLANATION OF FIGURES

- Fig. 1. Prepared slide of adult male.
- Fig. 2. Male thorax showing measurements, lateral view.
Abbreviations: th, thorax; as, anapleural suture.
- Fig. 3. Male abdomen showing measurement, dorsal view.
Abbreviations: abd, abdomen.
- Fig. 4. Female abdomen showing measurement, lateral view.
Abbreviations: abd, abdomen.
- Fig. 5. Thoracic structures in male of O. (Orthocladius) oliveri n. sp. (a) thorax, dorsal view, SEM 75X; (b) oval pit, dorsal view, SEM 700X; (c) cross section through notum in area of supraalar callus at anterior end of oval pit in preserved male, 200X; (d) cross section through notum in area of supraalar callus at anterior end of oval pit in freshly-killed male, 200X; (e) cross section through midline of scutum in area posterior to oval pit and anterior to scutellum in preserved male, 400X; (f) cross section through midline of scutum in oval pit in preserved male, 400X; (g) cross section through midline of scutum in oval pit in freshly-killed male, 400X; (h) mm scale for Figs. 5c-d; (i) mm scale for Figs. 5e-g.
- Fig. 6. Male head of O. (Orthocladius) wiensi Saether, showing measurement, frontal view. Abbreviations: cly, clypeus; iod, interocular distance; iv, inner verticals; ov, outer verticals; po, postorbitals; pl-p5, palpal segments 1 to 5; sc, scape.
- Fig. 7. Female head of O. (Orthocladius) wiensi Saether, frontal view. Abbreviations: as in Fig. 6.
- Fig. 8. Male antenna showing measurements. Abbreviations: fl 1-12, flagellomeres 1 to 12; fl 13, flagellomere 13; p, pedicel; s, scape.
- Fig. 9. Female antenna showing measurements. Abbreviations: fl 1-4, flagellomeres 1 to 4; fl 5, flagellomere 5.
- Fig. 10. Scutellar arrangements, dorsal view. (a) uniserial; (b) biserial; (c) multiserial.

Fig. 11. Male thorax, lateral view. Abbreviations: ac, acrostichals; dc, dorsocentrals; la, lateral anteprenotals; mp, mesonotal (oval) pit; pa, prealars; sc, scutellars.

Fig. 12. Male wing of O. (Orthocladius) nigritus Malloch.

Abbreviations: al, anal lobe; C-R4+5, costa and radius-four-plus-five; cs, campaniform sensilla; Cu1, cubitus-one; Cu2, cubitus-two; fCu, fork of cubitus-one and cubitus-two; M, media; R, radius; R1, radius-one; R2+3, radius-two-plus-three; R4+5, radius-four-plus-five; r-m, radio-medial crossvein; sq, squamals; st, stem vein.

Fig. 13. Female wing of O. (Orthocladius) nigritus Malloch.

Fig. 14. Male wings of Orthocladius. (a) O. (Orthocladius) nigritus Malloch, showing measurements. Abbreviations: a-fCu, arculus to fCu; a-rm, arculus to r-m; wl, wing length; ww, wing width. (b) apex of wing of O. (Orthocladius) tryoni n. sp.; (c) apex of wing of O. (Orthocladius) clarkei n. sp.; (d) apex of wing of O. (Orthocladius) cooki n. sp.; (e) proximal portion of wing of O. (Orthocladius) tryoni n. sp.; (f) proximal portion of wing of O. (Orthocladius) paradercoratus n. sp.; (g) proximal portion of wing of O. (Pogonocladius) consobrinus (Holmgren).

Fig. 15. Male legs of Orthocladius. (a) fore leg of O. (Orthocladius) mallochi Kieffer, showing measurements along median axis.

Abbreviations: F, femur; T, tibia; t1-t5, tarsal segments 1 to 5. (b) tarsus of fore leg of O. (Pogonocladius) consobrinus (Holmgren); (c) tibial comb and spines of hind leg of O. (Orthocladius) mallochi Kieffer; (d) tibial spurs of mid leg of O. (Orthocladius) trigonolabis Edwards, lectotype; (e) tibial spurs of mid leg of O. (Orthocladius) trigonolabis Edwards, North American specimen.

Fig. 16. Male hypopygium of O. (Orthocladius) trigonolabis Edwards.

(a) ventral view; (b) dorsal view. Abbreviations: ap, anal point; bml, basal median lobes; dbl, dorsal part of basal lobe; ds, dorsal strut; gcx, gonocoxite; gst, gonostylus; vbl, ventral part of basal lobe; vi, virga; vs, ventral strut.

- Fig. 17. Gonostylus of O. (Orthocladius) charensis n. sp.
Abbreviations: ia, inner area; de, dorsal edge; di, dorsal side; ve, ventral edge.
- Fig. 18. Everted endophallus of O. (Euorthocladius) sp.
Abbreviations: en, endophallus; vi, virga; vs, ventral strut.
- Fig. 19. Male hypopygium of O. (Orthocladius) obumbratus Johannsen with everted endophallus, showing measurements. Abbreviations: as in Fig. 16.
- Fig. 20. Male hypopygium of O. (Euorthocladius) sp. (a) ventral view; (b) dorsal view.
- Fig. 21. Male hypopygium of O. (Eudactylocladius) mixtus (Holmgren). (a) ventral view; (b) dorsal view.
- Fig. 22. Male hypopygium of O. (Pogonoladius) consobrinus (Holmgren). (a) ventral view; (b) dorsal view.
- Fig. 23. Male hypopygium of O. (Orthocladius) appersoni Sublette and Sublette, paratype. (a) ventral view; (b) dorsal view.
- Fig. 24. Male hypopygium of O. (Orthocladius) appersoni Sublette and Sublette, N.W.T. specimen. (a) ventral view; (b) dorsal view.
- Fig. 25. Male hypopygium of O. (Orthocladius) smolandicus Brundin. (a) ventral view; (b) dorsal view.
- Fig. 26. Male hypopygium of O. (Orthocladius) hellenthali Sublette and Sublette, holotype. (a) ventral view; (b) dorsal view.
- Fig. 27. Male hypopygium of O. (Orthocladius) curtiseti Saether, holotype. (a) ventral view; (b) dorsal view.
- Fig. 28. Male hypopygium of O. (Orthocladius) carlatus (Roback), holotype. (a) ventral view; (b) dorsal view.
- Fig. 29. Male hypopygium of O. (Orthocladius) clarkei n. sp., holotype. (a) ventral view; (b) dorsal view.
- Fig. 30. Male hypopygium of O. (Orthocladius) dentifer Brundin, (a) ventral view; (b) dorsal view.
- Fig. 31. Male hypopygium of O. (Orthocladius) charensis n. sp., holotype. (a) ventral view; (b) dorsal view.
- Fig. 32. Male hypopygium of O. (Orthocladius) subletti n. sp., holotype. (a) ventral view; (b) dorsal view.

- Fig. 33. Male hypopygium of O. (Orthocladius) trigonolabis Edwards, lectotype. (a) ventral view; (b) dorsal view.
- Fig. 34. Male hypopygium of O. (Orthocladius) lapponicus Goethghebuer, lectotype. (a) ventral view; (b) dorsal view.
- Fig. 35. Male hypopygium of O. (Orthocladius) lapponicus Goethghebuer, Char Lake specimen. (a) ventral view; (b) dorsal view.
- Fig. 36. Male hypopygium of O. (Orthocladius) nigritus Malloch, paratype. (a) ventral view; (b) dorsal view.
- Fig. 37. Male hypopygium of O. (Orthocladius) nigritus Malloch, Blanche River specimen. (a) ventral view; (b) dorsal view.
- Fig. 38. Male hypopygium of O. (Orthocladius) cooki n. sp., holotype. (a) ventral view; (b) dorsal view.
- Fig. 39. Male hypopygium of O. (Orthocladius) oblidens (Walker), holotype. (a) ventral view; (b) dorsal view.
- Fig. 40. Male hypopygium of O. (Orthocladius) mallochi Kieffer, Ontario specimen. (a) ventral view; (b) dorsal view.
- Fig. 41. Male hypopygium of O. (Orthocladius) mallochi Kieffer, holotype. (a) ventral view; (b) dorsal view.
- Fig. 42. Male hypopygium of O. (Orthocladius) oliveri n. sp., holotype. (a) ventral view; (b) dorsal view.
- Fig. 43. Male hypopygium of O. (Orthocladius) tryoni n. sp., holotype. (a) ventral view; (b) dorsal view, with gonostylus of paratype.
- Fig. 44. Male hypopygium of O. (Orthocladius) annectens Saether, holotype. (a) ventral view; (b) dorsal view.
- Fig. 45. Genitalia of intersex of O. (Orthocladius) obumbratus Johannsen. (a) ventral view; (b) dorsal view. Abbreviations: c, cercus.
- Fig. 46. Male hypopygium of O. (Orthocladius) obumbratus Johannsen, South Dakota specimen. (a) ventral view; (b) dorsal view.
- Fig. 47. Male hypopygium of O. (Orthocladius) obumbratus Johannsen, lectotype. (a) ventral view; (b) dorsal view.
- Fig. 48. Male hypopygium of O. (Orthocladius) doreus (Roback), holotype. (a) ventral view; (b) dorsal view.

- Fig. 49. Male hypopygium of O. (Orthocladius) doreus (Kovack), Minnesota specimen. (a) ventral view; (b) dorsal view.
- Fig. 50. Male hypopygium of O. (Orthocladius) knuthi n. sp., holotype. (a) ventral view; (b) dorsal view.
- Fig. 51. Male hypopygium of O. (Orthocladius) groerlandensis Goethghebuer, holotype. (a) ventral view; (b) dorsal view.
- Fig. 52. Male hypopygium of O. (Orthocladius) hazensis n. sp., holotype. (a) ventral view; (b) dorsal view.
- Fig. 53. Male hypopygium of O. (Orthocladius) pardecoratus n. sp., holotype. (a) ventral view; (b) dorsal view.
- Fig. 54. Male hypopygium of O. (Orthocladius) robacki n. sp., holotype. (a) ventral view; (b) dorsal view.
- Fig. 55. Male hypopygium of O. (Orthocladius) manitobensis Saether, holotype. (a) ventral view; (b) dorsal view.
- Fig. 56. Male hypopygium of O. (Orthocladius) wiensi Saether, holotype. (a) ventral view; (b) dorsal view.
- Fig. 57. Female genitalia of O. (Orthocladius) lapponicus Goethghebuer, lateral view. Abbreviations: cer, cercus; lsIX, lateral sternite IX; sp, spermatheca; spd, spermathecal duct; tIX, tergite IX.
- Fig. 58. Female genitalia of O. (Euorthocladius) sp., lateral view.
- Fig. 59. Female genitalia of O. (Eudactylocladius) sp., lateral view.
- Fig. 60. Female genitalia of O. (Pogonocladius) consobrinus (Holmgren), lateral view.
- Fig. 61. Female genitalia of O. (Orthocladius) charensis n. sp., paratype, lateral view.
- Fig. 62. Female genitalia of O. (Orthocladius) lapponicus Goethghebuer, lateral view.
- Fig. 63. Female genitalia of O. (Orthocladius) lapponicus Goethghebuer, lateral view.
- Fig. 64. Female genitalia of O. (Orthocladius) obumbratus Johannsen, lateral view.
- Fig. 65. Female genitalia of O. (Orthocladius) obumbratus Johannsen, paralectotype, lateral view.
- Fig. 66. Female genitalia of O. (Orthocladius) trigonolabis Edwards, paralectotype, lateral view.

- Fig. 67. Female genitalia of O. (Orthocladus) clarkei n. sp., allotype, lateral view.
- Fig. 68. Female genitalia of O. (Orthocladus) mallochi Kieffer, lateral view.
- Fig. 69. Female genitalia of O. (Orthocladus) doreus (Roback), allotype, lateral view.
- Fig. 70. Female genitalia of O. (Orthocladus) nigratus Malloch, paratype, lateral view.
- Fig. 71. Female genitalia of O. (Orthocladus) nigratus Malloch, lateral view.
- Fig. 72. Female genitalia of O. (Orthocladus) knuthi n. sp., allotype, lateral view.
- Fig. 73. Female genitalia of O. (Orthocladus) wiensi Saether, allotype, lateral view.
- Fig. 74. Female genitalia of O. (Orthocladus) carlatus (Roback), lateral view.
- Fig. 75. Female genitalia of O. (Orthocladus) annectens Saether, lateral view.
- Fig. 76. Female genitalia of O. (Orthocladus) oliveri n. sp., allotype, lateral view.
- Fig. 77. Female genitalia of O. (Orthocladus) appersoni Sublette and Sublette, paratype, ventral view.
- Fig. 78. Antennae of females of O. (Orthocladus). (a) O. annectens Saether; (b) O. carlatus (Roback); (c) O. charensis n. sp., allotype; (d) O. clarkei n. sp., allotype; (e) O. doreus (Roback), allotype; (f) O. lapponicus Goethghebuer; (g) O. mallochi Kieffer; (h) O. nigratus Malloch, paratype; (i) O. obumbratus Johannsen, paralectotype; (j) O. oliveri n. sp., allotype; (k) O. trigonolabis Edwards, paralectotype; (l) O. wiensi Saether, allotype.
- Fig. 79. Cephalothorax of pupal exuvia of O. (Orthocladus) obumbratus Johannsen, showing measurement, right side dorsal view, left side ventral view. Abbreviations: ctl, cephalothoracic length; dc, dorsocentrals; eca, area along eclosion line; ft, frontal tubercle; fs, frontal seta; h, humerals; la, lateral anteprenotals; ma, median anteprenotals; pa, prealar; po, postorbital; th, thoracic horn.

Fig. 80. Thoracic horns of pupal exuviae of Orthocladius. (a) O. (Orthocladius) obumbratus Johannsen, showing measurement. Abbreviations: thl, thoracic horn length. (b) O. (Pogonolacidus) consobrinus (Holmgren); (c) O. (Euorthocladius) Type I sp.; (d) O. (Eudactylocladius) sp.; (e) O. (Euorthocladius) Type II sp.

Fig. 81-89. Purposely omitted.

Fig. 90. Thoracic horns of pupal exuviae of O. (Orthocladius).

(a) O. annectens Saether; (b) O. appersoni Sublette and Sublette; (c) O. carlatus (Roback); (d) O. charensis n. sp.; (e) O. clarkei n. sp.; (f) O. curtiseta Saether; (g) O. dentifer Brundin; (h) O. doreus (Roback); (i) O. knuthi n. sp.; (j) O. lapponicus Goethghebuer; (k) O. mallochi Kieffer; (l) O. manitobensis Saether; (m) O. obumbratus Johannsen; (n) O. oliveri n. sp.; (o) O. nigratus Malloch; (p) O. robacki n. sp.; (q) O. trigonolabis Edwards; (r) O. tryoni n. sp.; (s) O. wiensi Saether.

Fig. 91. Pupal structures of O. (Orthocladius). (a) thoracic horn of O. (Orthocladius) doreus (Roback), SEM 270X; (b) thoracic horn of O. (Orthocladius) doreus (Roback), SEM 1080X; (c) thoracic horn of O. (Orthocladius) oliveri n. sp., SEM 230X; (d) thoracic horn of O. (Orthocladius) oliveri n. sp., SEM 1020X; (e) recurved spine patch on tergite II of O. (Orthocladius) obumbratus Johannsen, SEM 1100X; (f) bumpy area along eclosion line of cephalothorax of O. (Orthocladius) doreus (Roback), SEM 1200X; (g) chitinous rings on tergite II of O. (Orthocladius) carlatus (Roback), SEM 500X; (h) chitinous rings on tergite III of O. (Orthocladius) carlatus (Roback), SEM 300X.

Fig. 92. Abdomen of pupal exuvia of O. (Orthocladius) oliveri n. sp., showing measurements, dorsal view. Abbreviations: a-ds, anteriorly-directed spines; abd, abdomen; al, anal lobe; Amm, anal median muscle marks; csp, central spine patch; ds, dorsal seta; Omm, oval median muscle marks; psB, pedes spurii B; rsp, recurved spine patch; sp, spurs; ts, terminal setae.

- Fig. 93. Anterior part of cephalothorax of pupal exuvia along eclosion line of O. (Orthocladius) doreus (Roback), lateral view.
- Fig. 94. Anteroventral part of cephalothorax of pupal exuvia of O. (Orthocladius) doreus (Roback), frontal view. Abbreviations: ft, frontal tubercle.
- Fig. 95. Abdominal tergites IV-V of pupal exuvia of O. (Euorthocladius) Type I sp., dorsal view.
- Fig. 96. Abdominal sternite V of pupal exuvia of O. (Orthocladius) lapponicus Goethghebuer, ventral view.
- Fig. 97. Abdominal segment II of pupal exuvia of O. (Euorthocladius) Type II sp., ventral view.
- Fig. 98. Abdominal tergites IV-VI of pupal exuvia of O. (Eudactylocladius) sp., dorsal view.
- Fig. 99. Abdominal tergite III of O. (Pogonocladius) consobrinus (Holmgren), dorsal view.
- Fig. 100. Abdominal tergites III-IV of pupal exuvia of O. (Orthocladius) clarkei n. sp., dorsal view.
- Fig. 101. Abdominal tergites IV-V of pupal exuvia of O. (Orthocladius) appersoni Sublette and Sublette, dorsal view.
- Fig. 102. Abdominal tergites IV-VI of pupal exuvia of O. (Orthocladius) annectens Saether, dorsal view.
- Fig. 103. Abdominal tergites III-IV of pupal exuvia of O. (Orthocladius) carlatus (Roback), dorsal view.
- Fig. 104. Segment IX of pupal exuvia of O. (Orthocladius) tryoni n. sp., dorsal view.
- Fig. 105. Segment IX of pupal exuvia of O. (Euorthocladius) Type II sp., dorsal view.
- Fig. 106. Segment IX of pupal exuvia of O. (Euorthocladius) Type I sp., dorsal view.
- Fig. 107. Segment IX of pupal exuvia of O. (Orthocladius) charensis n. sp., dorsal view.
- Fig. 108. Cephalic structures of 3rd instar larva of O. (Orthocladius) charensis n. sp.. (a) larval head, ventral view, SEM 500X; (b) labral setae, SEM 1750X; (c) antenna, SEM 2250X; (d) epipharyngeal area, SEM 1250X.

- Fig. 109. Epipharynx of 4th instar larva of O. (Pogonocladus) consobrinus (Holmgren), ventral view.
- Fig. 110. Labial plate of 4th instar larva of O. (Orthocladus) carlatus (Roback), showing measurement. Abbreviations: lpw, labial plate width.
- Fig. 111. Antennae of 4th instar larvae of Orthocladus. (a) O. (Pogonocladus) consobrinus (Holmgren); (b) O. (Euorthocladus) Type II sp.; (c) O. (Eudactylocladius) sp.; (d) O. (Orthocladus) annectens Saether showing measurement. Abbreviations: as, accessory seta; bl, blade; Lo, Lauterborn organs; s, sensillum; sgml, segment 1; ss, sensory seta.
- Fig. 112. Cephalic structures of 4th instar larva of O. (Orthocladus) robacki n. sp. (a) epipharynx, ventral view; (b) antenna. Abbreviations: ls, lateral setae; p, pecten; pm, premandible; sp, spinules; ts, tormal seta.
- Fig. 113. Cephalic structures of 4th instar larva of O. (Orthocladus) wiensi Saether. (a) epipharynx, ventral view; (b) antenna.
- Fig. 114. Cephalic structures of 4th instar larvae of O. (Orthocladus). (a) antenna of O. (Orthocladus) carlatus (Roback); (b) antenna of O. (Orthocladus) curtiseta Saether; (c) antenna of O. (Orthocladus) dentifer Brundin; (d) ungula and chaetae of O. (Orthocladus) nigritus Malloch; (e) antenna of O. (Orthocladus) nigritus Malloch.
- Fig. 115. Cephalic structures of 4th instar larva of O. (Orthocladus) manitobensis Saether. (a) epipharynx, ventral view; (b) antenna.
- Fig. 116. Cephalic structures of 4th instar larva of O. (Orthocladus) obumbratus Johannsen. (a) epipharynx, ventral view; (b) antenna.
- Fig. 117. Cephalic structures of 4th instar larva of O. (Orthocladus) oliveri n. sp. (a) epipharynx, ventral view; (b) antenna. Abbreviations: g, grooves of antennal blade.
- Fig. 118. Cephalic structures of 4th instar larva of O. (Orthocladus) dorens (Roback). (a) epipharynx, ventral view; (b) antenna.

- Fig. 119. Cephalic structures of 4th instar larva of O.
(Orthocladus) lapponicus Goethghebuer. (a) epipharynx, ventral view; (b) antenna.
- Fig. 120. Cephalic structures of 4th instar larva of O.
(Orthocladus) mallochi Kieffer. (a) epipharynx, ventral view; (b) antenna.
- Fig. 121. Cephalic structures of 4th instar larva of O.
(Orthocladus) annectens Saether. (a) epipharynx, ventral view; (b) antenna of holotype exuvia; (c) antenna of N.W.T. specimen.
- Fig. 122. Cephalic structures of 4th instar larva of O.
(Orthocladus) charensis n. sp. (a) epipharynx, ventral view; (b) antenna; (c) eyespots.
- Fig. 123. Cephalic structures of 4th instar larva of O.
(Orthocladus) clarkei n. sp. (a) epipharynx, ventral view; (b) antenna.
- Fig. 124. Mouthparts of 4th instar larva of O. (Euorthocladus) Type I sp. (a) mandible; (b) labial plate.
- Fig. 125. Mouthparts of 4th instar larva of O. (Euorthocladus) Type II sp. (a) mandible; (b) labial plate.
- Fig. 126. Mouthparts of 4th instar larva of O. (Euorthocladus) Type III sp. (a) labial plate; (b) mandible.
- Fig. 127. Mouthparts of 4th instar larva of O. (Pogonocladus) consobrinus (Holmgren). (a) labial plate; (b) mandible.
- Fig. 128. Mouthparts of 4th instar larva of O. (Eudactylocladius) sp. (a) mandible; (b) labial plate.
- Fig. 129. Mouthparts of 4th instar larva of O. (Orthocladus) charensis n. sp. (a) mandible; (b) labial plate.
- Fig. 130. Mouthparts of larvae of O. (Orthocladus) lapponicus Goethghebuer. (a) mandible of 4th instar; (b) labial plate of 4th instar; (c) labial plate of 2nd instar.
- Fig. 131. Mouthparts of 4th instar larva of O. (Orthocladus) oliveri n. sp. (a) mandible; (b) labial plate.

- Fig. 132. Mouthparts of 4th instar larva of O. (Orthocladus) carlatus (Roback). (a) mandible; (b) labial plate.
- Fig. 133. Mouthparts of 4th instar larva of O. (Orthocladus) obumbratus Johannsen. (a) mandible; (b) labial plate.
- Fig. 134. Mouthparts of 4th instar larva of O. (Orthocladus) robacki n. sp. (a) labial plate; (b) mandible.
- Fig. 135. Mouthparts of 4th instar larva of O. (Orthocladus) manitobensis Saether. (a) mandible; (b) labial plate.
- Fig. 136. Mouthparts of 4th instar larva of O. (Orthocladus) doreus (Roback). (a) labial plate; (b) mandible.
- Fig. 137. Mouthparts of 4th instar larva of O. (Orthocladus) nigritus Malloch. (a) mandible; (b) labial plate.
- Fig. 138. Mouthparts of 4th instar larva of O. (Orthocladus) curtiseta Saether. (a) mandible; (b) labial plate.
- Fig. 139. Mouthparts of 4th instar larva of O. (Orthocladus) dentifer Brundin. (a) mandible; (b) labial plate.
- Fig. 140. Mouthparts of 4th instar larva of O. (Orthocladus) annectens Saether. (a) mandible; (b) labial plate.
- Fig. 141. Mouthparts of 4th instar larva of O. (Orthocladus) clarkei n. sp. (a) labial plate; (b) mandible.
- Fig. 142. Mouthparts of 4th instar larva of O. (Orthocladus) mallochi Kieffer. (a) labial plate; (b) mandible.
- Abbreviations: pl, paralabial plate.
- Fig. 143. Mouthparts of 4th instar larva of O. (Orthocladus) wiensi Saether. (a) labial plate; (b) mandible.
- Fig. 144. Distribution of O. (Orthocladus) annectens Saether.
- Fig. 145. Distribution of O. (Orthocladus) appersoni Sublette and Sublette.
- Fig. 146. Distributions of O. (Orthocladus) carlatus (Roback), O. curtiseta Saether, and O. hellenthali Sublette and Sublette,
 Δ O. carlatus, ▲ O. curtiseta, ● O. hellenthali.
- Fig. 147. Distribution of O. (Orthocladus) charensis n. sp.
- Fig. 148. Distribution of O. (Orthocladus) clarkei n. sp.

- Fig. 149. Distribution of O. (Orthocladius) dentifer Brundin.
- Fig. 150. Distribution of O. (Orthocladius) doreus (Roback).
- Fig. 151. Distribution of O. (Orthocladius) lapponicus Geothghebuer.
- Fig. 152. Distribution of O. (Orthocladius) mallochii Kieffer.
- Fig. 153. Distribution of O. (Orthocladius) manitobensis Saether.
- Fig. 154. Distribution of O. (Orthocladius) nigrinus Malloch.
- Fig. 155. Distribution of O. (Orthocladius) obumbratus Johannsen.
- Fig. 156. Distribution of O. (Orthocladius) oliveri n. sp.
- Fig. 157. Distribution of O. (Orthocladius) subletti n. sp.
- Fig. 158. Distribution of O. (Orthocladius) trigonolabis Edwards.
- Fig. 159. Distribution of O. (Orthocladius) tryoni n. sp.
- Fig. 160. Interspecific relationship of wing width to wing length in 24 species of Orthocladius (Orthocladius).
- Fig. 161. Interspecific relationship of wing length to anapleural suture length in 24 species of Orthocladius (Orthocladius).
- Fig. 162. Interspecific relationship of wing length to A.R., and of wing length to F.L.R. in 24 species of Orthocladius (Orthocladius).
- Fig. 163. (a) Interspecific relationship of antennal flagellomere 13 (ANTT) to wing length in 24 species of Orthocladius (Orthocladius); (b) Interspecific relationship of antennal flagellomeres 1-12 (ANT3) to wing length in 24 species of Orthocladius (Orthocladius).
- Fig. 164. (a) Interspecific relationship of length of tibia of fore leg (FT) to wing length in 24 species of Orthocladius (Orthocladius); (b) Interspecific relationship of length of first tarsal segment of fore leg (FTA1) to wing length in 24 species of Orthocladius (Orthocladius).

Fig. 1. Prepared slide of adult male.

Fig. 2. Male thorax showing measurements, lateral view.

Abbreviations: th, thorax; as, anapleural suture.

Fig. 3. Male abdomen showing measurement, dorsal view.

Abbreviations: abd, abdomen.

Fig. 4. Female abdomen showing measurement, lateral view.

Abbreviations: abd, abdomen.

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Fig. 5. Thoracic structures in male of O. (Orthocladius) oliveri n. sp. (a) thorax, dorsal view, SEM 75X; (b) oval pit, dorsal view, SEM 700X; (c) cross section through notum in area of supraalar callus at anterior end of oval pit in preserved male, 200X; (d) cross section through notum in area of supraalar callus at anterior end of oval pit in freshly-killed male, 200X; (e) cross section through midline of scutum in area posterior to oval pit and anterior to scutellum in preserved male, 400X; (f) cross section through midline of scutum in oval pit in preserved male, 400X; (g) cross section through midline of scutum in oval pit in freshly-killed male, 400X; (h) mm scale for Figs. 5c-d; (i) mm scale for Figs. 5e-g.

Fig. 6. Male head of O. (Orthocladius) wiensi Saether, showing measurement, frontal view. Abbreviations: cly, clypeus; iod, interocular distance; iv, inner verticals; ov, outer verticals; po, postorbitals; pl-p5, palpal segments 1 to 5; sc, scape.

Fig. 7. Female head of O. (Orthocladius) wiensi Saether, frontal view. Abbreviations: as in Fig. 6.

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Fig. 8. Male antenna showing measurements. Abbreviations: fl 1-12, flagellomeres 1 to 12; fl 13, flagellomere 13; p, pedicel; s, scape.

Fig. 9. Female antenna showing measurements. Abbreviations: fl 1-4, flagellomeres 1 to 4; fl 5, flagellomere 5.

Fig. 10. Scutellar arrangements, dorsal view. (a) uniserial; (b) biserial; (c) multiserial.

Fig. 11. Male thorax, lateral view. Abbreviations: ac, acrostichals; dc, dorsocentrals; la, lateral anteprenotals; mp, mesonotal (oval) pit; pa, prealars; sc, scutellars.

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Fig. 12. Male wing of O. (Orthocladius) nigrinus Malloch.

Abbreviations: al, anal lobe; C-R4+5, costa and radius-four-plus-five; cs, campaniform sensilla; Cu1, cubitus-one; Cu2, cubitus-two; fCu, fork of cubitus-one and cubitus-two; M, media; R, radius; R1, radius-one; R2+3, radius-two-plus-three; R4+5, radius-four-plus-five; r-m, radio-medial crossvein; sq, squamals; st, stem vein.

Fig. 13. Female wing of O. (Orthocladius) nigrinus Malloch.

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Fig. 14. Male wings of Orthocladius. (a) O. (Orthocladius) nigritus Malloch, showing measurements. Abbreviations: a-fCu, arculus to fCu; a-rm, arculus to r-m; wl, wing length; ww, wing width. (b) apex of wing of O. (Orthocladius) tryoni n. sp.; (c) apex of wing of O. (Orthocladius) clarkei n. sp.; (d) apex of wing of O. (Orthocladius) cooki n. sp.; (e) proximal portion of wing of O. (Orthocladius) tryoni n. sp.; (f) proximal portion of wing of O. (Orthocladius) paradecoratus n. sp.; (g) proximal portion of wing of O. (Pogonocladus) consobrinus (Holmgren).

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Fig. 15. Male legs of Orthocladius. (a) fore leg of O. (Orthocladius) mallochi Kieffer, showing measurements along median axis.

Abbreviations: F, femur; T, tibia; t1-t5, tarsal segments 1 to 5. (b) tarsus of fore leg of O. (Pogonocladus) consobrinus (Holmgren); (c) tibial comb and spines of hind leg of O. (Orthocladius) mallochi Kieffer; (d) tibial spur of mid leg of O. (Orthocladius) trigonolabis Edwards, lectotype; (e) tibial spurs of mid leg of O. (Orthocladius) trigonolabis Edwards, North American specimen.

Fig. 16. Male hypopygium of O. (Orthocladius) trigonolabis Edwards.

(a) ventral view; (b) dorsal view. Abbreviations: ap, anal point; bml, basal median lobes; dbl, dorsal part of basal lobe; ds, dorsal strut; gcx, gonocoxite; gst, gonostylus; vbl, ventral part of basal lobe; vi, virga; vs, ventral strut.

Fig. 17. Gonostylus of O. (Orthocladius) charensis n. sp.

Abbreviations: ia, inner area; de, dorsal edge; di, dorsal side; ve, ventral edge.

Fig. 18. Everted endophallus of O. (Euorthocladius) sp.

Abbreviations: en, endophallus; vi, virga; vs, ventral strut.

Fig. 19. Male hypopygium of O. (Orthocladius) obumbratus Johannsen with everted endophallus, showing measurements. Abbreviations: as in Fig. 16.

Fig. 20. Male hypopygium of O. (Euorthocladius) sp. (a) ventral view; (b) dorsal view.

Fig. 21. Male hypopygium of O. (Eudactylocladius) mixtus (Holmgren). (a) ventral view; (b) dorsal view.

Fig. 22. Male hypopygium of O. (Pogonoladius) consobrinus (Holmgren). (a) ventral view; (b) dorsal view.

Fig. 23. Male hypopygium of O. (Orthocladius) appersoni Sublette and Sublette, paratype. (a) ventral view; (b) dorsal view.

Fig. 24. Male hypopygium of O. (Orthocladius) appersoni Sublette and Sublette, N.W.T. specimen. (a) ventral view; (b) dorsal view.

Fig. 25. Male hypopygium of O. (Orthocladius) smolandicus Brundin. (a) ventral view; (b) dorsal view.

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Fig. 26. Male hypopygium of O. (Orthocladius) hellenthali Sublette and Sublette, holotype. (a) ventral view; (b) dorsal view.

Fig. 27. Male hypopygium of O. (Orthocladius) curtiseta Sæther, holotype. (a) ventral view; (b) dorsal view.

Fig. 28. Male hypopygium of O. (Orthocladius) carlatus (Roback), holotype. (a) ventral view; (b) dorsal view.

Fig. 29. Male hypopygium of O. (Orthocladius) clarkei n. sp., holotype. (a) ventral view; (b) dorsal view.

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b

Fig. 30: Male hypopygium of O. (Orthocladius) dentifer Brundin,
(a) ventral view; (b) dorsal view.

Fig. 31. Male hypopygium of O. (Orthocladius) charensis n. sp.,
holotype. (a) ventral view; (b) dorsal view.

Fig. 32. Male hypopygium of O. (Orthocladius) subletti n. sp.,
holotype. (a) ventral view; (b) dorsal view.

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Fig. 33. Male hypopygium of O. (Orthocladius) trigonolabis
Edwards, lectotype. (a) ventral view; (b) dorsal view.

Fig. 34. Male hypopygium of O. (Orthocladius) lapponicus
Goethghebuer, lectotype. (a) ventral view; (b) dorsal view.

Fig. 35. Male hypopygium of O. (Orthocladius) lapponicus
Goethghebuer, Char Lake specimen. (a) ventral view; (b)
dorsal view.

Fig. 36. Male hypopygium of O. (Orthocladius) nigritus Malloch,
paratype. (a) ventral view; (b) dorsal view.

Fig. 37. Male hypopygium of O. (Orthocladius) nigritus Malloch,
Blanche River specimen. (a) ventral view; (b) dorsal view.

Fig. 38. Male hypopygium of O. (Orthocladius) cooki n. sp.,
holotype. (a) ventral view; (b) dorsal view.

Fig. 39. Male hypopygium of O. (Orthocladius) oblidens (Walker),
holotype. (a) ventral view; (b) dorsal view.

Fig. 40. Male hypopygium of O. (Orthocladius) mallochi Kieffer,
Ontario specimen. (a) ventral view; (b) dorsal view.

Fig. 41. Male hypopygium of O. (Orthocladius) mallochi Kieffer,
holotype. (a) ventral view; (b) dorsal view.

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A resolution test chart featuring several groups of horizontal and vertical lines of varying thicknesses. Each group is accompanied by a numerical value indicating the resolution level. The values include 1.0, 1.25, 1.4, 1.6, 1.8, 2.0, 2.2, 2.5, 2.8, 3.2, 3.6, 4.0, 4.5, 5.0, 5.6, 6.3, 7.1, 8.0, 9.0, 10.0, 11.2, 12.5, 14.0, 16.0, 18.0, 20.0, 22.5, 25.0, 28.0, 32.0, 36.0, 40.0, 45.0, 50.0, 56.0, 63.0, 71.0, 80.0, 90.0, 100.0, 112.0, 125.0, 140.0, 160.0, 180.0, 200.0, 225.0, 250.0, 280.0, 320.0, 360.0, 400.0, 450.0, 500.0, 560.0, 630.0, 710.0, 800.0, 900.0, 1000.0, 1120.0, 1250.0, 1400.0, 1600.0, 1800.0, 2000.0, 2250.0, 2500.0, 2800.0, 3200.0, 3600.0, 4000.0, 4500.0, 5000.0, 5600.0, 6300.0, 7100.0, 8000.0, 9000.0, 10000.0.

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- Fig. 42. Male hypopygium of O. (Orthocladus) oliveri n. sp.,
holotype. (a) ventral view; (b) dorsal view.
- Fig. 43. Male hypopygium of O. (Orthocladus) tryoni n. sp.,
holotype. (a) ventral view; (b) dorsal view, with gonostylus
of paratype.
- Fig. 44. Male hypopygium of O. (Orthocladus) annectens Saether,
holotype. (a) ventral view; (b) dorsal view.

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Fig. 45. Genitalia of intersex of O. (Orthocladius) obumbratus Johannsen. (a) ventral view; (b) dorsal view. Abbreviations: c, cercus.

Fig. 46. Male hypopygium of O. (Orthocladius) obumbratus Johannsen, South Dakota specimen. (a) ventral view; (b) dorsal view.

Fig. 47. Male hypopygium of O. (Orthocladius) obumbratus Johannsen, Tectotype. (a) ventral view; (b) dorsal view.

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Fig. 48. Male hypopygium of O. (Orthocladius) doreus (Roback),
holotype. (a) ventral view; (b) dorsal view.

Fig. 49. Male hypopygium of O. (Orthocladius) doreus (Roback),
Minnesota specimen. (a) ventral view; (b) dorsal view.

Fig. 50. Male hypopygium of O. (Orthocladius) knuthi n. sp.,
holotype. (a) ventral view; (b) dorsal view.

Fig. 51. Male hypopygium of O. (Orthocladius) groenlandensis
Goethghebuer, holotype. (a) ventral view; (b) dorsal view.

Fig. 52. Male hypopygium of O. (Orthocladius) hazensis n. sp.,
holotype. (a) ventral view; (b) dorsal view.

Fig. 53. Male hypopygium of O. (Orthocladius) paradecoratus n. sp.,
holotype. (a) ventral view; (b) dorsal view.

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Fig. 54. Male hypopygium of O. (Orthocladius) robacki n. sp.,
holotype. (a) ventral view; (b) dorsal view.

Fig. 55. Male hypopygium of O. (Orthocladius) manitobensis Saether,
holotype. (a) ventral view; (b) dorsal view.

Fig. 56. Male hypopygium of O. (Orthocladius) wiensi Saether.,
holotype. (a) ventral view; (b) dorsal view.

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Fig. 57. Female genitalia of O. (Orthocladius) lapponicus

Goethghebuer, lateral view. Abbreviations: cer, cercus;
lsIX, lateral sternite IX; sp. spermatheca; spd, spermathecal
duct; tIX, tergite IX.

Fig. 58. Female genitalia of O. (Euorthocladius) sp., lateral view.

Fig. 59. Female genitalia of O. (Eudactylocladius) sp., lateral view.

Fig. 60. Female genitalia of O. (Pogonocladius) consobrinus

(Holmgren), lateral view.

Fig. 61. Female genitalia of O. (Orthocladus) charensis n. sp.,
paratype, lateral view.

Fig. 62. Female genitalia of O. (Orthocladus) lapponicus
Goethghebuer, lateral view.

Fig. 63. Female genitalia of O. (Orthocladus) lapponicus
Goethghebuer, lateral view.

Fig. 64. Female genitalia of O. (Orthocladus) obumbratus Johannsen,
lateral view.

Fig. 65. Female genitalia of O. (Orthocladus) obumbratus Johannsen,
paralectotype, lateral view.

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Fig. 66. Female genitalia of O. (Orthocladius) trigonolabis Edwards,
paralectotype, lateral view.

Fig. 67. Female genitalia of O. (Orthocladius) clarkei n. sp.,
allotype, lateral view.

Fig. 68. Female genitalia of O. (Orthocladius) mallochi Kieffer,
lateral view.

Fig. 69. Female genitalia of O. (Orthocladius) doreus (Roback),
allotype, lateral view.

Fig. 70. Female genitalia of O. (Orthocladius) nigrinus Malloch,
paratype, lateral view.

Fig. 71. Female genitalia of O. (Orthocladius) nigrinus Malloch,
lateral view.

Fig. 72. Female genitalia of O. (Orthocladus) knuthi n. sp.,
allotype, lateral view.

Fig. 73. Female genitalia of O. (Orthocladus) wiensi Saether,
allotype, lateral view.

Fig. 74. Female genitalia of O. (Orthocladus) carlatus (Röback),
lateral view.

Fig. 75. Female genitalia of O. (Orthocladus) annectens Saether,
lateral view.

Fig. 76. Female genitalia of O. (Orthocladus) oliveri n. sp.;
allotype, lateral view.

Fig. 77. Female genitalia of O. (Orthocladus) appersoni Sublette
and Sublette, paratype, ventral view.

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Fig. 78. Antennae of females of O. (Orthocladus). (a) O. annectens Saether; (b) O. carlatus (Roback); (c) O. charensis n. sp., allotype; (d) O. clarkei n. sp., allotype; (e) O. doreus (Roback), allotype; (f) O. lapponicus Goethghebuer; (g) O. mallochi Kieffer; (h) O. nigratus Malloch, paratype; (i) O. obumbratus Johannsen, paralectotype; (j) O. oliveri n. sp., allotype; (k) O. trigonolabis Edwards, paralectotype; (l) O. wiensi Saether, allotype.

Fig. 79. Cephalothorax of pupal exuvia of O. (Orthocladius) obumbratus Johannsen, showing measurement, right side dorsal view, left side ventral view. Abbreviations: ctl, cephalothoracic length; dc, dorsocentrals; eca, area along eclosion line; ft, frontal tubercle; fs, frontal seta; h, humerals; la, lateral anteprenotals; ma, median anteprenotals; pa, prealar; po, postorbital; th, thoracic horn.

Fig. 80. Thoracic horns of pupal exuviae of Orthocladius. (a) O. (Orthocladius) obumbratus Johannsen, showing measurement. Abbreviations: thl, thoracic horn length. (b) O. (Pogonolacidus) consobrinus (Holmgren); (c) O. (Euorthocladius) Type I sp.; (d) O. (Eudactylocladius) sp.; (e) O. (Euorthocladius) Type II sp.

Fig. 81-89. Purposely omitted.

Fig. 90. Thoracic horns of pupal exuviae of O. (Orthocladus).

(a) O. annectens Saether; (b) O. appersoni Sublette and Sublette; (c) O. carlatus (Roback); (d) O. charensis n. sp.; (e) O. clarkei n. sp.; (f) O. curtiseta Saether; (g) O. dentifer Brundin; (h) O. doreus (Roback); (i) O. knuthi n. sp.; (j) O. lapponicus Goethghebuer; (k) O. mallochi Kieffer; (l) O. manitobensis Saether; (m) O. obumbratus Johannsen; (n) O. oliveri n. sp.; (o) O. nigrinus Malloch; (p) O. robacki n. sp.; (q) O. trigonolabis Edwards; (r) O. tryoni n. sp.; (s) O. wiensi Saether.

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Fig. 91. Pupal structures of O. (Orthocladius). (a) thoracic horn of O. (Orthocladius) dorenus (Roback), SEM 270X; (b) thoracic horn of O. (Orthocladius) dorenus (Roback), SEM 1080X; (c) thoracic horn of O. (Orthocladius) oliveri n. sp., SEM 230X; (d) thoracic horn of O. (Orthocladius) oliveri n. sp., SEM 1020X; (e) recurved spine patch on tergite II of O. (Orthocladius) obumbratus Johannsen, SEM 1100X; (f) bumpy area along eclosion line of cephalothorax of O. (Orthocladius) dorenus (Roback), SEM 1200X; (g) chitinous rings on tergite II of O. (Orthocladius) carlatus (Roback), SEM 500X; (h) chitinous rings on tergite III of O. (Orthocladius) carlatus (Roback), SEM 300X.

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Fig. 92. Abdomen of pupal exuvia of O. (Orthocladus) oliveri n. sp., showing measurements, dorsal view. Abbreviations: a-ds, anteriorly-directed spines; abd, abdomen; al, anal lobe; Amm, anal median muscle marks; csp, central spine patch; ds, dorsal seta; Omm, oval median muscle marks; psB, pedes spurii B; rsp, recurved spine patch; sp, spurs; ts, terminal setae.

Fig. 93. Anterior part of cephalothorax of pupal exuvia along eclosion line of O. (Orthocladius) doreus (Roback), lateral view.

Fig. 94. Anteroventral part of cephalothorax of pupal exuvia of O. (Orthocladius) doreus (Roback), frontal view. Abbreviations: ft, frontal tubercle.

Fig. 95. Abdominal tergites IV-V of pupal exuvia of O. (Euorthocladius) Type I sp., dorsal view.

Fig. 96. Abdominal sternite V of pupal exuvia of O. (Orthocladius) lapponicus Goethghebuer, ventral view.

Fig. 97. Abdominal segment II of pupal exuvia of O. (Euorthocladius) Type II sp., ventral view.

Fig. 98. Abdominal tergites IV-VI of pupal exuvia of O.
(Eudactylocladius) sp., dorsal view.

Fig. 99. Abdominal tergite III of O. (Pogonocladus) consobrinus
(Holmgren), dorsal view.

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- Fig. 100. Abdominal tergites III-IV of pupal exuvia of O.
(Orthocladius) clarkei n. sp., dorsal view.
- Fig. 101. Abdominal tergites IV-V of pupal exuvia of O. (Orthocladius)
appersoni Sublette and Sublette, dorsal view.
- Fig. 102. Abdominal tergites IV-VI of pupal exuvia of O. (Orthocladius)
annectens Saether, dorsal view.
- Fig. 103. Abdominal tergites III-IV of pupal exuvia of (O.)
(Orthocladius) carlatus (Roback), dorsal view.
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Fig. 104. Segment IX of pupal exuvia of O. (Orthocladius) tryoni
n. sp., dorsal view.

Fig. 105. Segment IX of pupal exuvia of O. (Euorthocladius) Type
II sp., dorsal view.

Fig. 106. Segment IX of pupal exuvia of O. (Euorthocladius) Type
I sp., dorsal view.

Fig. 107. Segment IX of pupal exuvia of O. (Orthocladius) charensis
n. sp., dorsal view.

Fig. 108. Cephalic structures of 3rd instar larva of O. (Orthocladus)
charensis n. sp.. (a) larval head, ventral view, SEM 500X;
(b) labral setae, SEM 1750X; (c) antenna, SEM 2250X; (d)
epipharyngeal area, SEM 1250X.

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Fig. 109. Epipharynx of 4th instar larva of O. (Pogonocladus) consobrinus (Holmgren), ventral view.

Fig. 110. Labial plate of 4th instar larva of O. (Orthocladus) carlatus (Roback), showing measurement. Abbreviations: lpw, labial plate width.

Fig. 111. Antennae of 4th instar larvae of Orthocladus. (a) O. (Pogonocladus) consobrinus (Holmgren); (b) O. (Euorthocladus) Type II sp.; (c) O. (Eudactylocladius) sp.; (d) O. (Orthocladus) annectens Saether showing measurement. Abbreviations: as, accessory seta; bl, blade; Lo, Lauterborn organs; s, sensillum; sgm 1, segment 1; ss, sensory seta.

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Fig. 112. Cephalic structures of 4th instar larva of O.

(Orthocladius) robacki n. sp. (a) epipharynx, ventral view;
(b) antenna. Abbreviations: ls, lateral setae; p, pecten;
pm, premandible; sp, spinules; ts, tormal seta.

Fig. 113. Cephalic structures of 4th instar larva of O.

(Orthocladius) wiensi Saether. (a) epipharynx, ventral view;
(b) antenna.

Fig. 114. Cephalic structures of 4th instar larvae of O.

(Orthocladius). (a) antenna of O. (Orthocladius) carlatus
(Roback); (b) antenna of O. (Orthocladius) curtiseta Saether;
(c) antenna of O. (Orthocladius) dentifer Brundin; (d)
ungula and chaetae of O. (Orthocladius) nigritus Malloch;
(e) antenna of O. (Orthocladius) nigritus Malloch.

Fig. 115. Cephalic structures of 4th instar larva of O.

(Orthocladus) manitobensis Saether. (a) epipharynx, ventral view; (b) antenna.

Fig. 116. Cephalic structures of 4th instar larva of O.

(Orthocladus) obumbratus Johannsen. (a) epipharynx, ventral view; (b) antenna.

Fig. 117. Cephalic structures of 4th instar larva of O.

(Orthocladus) oliveri n. sp. (a) epipharynx, ventral view; (b) antenna. Abbreviations: g, grooves of antennal blade.

Fig. 118. Cephalic structures of 4th instar larva of O.
(Orthocladus) dorenus (Roback). (a) epipharynx, ventral
view; (b) antenna.

Fig. 119: Cephalic structures of 4th instar larva of O.
(Orthocladus) lapponicus Goethghebuer. (a) epipharynx,
ventral view; (b) antenna.

Fig. 120. Cephalic structures of 4th instar larva of O.
(Orthocladus) mallochi Kieffer. (a) epipharynx, ventral
view; (b) antenna.

118

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b

Fig. 121. Cephalic structures of 4th instar larva of O.

(Orthocladius) annectens Saether. (a) epipharynx, ventral view; (b) antenna of holotype exuvia; (c) antenna of N.W.T. specimen.

Fig. 122. Cephalic structures of 4th instar larva of O.

(Orthocladius) charensis n. sp. (a) epipharynx, ventral view; (b) antenna; (c) eyespots.

Fig. 123. Cephalic structures of 4th instar larva of O.

(Orthocladius) clarkei n. sp. (a) epipharynx, ventral view; (b) antenna.

Fig. 124. Mouthparts of 4th instar larva of O. (Euorthocladius)

Type I sp. (a) mandible; (b) labial plate.

Fig. 125. Mouthparts of 4th instar larva of O. (Euorthocladius)

Type II sp. (a) mandible; (b) labial plate.

Fig. 126. Mouthparts of 4th instar larva of O. (Euorthocladius)

Type III sp. (a) labial plate; (b) mandible.

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b

Fig. 127. Mouthparts of 4th instar larva of O. (Pogonocladius)
consobrinus (Hölmgren). (a) labial plate; (b) mandible.

Fig. 128. Mouthparts of 4th instar larva of O. (Eudactylocladius)
sp. (a) mandible; (b) labial plate.

127

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128

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b

Fig. 129. Mouthparts of 4th instar larva of O. (Orthocladius)
charensis n. sp. (a) mandible; (b) labial plate.

Fig. 130. Mouthparts of larvae of O. (Orthocladius) lapponicus
Goethghebuer. (a) mandible of 4th instar; (b) labial plate
of 4th instar; (c) labial plate of 2nd instar.

Fig. 131. Mouthparts of 4th instar larva of O. (Orthocladius)
oliveri n. sp. (a) mandible; (b) labial plate.

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b

Fig. 132. Mouthparts of 4th instar larva of O. (Orthocladius) carlatus (Roback). (a) mandible; (b) labial plate.

Fig. 133. Mouthparts of 4th instar larva of O. (Orthocladius) obumbratus Johannsen. (a) mandible; (b) labial plate.

Fig. 134. Mouthparts of 4th instar larva of O. (Orthocladius) robacki n. sp. (a) labial plate; (b) mandible.

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b

Fig. 135. Mouthparts of 4th instar larva of O. (Orthocladius)
manitobensis Saether. (a) mandible; (b) labial plate.

Fig. 136. Mouthparts of 4th instar larva of O. (Orthocladius)
dorenus (Roback). (a) labial plate; (b) mandible.

Fig. 137. Mouthparts of 4th instar larva of O. (Orthocladius)
nigritus Malloch. (a) mandible; (b) labial plate.

Fig. 138. Mouthparts of 4th instar larva of O. (Orthocladius)
curtiseta Saether. (a) mandible; (b) labial plate.

Fig. 139. Mouthparts of 4th instar larva of O. (Orthocladius)
dentifer Brundin. (a) mandible; (b) labial plate.

Fig. 140. Mouthparts of 4th instar larva of O. (Orthocladius)
annectens Saether. (a) mandible; (b) labial plate.

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b

Fig. 141. Mouthparts of 4th instar larva of O. (Orthocladius)
clarkei n. sp. (a) labial plate; (b) mandible.

Fig. 142. Mouthparts of 4th instar larva of O. (Orthocladius)
mallochi Kieffer. (a) labial plate; (b) mandible.

Abbreviations: pl, paralabial plate.

Fig. 143. Mouthparts of 4th instar larva of O. (Orthocladius)
wiensi Saether. (a) labial plate; (b) mandible.

Fig. 144. Distribution of O. (Orthocladus) annectens Saether.

Fig. 145. Distribution of O. (Orthocladius) appersoni Sublette
and Sublette.

Fig. 146. Distributions of O. (Orthocladius) carlatus (Roback),
O. curtiseta Saether, and O. hellenthali Sublette and Sublette,
△ O. carlatus, ▲ O. curtiseta, ● O. hellenthali.

Fig. 147. Distribution of O. (Orthocladius) charensis n. sp.

Fig. 147.

Fig. 148. Distribution of O. (Orthocladus) clarkei n. sp.

Fig. 149. Distribution of O. (Orthocladus) dentifer Brundin.

Fig. 150. Distribution of O. (Orthocladius) doreus (Roback).

Fig. 150.

Fig. 152. Distribution of O. (Orthocladus) mallochi Kieffer.

Fig. 151.

Fig. 153. Distribution of O. (Orthocladus) manitobensis Saether.

Fig. 154. Distribution of O. (Orthocladius) nigritus Malloch.

Fig. 155. Distribution of O. (Orthocladus) obumbratus Johannsen.

Fig. 156. Distribution of O. (Orthocladus) oliveri n. sp.

Fig. 157. Distribution of O. (Orthocladius) subletti n. sp.

Fig. 157.

Fig. 158. Distribution of O. (Orthocladius) trigonolabis Edwards.

Fig. 158.

Fig. 159. Distribution of O. (Orthocladius) tryoni n. sp.

Fig. 160. Interspecific relationship of wing width to wing length
in 24 species of Orthocladus (Orthocladus).

Fig. 160.

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NATIONAL BUREAU OF STANDARDS
STANDARD REFERENCE MATERIAL 1010a
(ANSI and ISO TEST CHART No. 2)

Fig. 161. Interspecific relationship of wing length to anapleural suture length in 24 species of Orthocladius (Orthocladius).

Fig. 161.

Fig. 162. Interspecific relationship of wing length to A.R., and of wing length to F.L.R. in 24 species of Orthocladius (Orthocladius).

Fig. 162.

Fig. 163. (a) Interspecific relationship of antennal flagellomere 13 (ANTT) to wing length in 24 species of Orthocladius (Orthocladius); (b) Interspecific relationship of antennal flagellomeres 1-12 (ANT3) to wing length in 24 species of Orthocladius (Orthocladius).

Fig. 163a.

Fig. 163b.

Fig. 164. (a) Interspecific relationship of length of tibia of fore leg (FT) to wing length in 24 species of Orthocladius (Orthocladius); (b) Interspecific relationship of length of first tarsal segment of fore leg (FTA1) to wing length in 24 species of Orthocladius (Orthocladius).

Fig. 164a.

Fig. 164b.

END

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