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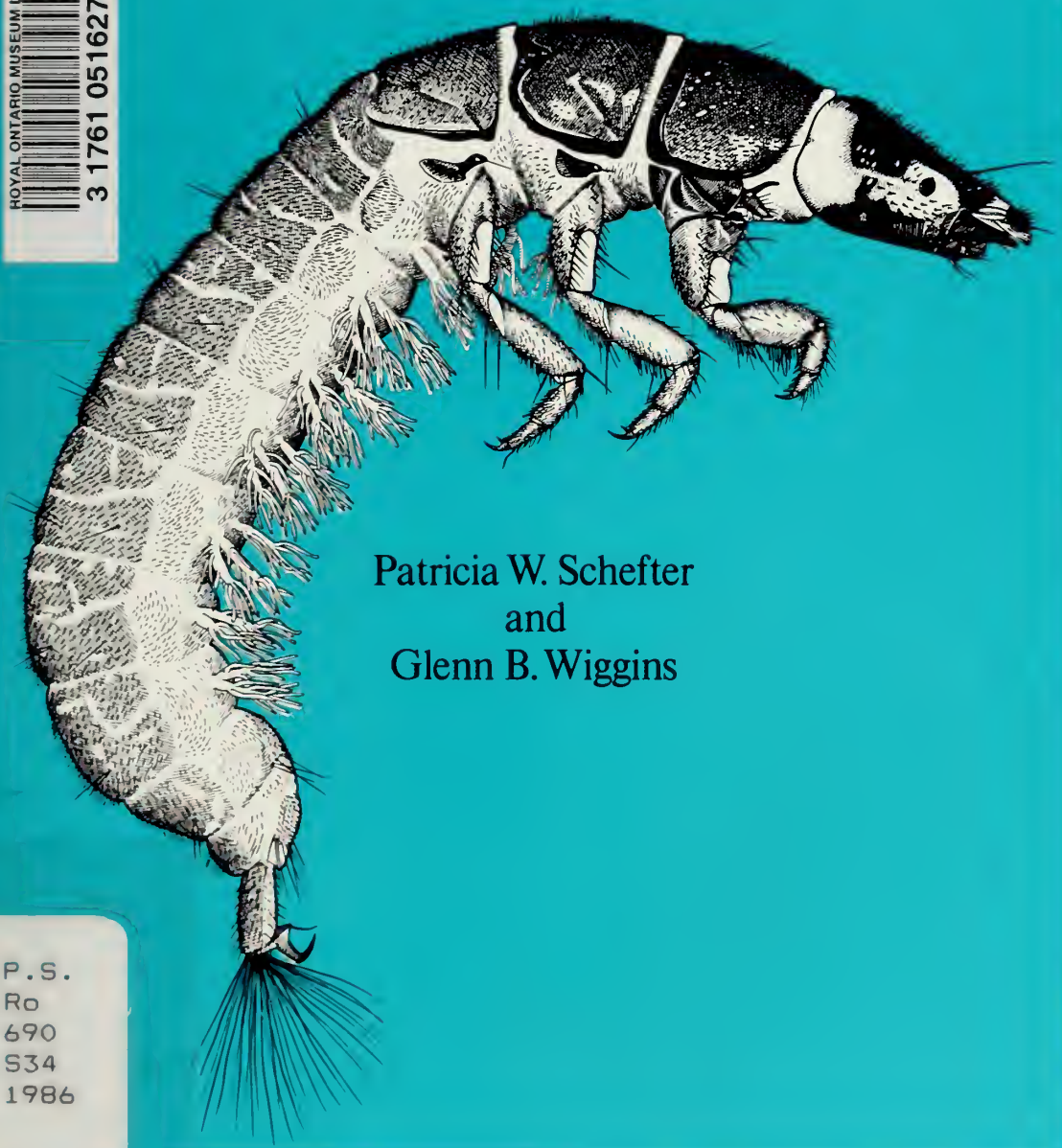

Patricia W. Schefter
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Patricia W. Schefter is a Curatorial Assistant in the Department of Entomology, Royal Ontario Museum.
Glenn B. Wiggins is Curator in charge, Department of Entomology, Royal Ontario Museum, and Professor in the Department of Zoology, University of Toronto.

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CONTENTS

A Systematic Study of Nearctic Larvae of the *Hydropsyche morosa* Group (Trichoptera: Hydropsychidae)

Abstract

A system of taxonomic characters based on primary and secondary setae is developed and applied to identification of larvae of the *Hydropsyche morosa* (formerly *bifida*) species group known in North America. Diagnoses are provided for final instar larvae of *H. aenigma* Schefter, Wiggins, and Unzicker, *alhedra* Ross, *alternans* (Walker), *amblis* Ross, *bronta* Ross, *centra* Ross, *cheilonis* Ross, *cockerelli* Banks, *etnieri* Schuster and Talak, *macleodi* Flint, *morosa* Hagen, *oslari* Banks, *piatrix* Ross, *slossonae* Banks, *sparna* Ross, *tana* Ross, *venada* Ross, *ventura* Ross, *vexa* Ross, and *walkeri* Betten and Mosely. Of the Nearctic species known in the *morosa* group, *H. abella* Denning, *andersoni* Denning, *cora* Denning, *dorata* Denning, *intrica* Denning, *protis* Ross, and *vanaca* Denning remain unassociated in the larval stage, although diagnoses for three unnamed species known only as larvae are also provided. Secondary setal types are defined and illustrated, and a key is provided to the Nearctic larvae now known; distribution of each species is summarized. Characters based on setae appear to be less variable over the entire range of each species than the traditional characters of colour, and for the most part they are concordant with genitalic characters, suggesting that larval chaetotaxy is likely to provide useful data for classification and phylogeny in the Hydropsychidae.

INTRODUCTION

More than 80 species of *Hydropsyche* are known in North America, their larvae abundant in running water habitats. Although discrimination of species among the adult stages has developed with growing precision, identification of the larvae is a problem of long standing. Taxonomy of larvae based largely on markings of the head was introduced by Ross (1944) for a number of eastern species, and a major advance in larval identification was made by Schuster and Etnier (1978) with diagnoses for 39 eastern species based mainly on markings with some characters of setal form. Diagnoses based on head pattern were provided for three western species by Alstad (1980).

The present study was prompted by problems of geographic variability in head markings which made existing diagnoses ineffective over the full geographic range of many species, particularly for northern populations of species originally characterized in the southeast. Moreover, even with larval/adult associations from populations over

much of the range, larvae of several species were inseparable because of intergradation of traditional characters. The objective of the present study was, then, to discover diagnostic characters that were less variable over the entire range of the species, and appropriate for discrimination among similar species. New suites of setal characters were found which satisfied these criteria fairly effectively. Some similar characters were employed by Smith and Lehmkuhl (1980) in diagnoses for four species which appeared during the final stages of the present study.

THE *HYDROPSYCHE MOROSA* GROUP

Because *Hydropsyche bifida* Banks has been shown to be a junior synonym of *H. morosa* Hagen (Schefter and Unzicker, 1984), the *bifida* species group is now known as the *morosa* group.

SYSTEMATICS

Approximately 200 species of *Hydropsyche*, distributed throughout all biotic regions of the world except the Neotropical, are divided into species groups: the *morosa*, *depravata*, *scalaris*, and *cuanis* groups in North America; the *fulvipes-instabilis* and *simulans* groups in Europe; the *bryanti-celebensis-annulata* group in southeast Asia; the *propinqua* group in Africa. The Eurasian *nevae* group (Schmid, 1961) and *penicillata* group (Schmid, 1965), combined by Botoşăneanu (1970) as the *nevae* group, should be incorporated in the *morosa* group along with the Palaearctic *H. silfvenii*. Approximately 15 species of the *morosa* group have ranges in Asia, two occur in Siberia and Europe, and 21 in North America.

Traditionally the *morosa* group has been distinguished from other Nearctic *Hydropsyche* species on the basis of male genitalic characters. Homologies of the phallic structures in *Hydropsyche* have been interpreted differently by various authors (Nielsen, 1957, 1981; Ross and Unzicker, 1977; Schmid, 1979, 1980), and we are employing a synthesis of terminology derived from Schmid (1979, 1980) and Schefter and Unzicker (1984), until a phylogenetic assessment of the whole of *Hydropsyche* and related genera has been completed on a world-wide basis.

In contrast with the entirely sclerotized phallotheca of the *depravata*, *scalaris*, and *cuanis* groups, the phallus of the *morosa* group species (Figs. 1–5) comprises a sinuate, tubular phallotheca into which is inserted dorsally in the distal portion a complex dorsolateral membrane, probably a modified endotheca (F. Schmid, pers. comm.) surmounted by a pair of ovoid sclerotized processes, the phallotremal sclerites (parameres, Nielsen, 1981). These dorsal sclerites articulate with an internal ejaculatory structure and the proximal membrane may be relatively unmodified as in *H. oslari* (Fig. 1) or be more elaborately lobed and armed with spicules or spines as in the other species (Figs. 2–5). The apex of the phallotheca (ventral endothecal lobe, Ross and Unzicker, 1977) is modified as well, usually partially membranous and in most cases equipped with eversible or permanently everted membranous lobes tipped with spicules. Nielsen identified the gonopore as the distal opening of the ejaculatory duct near the apex of the aedeagus, flanked by inner lips (1957) or parameres (1981); Ross and Unzicker (1977) placed the gonopore in the proximal cavity of the

phallobase, opening into a large endophallus occupying much of the phallic cavity, and apparently opened and closed by phallotremal sclerites flanking the distal pore, or phallotreme. Schmid's (1979) comments draw attention to the difficulties raised in phylogenetic interpretation by inconsistencies in phallic homologies.

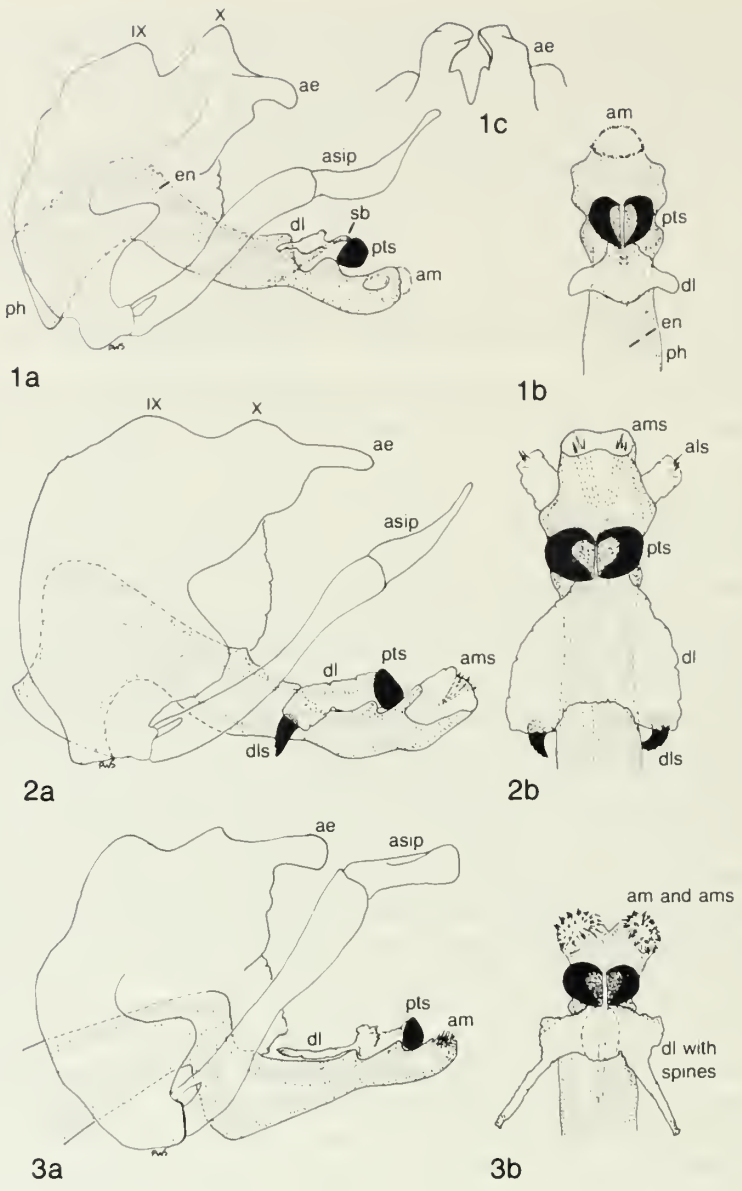
The tenth abdominal segment bears two fingerlike apical extensions (paraprocts, Nielsen, 1981) (Fig. 1c) absent in most other *Hydropsyche* species groups, although present in the Asian *bryanti-celebensis-annulata* group. Internal abdominal glands, characteristic of many families of Trichoptera, are present and well developed in the *morosa* group although greatly reduced in the other species of *Hydropsyche* (Schuster, 1977). Abdominal segment X is distinctive in *morosa* group females, bearing an arched row of setae adjacent to the invaginated clasper receptacle (Figs. 6–8).

Pupae of the *morosa* group bear a pair of dorsal hook plates on the second abdominal segment which are lacking in other species of *Hydropsyche* (Schuster, 1984).

All *Hydropsyche* larvae bear several different types of secondary setae, described in detail below, but the *morosa* species group is distinguished from others by the absence of minute, often colourless spines on the dorsal surface of at least the first three abdominal segments; these spines occur on all abdominal segments in the *depravata*, *scalaris*, and *cuanis* species groups.

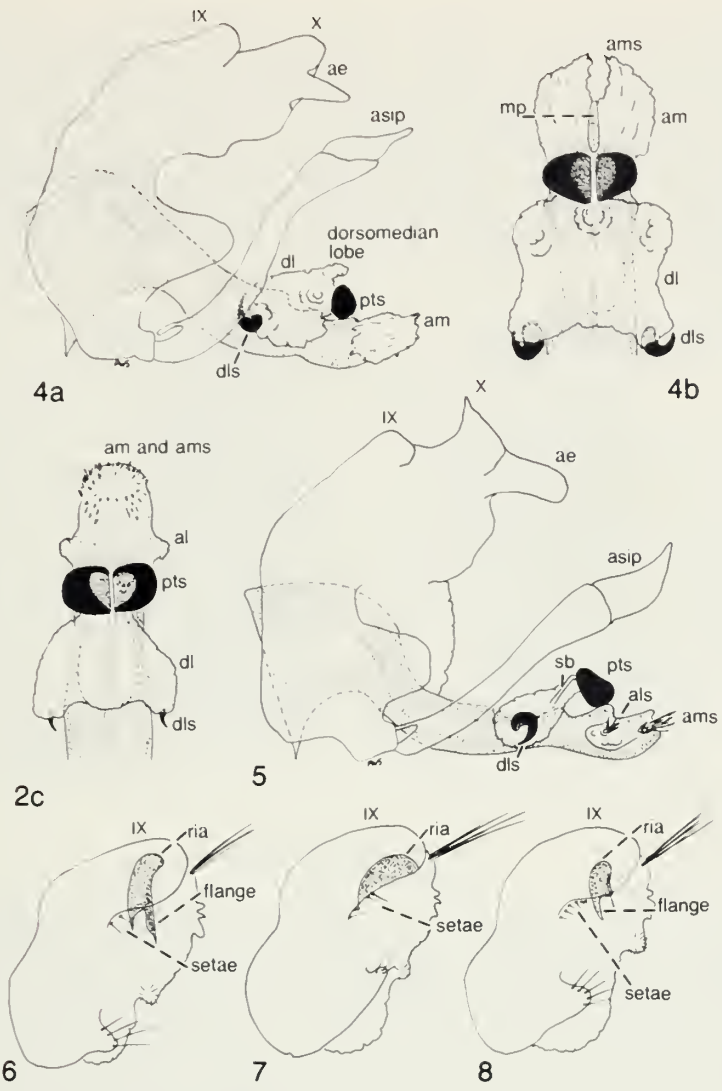
Larvae of *Hydropsyche* are of the typical hydropsychid form (Wiggins, 1977), with a quadrate to globose head, flattened dorsally, straight or slightly curved frontoclypeal sutures, the ventral apotome divided into a large and roughly triangular anterior portion, and a minute posterior triangular part connected by the ventral ecdysial suture. Meso- and metanotal sclerites lack transverse ecdysial sutures, and the foretrochantin is forked. Abdominal gills occur as single ventromedian stalks and bifid ventrolateral stalks bearing short filaments, and sometimes single lobelike filaments laterally on at least abdominal segments I to VII. *Hydropsyche* is distinguished from other hydropsychines by the paired ventral sclerites of abdominal segment VIII and the large, subrectangular prosternal sclerites (Wiggins, 1977). Further distinction between *Hydropsyche* and *Cheumatopsyche* is in the primary setation of the head and prothorax (Mackay, 1978). Whereas head setae 2, 3, and 14 and pronotal seta 22 (*sensu* Williams and Wiggins, 1981) in *Cheumatopsyche* are thin, finely tapered, and usually more than one-half as long as the head or thorax, in *Hydropsyche* the same setae are usually less than one-half the length of head or prothorax and, although frequently finely tapered as well, appear thicker and stiffer.

The *morosa* group of *Hydropsyche* was recently transferred to the genus *Symphitopsyche* Ulmer, although as a separate subgenus *Ceratopsyche* (Ross and Unzicker, 1977). Shortcomings in the genitalic homologies employed in that study have been pointed out by Schmid (1979), but one of the strongest reservations about the taxonomic conclusions arises from the fact that many groups within the Hydropsychinae were not included in the analysis. More recently *Ceratopsyche* was elevated to full generic status (Nielsen, 1981) to include the *morosa* group of North America and some European species. It has long been a tenet of systematic biology that relationships among taxa comprising a group such as the subfamily Hydropsychinae can be accurately assessed only after making an exhaustive analysis of many characters of representatives of the world's fauna. Until this has been done in the Hydropsychinae, we take the position that taxonomic proposals resulting in



Figs. 1–5. Genital segments, male.

1. *H. oslari*.
   a) Lateral view.
   b) Tip of phallotheca, dorsal view.
   c) Apical extensions of abdominal segment X, dorsal view.
2. *H. morosa*.
   a) Lateral view.
   b) Eastern form, tip of phallotheca, dorsal view.
   c) West/central form, tip of phallotheca, dorsal view.
3. *H. ventura*.
   a) Lateral view.
   b) Tip of phallotheca, dorsal view.
4. *H. alternans*.
   a) Lateral view.
   b) Tip of phallotheca, dorsal view.
5. *H. amblis*. Lateral view.



Figs. 6–8. Genital segments, female, lateral view showing receptacle of inferior appendage.

6. *H. oslari*.
7. *H. ventura*.
8. *H. morosa*.

Abbreviations for genital segments:

ae	apical extension of abdominal segment X
al	apicolateral membrane
als	spicules of apicolateral membrane
am	apical membrane
ams	spicules of apical membrane
asip	apical segment of inferior appendage
dl	dorsolateral membrane
dls	spur of dorsolateral membrane
en	endophallus
ph	phallotheca
pts	phallotremal sclerite
ria	receptacle of inferior appendage
sb	sclerous band
IX	abdominal segment IX
X	abdominal segment X

nomenclatorial changes are premature. Morover, the monophyletic sets of species within *Hydropsyche sensu lato* are more appropriately expressed as subgenera and species groups because, as stated by Schmid (1979), their recognition as coordinate genera will become a precedent by which several large genera in the Trichoptera could be subdivided with equal justification; we are not convinced that generic fragmentation is a constructive development for the taxonomy of Trichoptera.

This study is concerned with larvae of Nearctic species of the *H. morosa* group, as listed below; species marked * are not treated because no larval material was available.

Hydropsyche abella Denning*
aenigma Schefter, Wiggins, and Unzicker
alhedra Ross
alternans (Walker)
amblis Ross
andersoni Denning*
bronta Ross
centra Ross
cheilonis Ross
cockerelli Ross
cora Denning*
dorata Denning*
etnieri Schuster and Talak
H. intrica Denning*
macleodi Flint
morosa Hagen
oslari Banks
piatrix Ross
protis Ross*
slossonae Banks
sparna Ross
tana Ross
vanaca Denning*
venada Ross
ventura Ross
vexa Ross
walkeri Betten and Mosely

BIOLOGY

Larvae of *Hydropsyche* species are widespread throughout the running water continuum, with the *scalaris* and *depravata* groups occurring primarily in downstream areas and *morosa* group larvae in summer-cool upper reaches of the stream. Although *morosa* group species are not usually found in torrential headwaters, *H. sparna* has been collected in cold, turbulent waterfall basins as well as a wide variety of other habitats, and some species, notably *H. etnieri* and *H. piatrix*, are apparently restricted to permanent spring-fed streams. *H. alternans*, although frequently found in large, fast rivers and lake outflows, also occurs along wave-washed shores of lakes.

Hydropsyche larvae attach fine-meshed silken nets to permanent substrates in moving water. Oriented in the current to filter suspended organic particles, the nets of different species vary in mesh size or location within the stream. At the edge of the net is a silken retreat, covered with sand grains or organic material, in which the larva lies concealed. *Hydropsyche* larvae are generally omnivorous, feeding on a variety of suspended organic materials including detritus, various invertebrates, algae, and diatoms, the latter also being scraped from algal mats which may accumulate near the opening of the larval retreat (Fuller and Mackay, 1980).

RANGE

Nearctic species of the *Hydropsyche morosa* group, with the exception of *H. cheilonis*, occur throughout the boreal forest biome and its ecotone extensions southwards into the Cordilleran and Appalachian montane forests (Ross, 1963, fig. 5), although no single species is distributed across the whole of North America. Three major range types can be delineated as follows:

Northern transcontinental species occur from Atlantic coastal watersheds across Canada and the northern United States to the northern Pacific coastal ranges, with northern limits at the tree line and southern limits roughly those of the boreal forest biome; species in this group may also extend southwards along the Rocky Mountains and/or the Appalachians. Species with northern transcontinental ranges are *H. alternans*, *alhedra*, *morosa*, and *slossonae*.

Eastern and northeastern species are either restricted to small areas of the Appalachians (*H. macleodi, H. etnieri*), or the Ozarks (*H. piatrix*), present only in the temperate deciduous forest biome of the south-central and midwestern United States (*H. cheilonis*), or are more widespread, extending through the Appalachian Mountains, northeastwards to Newfoundland, and northwestwards as far as the eastern slopes of the Rocky Mountains. Northern limits of this group lie considerably south of the tree line, with the southern limits variable; *H. bronta* has a widespread range within this group, and *H. ventura* is a species with a limited eastern range.

Species with western ranges are either widespread from the southwestern states and Mexico northwards into Alaska and the Yukon (*H. oslari, H. cockerelli*), or are more restricted (*H. amblis* and *H. centra* in the Pacific Northwest, *H. venada* in Arizona and New Mexico).

MATERIALS

Material examined in this study was obtained from several sources. The extensive collection of adult and immature *Hydropsyche* in the Department of Entomology, Royal Ontario Museum, and the many specimens collected during the course of the study provided the major portion; all material not otherwise indicated by acronym (see below) is deposited in the ROM, with that collected since 1978 bearing six-digit field site numbers. The geographic scope of the study has been broadened through loans and gifts of additional material from these institutions and individuals: D. G. Cobb and J. F. Flannagan, Freshwater Institute, Winnipeg; P. L. Flannagan, Manitoba Department of Natural Resources; O. S. Flint, National Museum of Natural History, Smithsonian Institution (USNMNH); D. Fowler, University of Central Michigan (DF); University of Minnesota Department of Entomology collection; R. J. Mackay, University of Toronto; J. A. Nasca, Buffalo, New York; A. P. Nimmo, University of Alberta; D. E. Ruiter, Denver, Colorado (DER); G. A. Schuster, Eastern Kentucky University (GAS); S. D. Smith, Central Washington University (SDS); M. J. Stansbury, Oregon (MJS); L. Tsomides, University of Maine (UM); J. D. Unzicker, Illinois Natural History Survey (INHS); J. S. Weaver, Clemson University (JSW).

TECHNIQUES

When larvae of unknown identity are encountered, there are two basic methods available for species discrimination, both widely employed for adult/larval species association in Trichoptera. The more precise is rearing sorted, field-collected larvae through to the adult stage, a process which can be difficult for hydropsychids because particular current and temperature regimes are often difficult to simulate. We have successfully reared *Hydropsyche* larvae in the small plexiglass chamber recently developed by Mackay (1981). Larvae can survive several days' transport from collecting site to laboratory packed with damp moss or paper towelling in plastic bags in a container of ice. Living fifth instar larvae should be sorted under a dissecting microscope to ensure as nearly as possible that they are of the same species, and some preserved as larvae.

The second method of larval/adult association involves repeated collecting at the same location until all life stages are obtained, or occasionally an opportunely timed single series yielding both larvae and mature pupae. The larval sclerites, shed at larval/pupal ecdysis and present in the intact case, along with the fully developed pharate adult, comprise a metamorphotype which is essential for positive larval/adult association. Larval identity, inferred from the exuvial sclerites in the pupal case, is still uncertain if species with similar pattern, size, and pupation time coexist in the same area of the stream, a situation encountered frequently. Moreover, setae are not retained on exuvial sclerites, and the connection between larval colour pattern and diagnostic setal patterns must be made on the basis of preserved whole specimens. It is necessary, therefore, to have identifiable larvae as well as metamorphotypes.

Metamorphotypes should be processed carefully in order to preserve all elements present in the pupal case. The anterior end of the case is opened and the specimen carefully extracted into a dish of clean alcohol, the larval exuviae remaining in the posterior end of the case. The species can be identified if genitalia of the pharate adult are sufficiently sclerotized, and the larval sclerites removed and compared with mature larvae collected at the same site. Each metamorphotype, with case and larval exuviae, is stored in a separate microvial, and all vials from one collection are placed in a jar with the larval collection and properly documented. We have found that for pharate adults fixed in Kahle's solution, the genitalia are more readily cleared for species determination by immersion in KOH solution at room temperature for several hours or overnight; internal tissues preserved in Kahle's solution tend to resist maceration.

The availability of metamorphotypes is often restricted to a brief period in the spring for univoltine species, and obtaining them may be further complicated by the migration of the mature larva from its filter-feeding location in the stream to an area more suitable for the sessile pupal stage. Thus while larval populations may be easily located and collected, pupae may be in different parts of the stream and attached to different kinds of substrate, or even buried within the substrate.

Because trichopteran adults are mainly nocturnal insects, they are most effectively collected by light traps at night or by sweeping riparian vegetation during the day. These methods are, however, not appropriate for establishing composition of communities at a particular site because *Hydropsyche* adults may fly long distances from their larval habitat. Emergence traps positioned over small areas of substrate, although yielding localized distribution and emergence data, are spatially and

temporally limited as well as impractical for extensive survey collections. Larvae may be collected by hand picking, kick and Surber sampling, or colonization of artificial substrate; but whatever method is employed, the habitat must be thoroughly explored because most sites support more than one species of *Hydropsyche*. For taxonomic study, the best larval specimens are obtained by fixation in Kahle's solution (Wiggins, 1977). The tendency for internal decomposition and reduced colour patterning of alcohol-fixed larvae is a detriment to the study of larval characters.

For this study, larvae of each species were cleared by immersion in KOH at room temperature, often for 24 hours, with the abdomen carefully cut from the rest of the body, ensuring complete maceration of all tissue. Setation was examined, sketched, and photographed at × 63.5 magnification with a Zeiss dissecting microscope, using both reflected and transmitted light. Head capsules cleared and mounted in glycerin in depression slides were viewed at × 100 using a compound microscope. For the scanning electron microscope (SEM) micrographs, cleared specimens were mounted on stubs and airdried at room temperature before coating with gold for examination. In using the key, diagnostic setal characters require magnification of at least × 50. To obtain mean head capsule measurements, a number of larvae were measured from geographically separate populations whenever possible, or a selection of largest and smallest fifth instars from a single population were measured (Mackay, 1978); sample size is bracketed following measurements.

CHAETOTAXAL CHARACTERS

INTRODUCTION

Although *Hydropsyche* larvae have been treated taxonomically by several authors in recent years (e.g., Ross, 1944; Lepneva, 1964; Wiggins, 1977; Schuster and Etnier, 1978), and some of the numerous and highly differentiated setal types have been described as morphological features (see Lepneva, 1964), setae with few exceptions have not been investigated as diagnostic characters within the genus. Ross (1944) and Schuster and Etnier (1978) distinguished *H. morosa* group larvae on the basis of dorsal abdominal setation. Schuster and Etnier distinguished *H. piatrix* larvae by the presence of large spinelike setae on the venter of the anal prolegs, and several species of the *scalaris* group by the presence of bristlelike setae on the frontoclypeus. Mackay (1978) used characters of anterolateral pronotal setae to distinguish between *Cheumatopsyche* larvae, *Hydropsyche sparna*, and the other hydropsychid species in her study area. Smith and Lehmkuhl (1980) distinguished four *morosa* group species using colour patterns, morphometric comparisons, and secondary setation of the head capsule. Williams and Wiggins (1981) have re-examined existing setal nomenclature for the Trichoptera, proposing a new and unified system incorporating primary setae and sensory pits of all body parts, homologizing them among the caddisfly taxa. We have found that distribution and morphology of both primary and secondary setae provide diagnostic characters which are much less subject to geographic variability than colour patterns.

PRIMARY SETAE

These setae are present on first instar larvae (Fig. 9) and persist in homologous positions through subsequent instars. Primary setae are therefore distinguished by position, rather than by morphology. Numbers used for primary setae in this study are those proposed by Williams and Wiggins (1981) in their comprehensive chaetotaxy for Trichoptera. Some primary setae on first instar larvae are plumose (Fig. 9), but primary setae of later instars are usually long, tapered, flexible, and may be either clear or dark (Fig. 24). Shorter and less flexible primary setae occur dorsally on the posterior parietal sclerites (e.g., head seta 17), dorsally and laterally on the thoracic notal sclerites (thoracic setae 22 and 5), and in some species pronotal seta 22 is very short and cylindrical or moderately long and slightly tapered. SEM study reveals that head seta 17 has a tubular structure with a distal pore (Fig. 10), as does the shorter pronotal seta 22 (Fig. 11); head seta 14, although longer and more flexible than seta

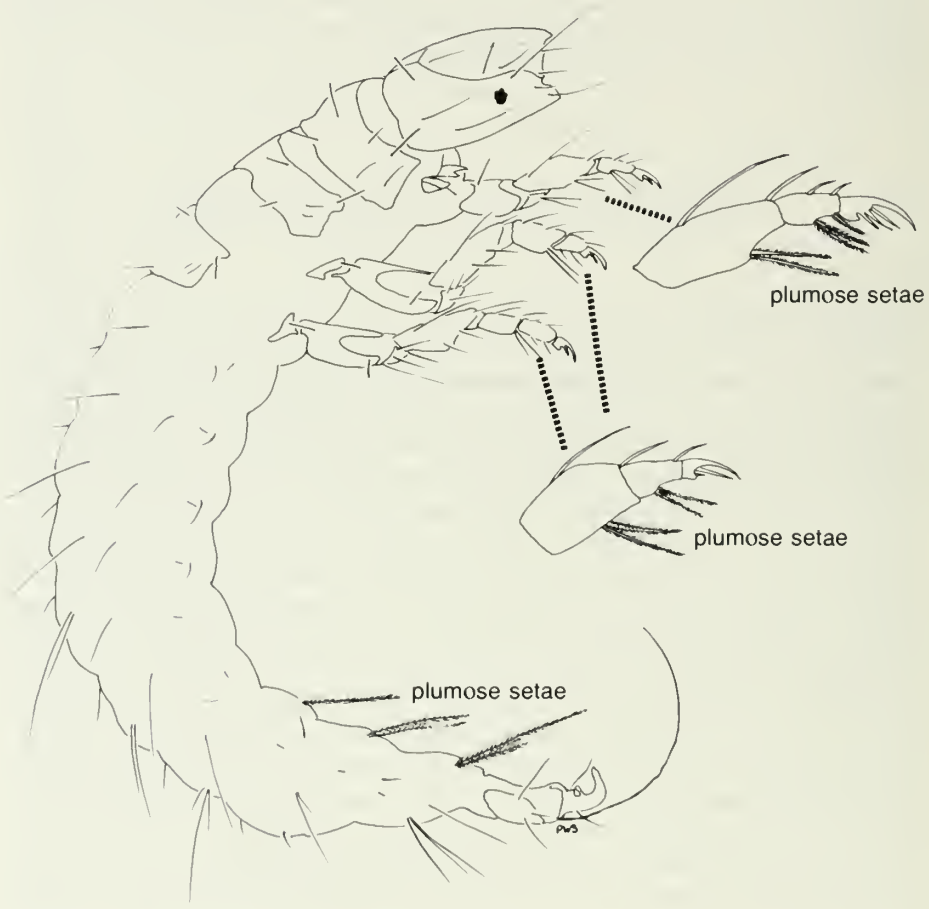


Fig. 9. First instar larva, *Hydropsyche sp.*, showing primary setation for *Hydropsyche*.

17, also has a distal pore in some species. Although primary setae of the head do not provide the diagnostic characters for larvae in this study, the length of pronotal seta 22 is used to distinguish subgroups of species. Primary setae on the legs, distinguished by their position, are often accompanied by long secondary setae or shorter spikelike setae (Fig. 26). Presence or absence, and colour of setae 1, 2, 3, and 5 on the trochanter, and setae 3 and 4 on the femur also furnish diagnostic characters (Figs. 39–44,53,54,58–61).

SECONDARY SETAE

Secondary setae arise in various positions on the body in instars II to V. Abundant and diverse, they provide a rich source of chaetotaxal characters. The designation, morphology, and distribution of diagnostic types recognized in this study are as follows:

ls *Long slender* setae are similar in appearance to long primary setae, may be clear or dark, and are usually located close to a primary seta; found on head, notal, and leg sclerites, and anal prolegs (Figs. 35–38,39–42,56).

ap *Acuminate peg* setae are short, bristlelike, distinctly tapered, clear (Fig. 28) or dark (Fig. 25), and are usually erect or inclined anteriorly on head and thoracic notal sclerites. SEM study reveals a fluted, tapering tubular structure, the distal pore with a smooth aperture (Fig. 12).

tp *Truncate peg* setae are short, bristlelike, cylindrical in shape (Fig. 13) or distally enlarged (Fig. 14), clear (Fig. 27a) or dark (Fig. 31), and are usually erect or inclined posteriorly on head and thoracic notal sclerites. Study by SEM reveals a fluted, sometimes finely grooved, tubular structure, with the distal pore crenulate (Fig. 14), dorsolaterally compressed (Fig. 10), or unelaborated (Fig. 13).

bl *Brushlike* setae are usually clear, very short, and inconspicuous under a dissecting microscope. Located on the frontoclypeus of several western species, the regularly spaced alveoli of these setae give the sclerite a punctate appearance (Fig. 27a). The presence of *brushlike* frontoclypeal setation is most easily detected by gently cleaning any detritus from the head and viewing it obliquely or laterally so that light directed through the minute, clear setae is visible. Examination with SEM shows the setae arising from a short fluted base, and distally dissected into 8 to 10 filaments (Fig. 15).

hl *Hairlike* setae are short, appressed, flexible, and present on most cuticular and sclerotized body surfaces. While the morphological diversity of the *hairlike* setae on the head capsule is not discernible under a dissecting microscope, study by SEM or examination of a cleared head capsule under a compound microscope reveals a variety of forms. Simple whiplike setae (Fig. 16) may be asymmetrically bifurcate, bifid, trifid, or have four to five filaments (Figs. 17,18). Fine structure of *hairlike* setae can vary within species and is therefore not useful as a diagnostic character.

sl *Spikelike* setae are sharp, inflexible, and may be short or medium long, clear reddish, clear tan, or dark. They are present on leg sclerites (Fig. 26), and anal prolegs (Fig. 35). Some *spikelike* setae have prominent sockets and are similar to the *spikelike* setae found on the ventral sclerites of abdominal segments VIII and IX (Fig. 35); these may be clear reddish or clear tan, or occasionally opaque red, and their arrangement on ventral membranous areas of the anal prolegs is diagnostic.

sh *Scale hairs* are erect or semierect abdominal setae, clavate (Figs. 19,20) or flattened and conspicuously wider than adjacent *hairlike* (*hl*) setae (Fig. 21) in some species, and are homologous with the club hairs of Schuster and Etnier (1978). They are mingled with appressed *hairlike* (*hl*) setae dorsally and occasionally laterally on abdominal segments (Figs. 65,66). SEM reveals a fluted structure with a terminal pore. Figure 21 shows abdominal setae in *H. betteni*, a species of the *depravata* group; note the wide, flattened *scale hair* (*sh*), and also the *minute spines* (*ms*) diagnostic for *depravata*, *scalaris*, and *cuanis* species groups.

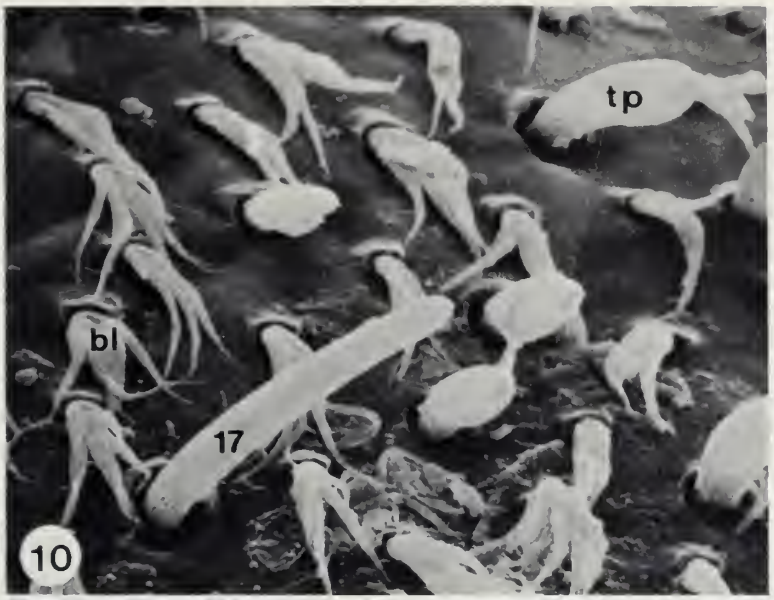
Other specialized but nondiagnostic secondary setae are the pectinate setae present on the lateral margins of the labrum (Fig. 22), the featherlike setae on the proximal leg segments illustrated by Jansson and Vuoristo (1979), and the brushlike setae on the anterior frontoclypeal margin (Fig. 23).

Colours of setae are very important in these diagnoses, and yet the vocabulary available to describe subtle differences is inadequate. We have tried to convey a visual impression—setae designated as "clear" may be hyaline, golden, orange, red, or tan, but they share the property of being transparent. On the other hand, "dark" setae are not necessarily opaque, but are simply darkly pigmented and may be brown or black, opaque or slightly translucent. A frontoclypeus "lacking apparent setation" may bear fine, clear, and inconspicuous *hairlike* (*hl*) setae which are often not visible under a dissecting microscope.

Describing larval colour patterns is equally difficult, and we use "light" and "dark" to imply contrasting colours—"light" may be yellow or tan, whereas "dark" may be tan, brown, or black, relative to the contrasting area.

Figs. 10–23. SEM photographs of setae.

10. Parietal, seta 17, *truncate peg* (*tp*) and *brushlike* (*bl*) setae; *H. sp.* (San Bernardino), × 860.
11. Pronotum, anterolateral seta 22; *H. sparna*, × 1300.
12. Parietal, *acuminate peg* (*ap*) seta; *H. bronta*, × 4000.
13. Parietal, *truncate peg* (*tp*) seta; *H. sparna*, × 4000.
14. Parietal, *truncate peg* (*tp*) seta; *H. walkeri*, × 4000.
15. Frontoclypeus, *brushlike* (*bl*) seta; *H. sp.* Snake River, × 1800.
16. Parietal, *hairlike* (*hl*) seta; *H. bronta*, × 1800.
17. Parietal, *hairlike* (*hl*) seta; *H. walkeri*, × 1800.
18. Parietal, *hairlike* (*hl*) seta; *H. cockerelli*, × 1800.
19. Abdomen, erect, clavate *scale hair* (*sh*); *H. sp.* (San Bernardino), × 1400.
20. Abdomen, erect, flattened *scale hair* (*sh*); *H. alhedra*, × 1400.
21. Abdomen, erect, flattened *scale hair* (*sh*) and *minute spines* (*ms*); *H. betteni*, × 1030.
22. Labrum, lateral pectinate setae; *H. alhedra*, × 1300.
23. Frontoclypeus, anterior margin; *H. alhedra*, × 2000.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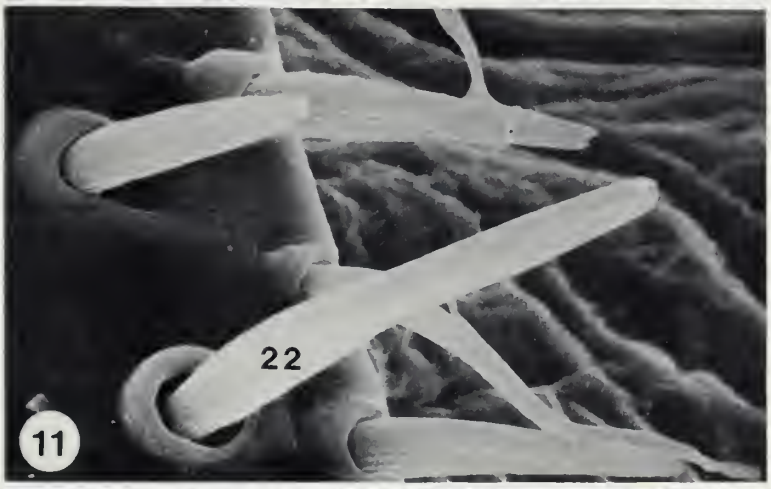
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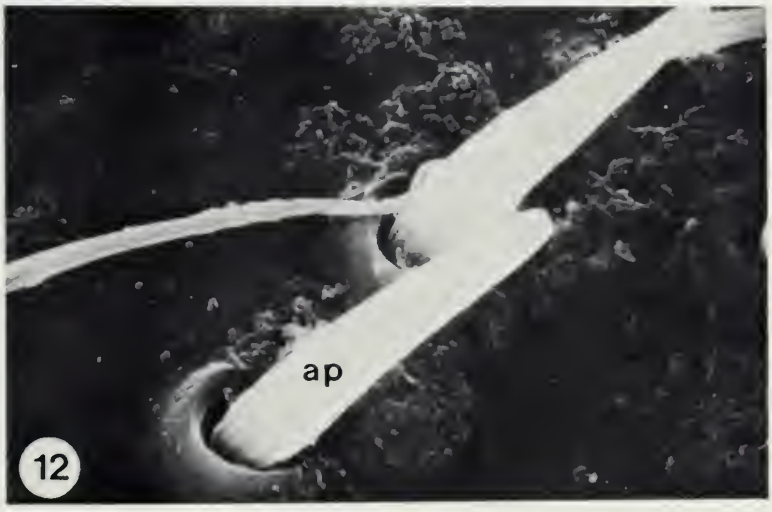
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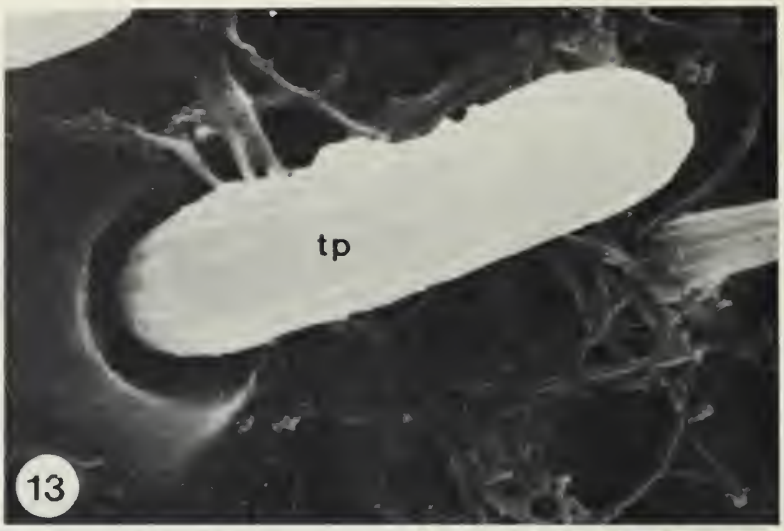
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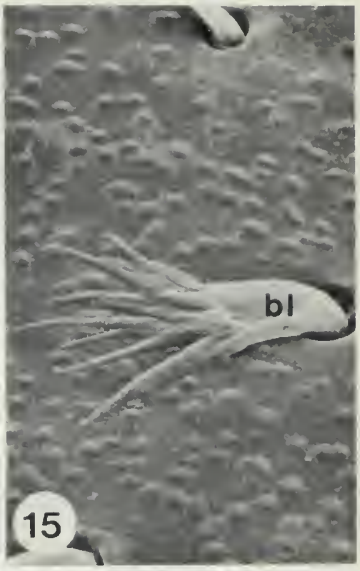
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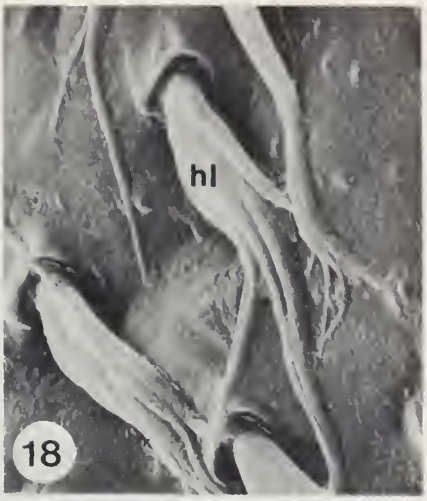
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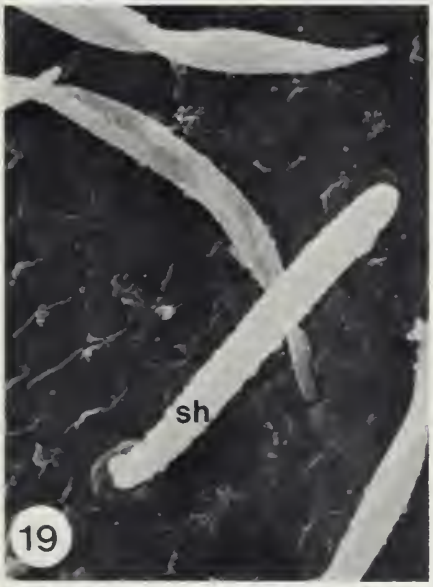
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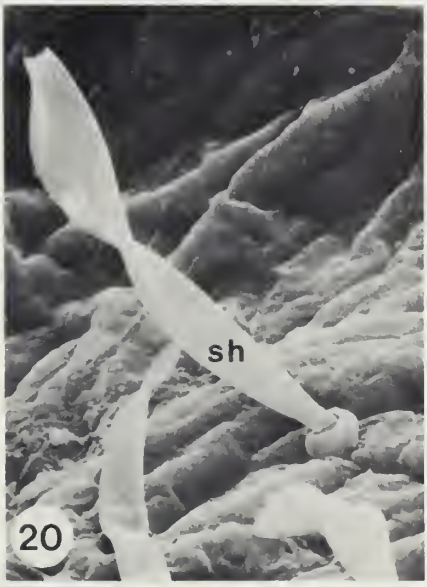
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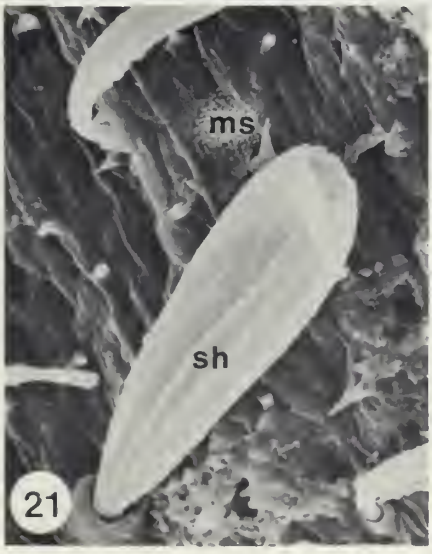
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22


23

DISTRIBUTION

HEAD

The anterolateral corner of the frontoclypeus bears, in addition to setae 2 and 3, several secondary peg setae identical to those adjacent on the parietal sclerite. The remainder of the frontoclypeus may be free of secondary setae (as in Figs. 25,28,45), may bear appressed *acuminate peg* (*ap*) setae posteriad of the tentorial ridge (as in Figs. 57,62), or erect *truncate peg* (*tp*) setae near the frontoclypeal sutures (as in Figs. 31,46). Many erect or semierect *acuminate peg* (*ap*) setae are present over the entire frontoclypeal surface in *H. macleodi* (Fig. 30), while clear or dark, short, inconspicuous *brushlike* (*bl*) setae cover the frontoclypeus in several of the species found in the Rocky Mountains and westwards (Fig. 27). Frontoclypeal setation is best seen in dorsal view, especially in species with checkerboard coloration. Appressed *acuminate peg* (*ap*) setae near the lateral and posterior angles of the frontoclypeus are usually evident in light areas of the head colour pattern. Specimens

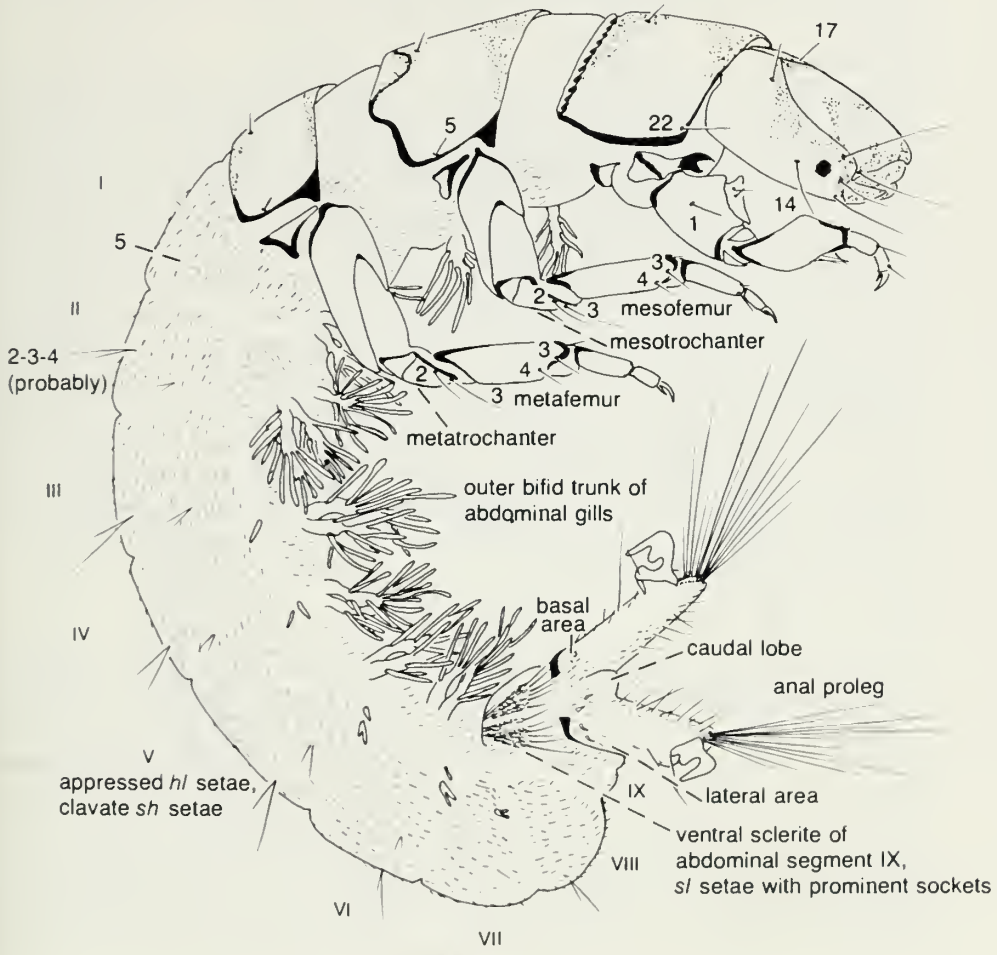


Fig. 24. Fifth instar larva, *H. bronta*.

with dark heads should be viewed in lateral aspect so that otherwise inconspicuous setae may be detected. Clear, inconspicuous *brushlike* (*bl*) setae are often discernible only by light directed through them in lateral view. If the head capsule is carefully cleaned of detritus with a soft brush, the frontoclypeal setation can be seen in both dorsal and lateral view.

On the parietal sclerites secondary setae can be uniform in length and morphology, or they can be varied. By examining each specimen from the same aspect (as in Figs. 29,30) the characteristic setation occurring near the frontoclypeal suture can be seen. The *truncate peg* (*tp*) setae are usually erect and may be inclined posteriorly; *acuminate peg* (*ap*) setae are usually inclined anteriorly or appressed. Some species, notably *H. alhedra* and *H. sparna*, have peg setae of intermediate form, i.e., tapered and truncate. *Brushlike* (*bl*) setae may be mingled with peg setae, although more commonly *hairlike* (*hl*) setae are present on the parietals, sometimes as fine, clear, inconspicuous setae which may also be present on the frontoclypeus (Fig. 16), or as more conspicuous *hairlike* (*hl*) setae evident in a lateral view (Figs. 48,62). In most species, the lateral parietal areas bear more and longer *acuminate peg* (*ap*) setae than *truncate peg* (*tp*) setae, while the areas dorsad of the eyes bear denser and longer *truncate peg* (*tp*) setae than other areas of the head.

THORAX

The pronotum bears a prominent primary seta near each anterolateral corner at position 22 (Figs. 25,32–34); a long, finely tapered seta is typical of most species, including those with checkerboard head patterns (Fig. 57), while a short, blunt seta (less than one and one-half times the length of the adjacent peg setae on the pronotal surface) occurs in most of the remaining species (Fig. 31). *H. alhedra* larvae show some variation in this character, as do several western species, the anterolateral seta being two to five times the length of adjacent secondary setae and tapered but apically truncate (Figs. 33,34). All three thoracic notal sclerites may have fine appressed *hairlike* (*hl*) setae, tapered, bristlelike *acuminate peg* (*ap*) setae inclined anteriorly or appressed, and erect, blunt, bristlelike *truncate peg* (*tp*) setae, often inclined posteriorly on the meso- and metanotum. The *truncate peg* (*tp*) setae are usually the only short, erect setae on the metanotum and are mingled with appressed *hairlike* (*hl*) setae and *minute spines*. *Minute spines*, outgrowths of the cuticle which are not articulated (as in Fig. 21), present on the meso- and metanotum, are detected by using transmitted light on cleared specimens. Meso- and metanota often have a primary seta at position 5 (Fig. 25).

LEGS

The legs also bear abundant and diverse setal types, some of which may be vibration receptors (Jansson and Vuoristo, 1979). The diagnostic setae, however, are long and tapered primary setae (as in Fig. 26), usually darkly pigmented and conspicuous. The procoxa in all species bears at least one long primary seta mesolaterally at position 1 (Figs. 26,63). Some species have a long secondary seta, and/or sharply tapered *spikelike* (*sl*) setae on the same surface (Fig. 64). The mesotrochanter bears a dark primary seta at each of positions 2, 3, and 5, and there may be long secondary setae near position 3 (Figs. 39,41,58,60). The mesotrochanter of some species bears a dark primary seta at position 1, usually slightly shorter than the other three primary setae, but darkly pigmented and conspicuous (Figs. 53,54). Clear *spikelike* (*sl*) setae are

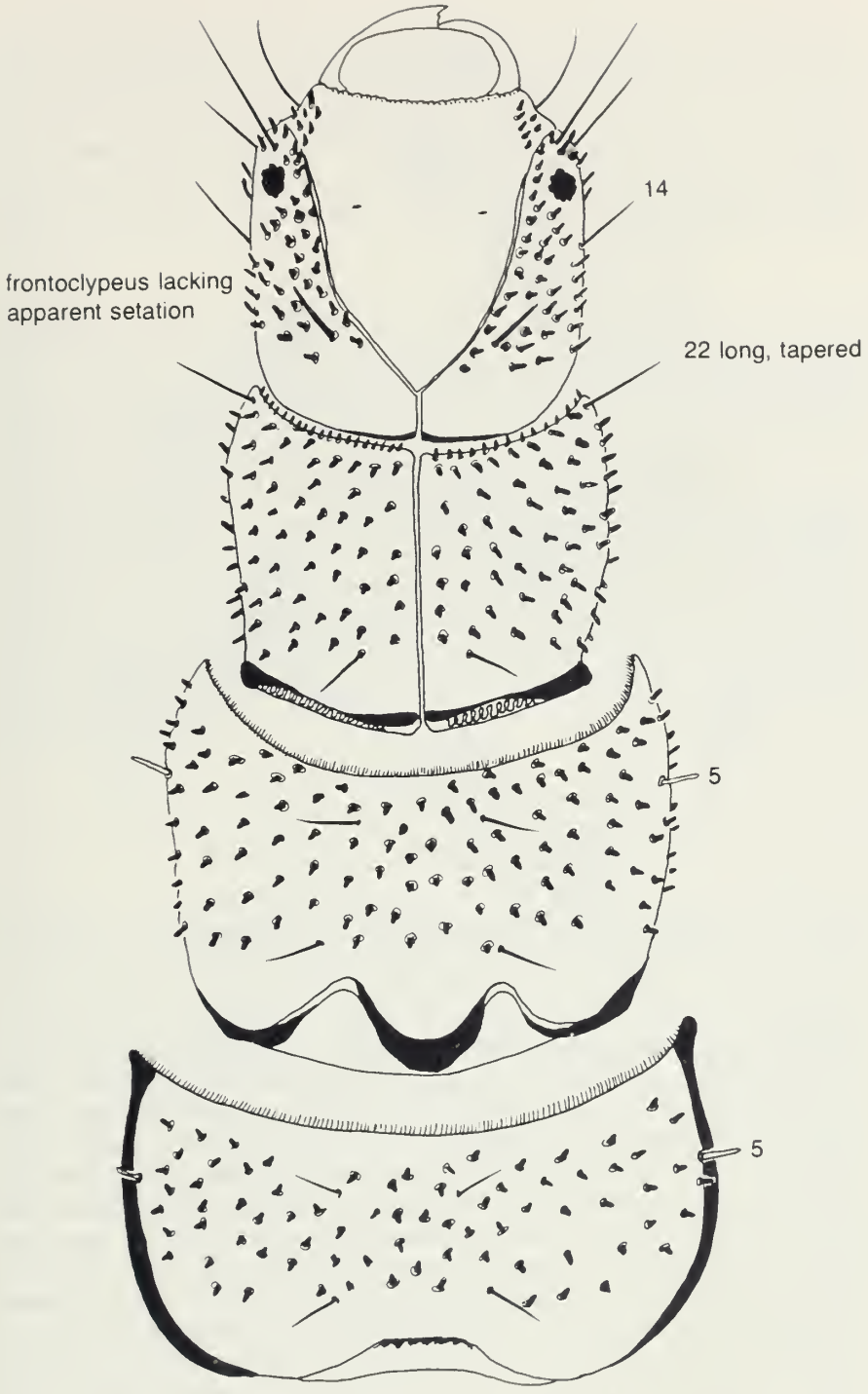


Fig. 25. *H. slossonae*, head and thoracic segments, dorsal view showing setation (in part).

Fig. 26. *H. sparna*, legs, posterior view showing setation.

abundant on the distal leg segments, and on the mesotrochanter seta 1 may be distinguishable as a clear seta, longer than adjacent clear *spikelike* (*sl*) setae. A dark seta 1 may also be present on one or both sides of occasional specimens in several species. This is critical in the distinction of *H. slossonae* and *H. aenigma* where characters of size, colour, and distribution may not discriminate between them. The mesofemur shows characteristic setation along the distolateral margin when examined from the posterior aspect (usually best accomplished by holding the larva head downwards). There may be only two dark long primary setae, one at each of positions 3 and 4, in addition to the invariable dark seta at position 2 (Fig. 39), or near these two setae there may be one or two shorter but equally dark *long slender* (*ls*) setae (Fig. 60), or a cluster of three or more dark *long slender* (*ls*) setae near position 3, sometimes extending to position 4, as is characteristic of *H. slossonae* (Fig. 41). This character, in some species, can vary considerably among populations. Clear *long slender (ls)* or *spikelike* (*sl*) setae are also present on the distolateral margin of both meso- and metafemur.

The metatrochanter of most species has a single dark primary seta at each of positions 2 and 3 (Fig. 40). *H. oslari*, *H. walkeri*, and occasionally *H. alhedra* show a dark primary seta at position 3 and a clear, inconspicuous primary seta at position 2 (Fig. 44). Both the second and third trochanters have other clear *long slender* (*ls*) setae distributed on the sclerite. The metafemur bears, in addition to the invariable seta 2, a dark primary seta at each of positions 3 and 4 (Fig. 40) or a single dark primary seta at position 3, and a clear, inconspicuous primary seta at position 4 (Figs. 43,44,61).

ABDOMEN

Setation on most segments consists of fine, black, appressed *hairlike* (*hl*) setae dorsally, laterally, and ventrally, with two or three long, fine primary setae at what is probably position 2-3-4 and one primary setae at position 5 (Fig. 24), and erect or semierect, clavate (Fig. 65) or flattened (Fig. 66) *scale hairs* (*sh* setae) dorsally and laterally. *Minute spines* are present ventrally on abdominal segment IX.

The ventral membranous surface of the anal proleg bears several different types of setae in addition to the covering *hairlike* (*hl*) setae and *minute spines*. Sharply tapered, dark or clear *spikelike* (*sl*) setae (as in Figs. 38,50) or sharp, reddish *spikelike* (*sl*) setae (some with prominent sockets), either straight (as in Fig. 36) or hooklike (as in Fig. 49), are mingled with the *hairlike* (*hl*) setae. The triangular ventral sclerite of abdominal segment IX bears 20 to 50 reddish *spikelike* (*sl*) setae with prominent sockets, and these are used as a reference in descriptions of some of the *spikelike* (*sl*) setae on the anal proleg.

OTHER CHARACTERS

The number and arrangement of abdominal gill trunks is constant in all known *Hydropsyche morosa* group species, although the number of filaments on each branch may be distinctive for certain species. Characters involving gills are based on the third abdominal segment. Larvae of the very closely related species *H. ventura* and *H. macleodi* are distinguished by the difference in numbers of gill filaments, in addition to the distribution of *acuminate peg* (*ap*) setae on the frontoclypeus.

Many species share a similar head colour pattern, and the well-established term "checkerboard" is used in this study to indicate the basic pattern of seven contrasting light patches on the frontoclypeus: one anterior, two anterolateral, one central, two posterolateral, one near the posterior frontoclypeal angle, and various light areas dorsally and laterally on the parietal sclerites. Ten of the known *H. morosa* group larvae share the characteristic checkerboard-patterned head, often intraspecifically variable, as described above and illustrated in Figures 71 to 85. Some species with patterns other than checkerboard are geographically variable in colour (*H. slossonae*, *H. alhedra*, *H. sparna*), while in others variability has not been demonstrated (*H. etnieri*, *H. amblis*).

Improperly preserved larvae, or preserved larvae exposed to light for long periods of time, tend to lose contrast in sclerite or setal colours, appearing uniformly reddish brown or sometimes black.

KEY TO NEARCTIC LARVAE OF THE *HYDROPSYCHE MOROSA* GROUP

1 Frontoclypeus with, in addition to peg setae near anterolateral corners, numerous minute, clear or tan *bl* setae; viewed laterally, setae evident by light directed through them; viewed dorsally, setae visible, or clear and inconspicuous with sclerite appearing punctate, especially on posterior surface (as in Fig. 27). Rocky Mountains and westwards 2

1′ Frontoclypeus bare (as in Figs. 25,28), or with occasional *tp* or *ap* setae near frontoclypeal sutures (as in Figs. 31,57), or with many *ap* setae on surface (as in Fig. 30). Several peg setae occur near anterolateral corners. Widespread 6

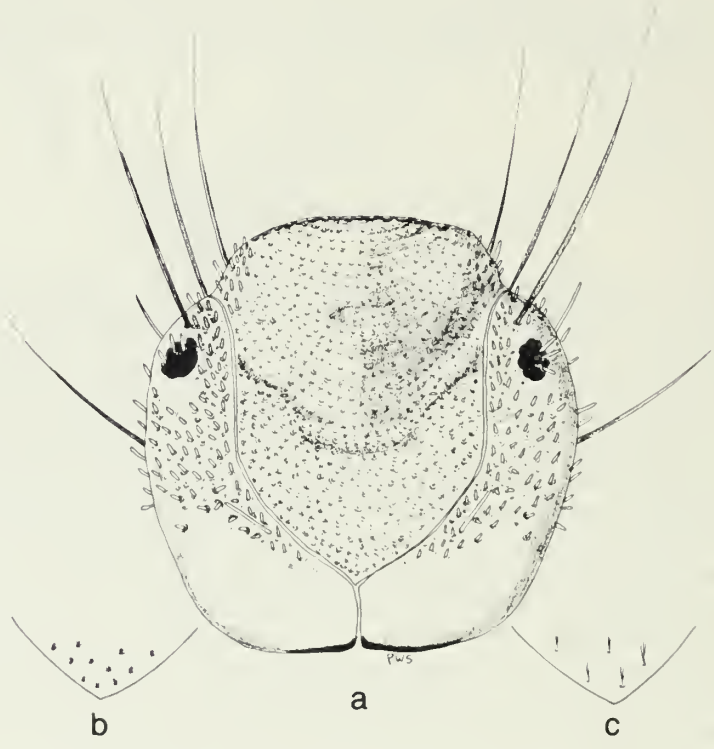
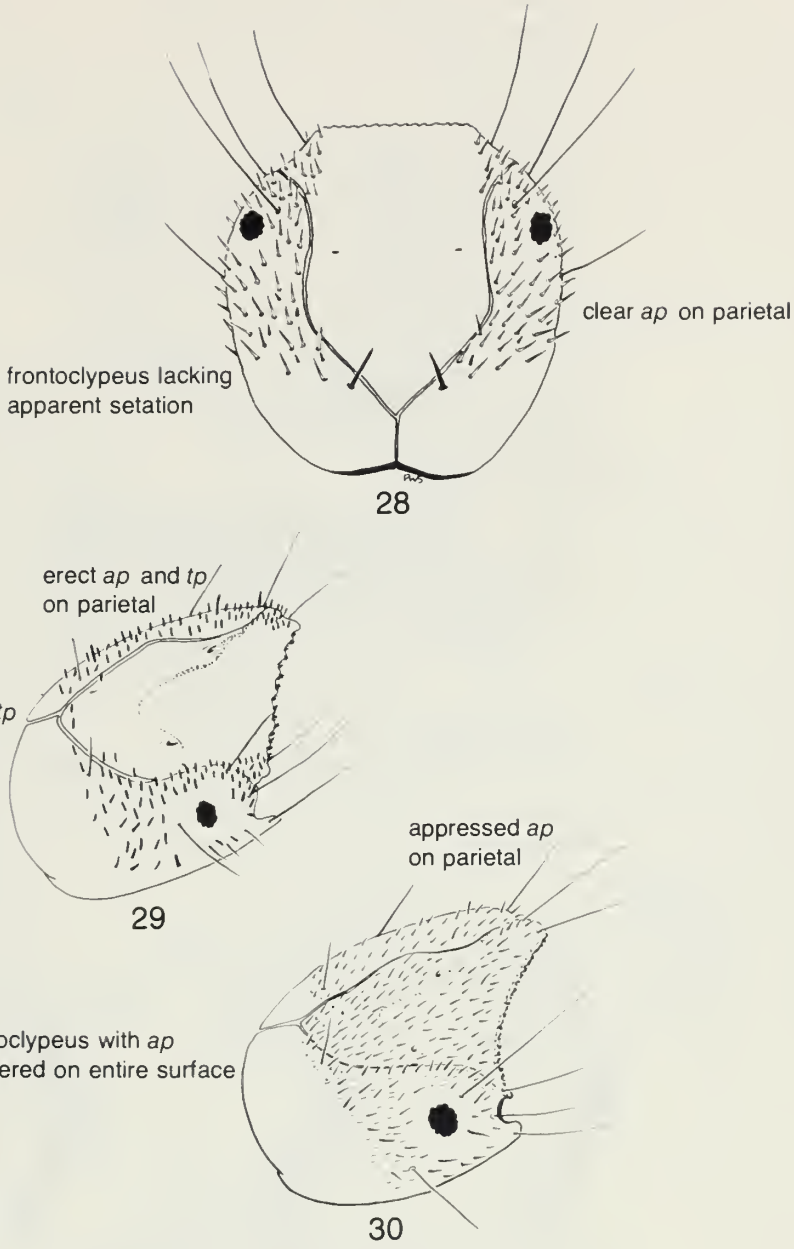


Fig. 27. Head, dorsal view, showing partial setation and texture.

a) *H. sp.* (San Bernardino).
b) *H. sp.* (British Columbia), detail of frontoclypeus, posterior angle.
c) *H. tana*, detail of frontoclypeus, posterior angle.



Figs. 28–30. Head, showing setation (in part).

28. *H. venada*, dorsal view.
29. *H. sparna*, oblique view.
30. *H. macleodi*, oblique view.

2(1) Mesofemur in posterior aspect with setae 3 and 4 accompanied by several dark, long secondary (*ls*) setae (as in Fig. 41). Idaho, Oregon ..... *H. sp.* (Snake River)

2′ Mesofemur in posterior aspect with long, dark primary seta at each of positions 3 and 4, no more than one dark, long secondary seta near position 3 or 4 (as in Fig. 60), although tan or clear setae are present 3

3(2′) Parietal sclerites with dorsal and lateral peg setae inconspicuous, clear yellow or tan (Fig. 27a). Frontoclypeal *bl* setae clear, inconspicuous in dorsal aspect, but pubescent effect visible in profile. Southern California ..... *H. sp.* (*San Bernardino*)

3′ Parietals with dorsal and lateral peg setae brown, conspicious (as in Fig. 45). Frontoclypeal *bl* setae either conspicuous or inconspicuous 4

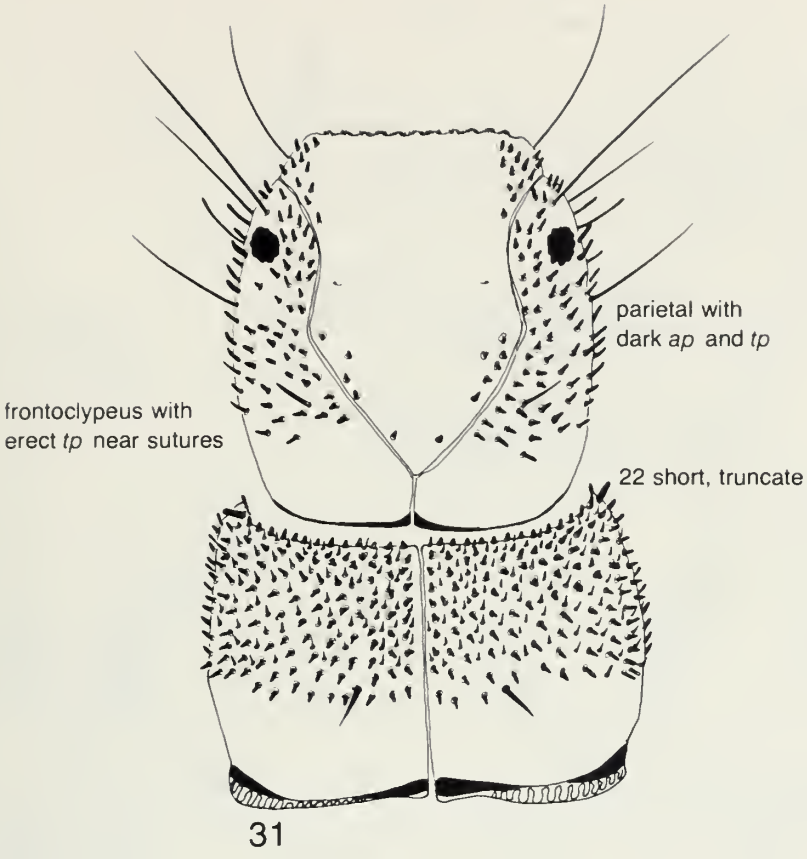
4(3′) Frontoclypeus with *bl* setae tan or brown, conspicuous on yellow or tan sclerite (Fig. 27b). Alaska and British Columbia ... *H. sp.* (British Columbia)

4′ Frontoclypeus with *bl* setae transparent, inconspicuous on dark sclerite (Fig. 27a) 5

5(4′) Frontoclypeus with alveoli of *bl* setae closely spaced, sclerite appearing rough, densely punctate (as in Fig. 27a). Head capsule width greater than 0.9 mm, posterior area of parietals uniform dark brown; light area around eyes only (Fig. 87). Pacific Northwest ..... *H. amblis*

5′ Frontoclypeus with alveoli of *bl* setae widely spaced, sclerite smooth, not densely punctate (Fig. 27c). Head capsule width less than 0.9 mm, posterior area of parietals light in colour, the parietal suture suffused with dark pigment (as in Fig. 84). Montana, Idaho, California, British Columbia ..... *H. tana*

6(1′) Pronotum with anterolateral seta 22 long, at least 2 times length of adjacent peg setae, and tapered (Figs. 24,25,33,34). Head with



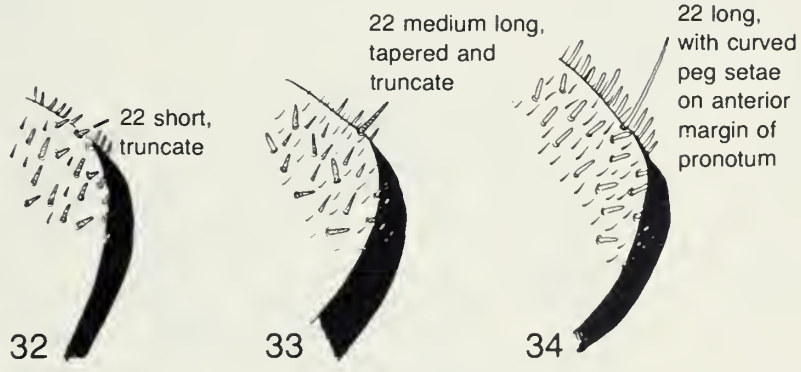


Fig. 31. *H. sparna*, head and prothorax showing setation (in part).

Figs. 32–34. Pronotum, anterolateral corner showing setation.

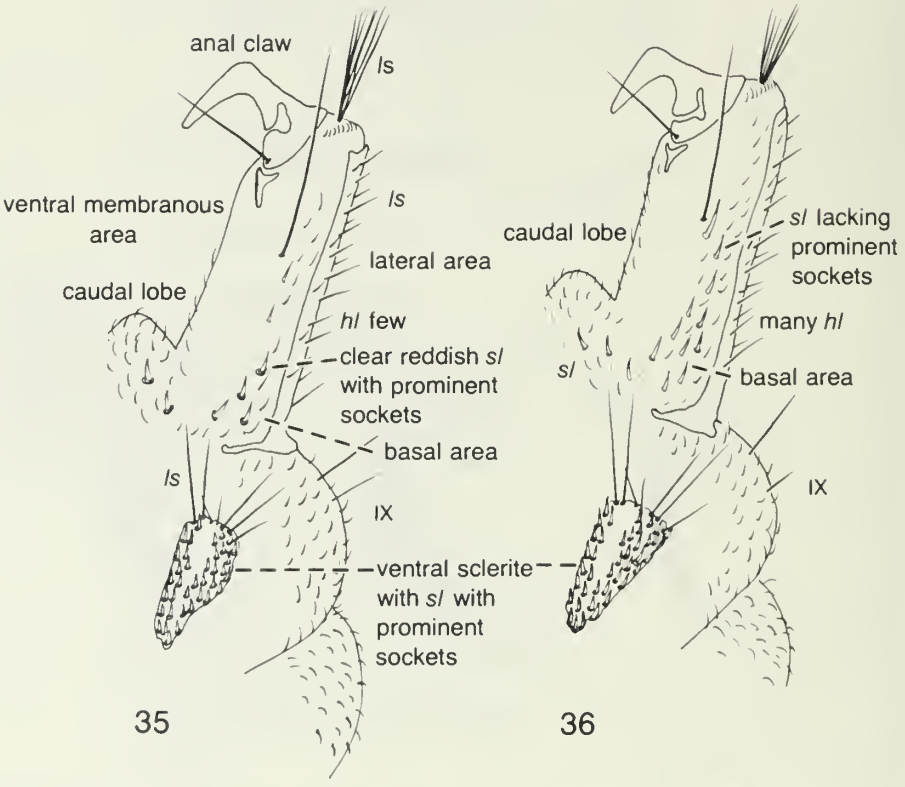
32. *H. sparna*.
33. *H. alhedra*.
34. *H. oslari*.

various colour patterns, including checkerboard 7

6′ Pronotum with anterolateral seta 22 short, one to one and one-half times length of adjacent peg setae, and cylindrical or slightly tapered (Figs. 31,32). Head with colour pattern other than checkerboard 20

7(6) Venter of anal proleg lacking clear reddish *sl* setae on caudal lobes (Figs. 37,38). Head with various colour patterns 8

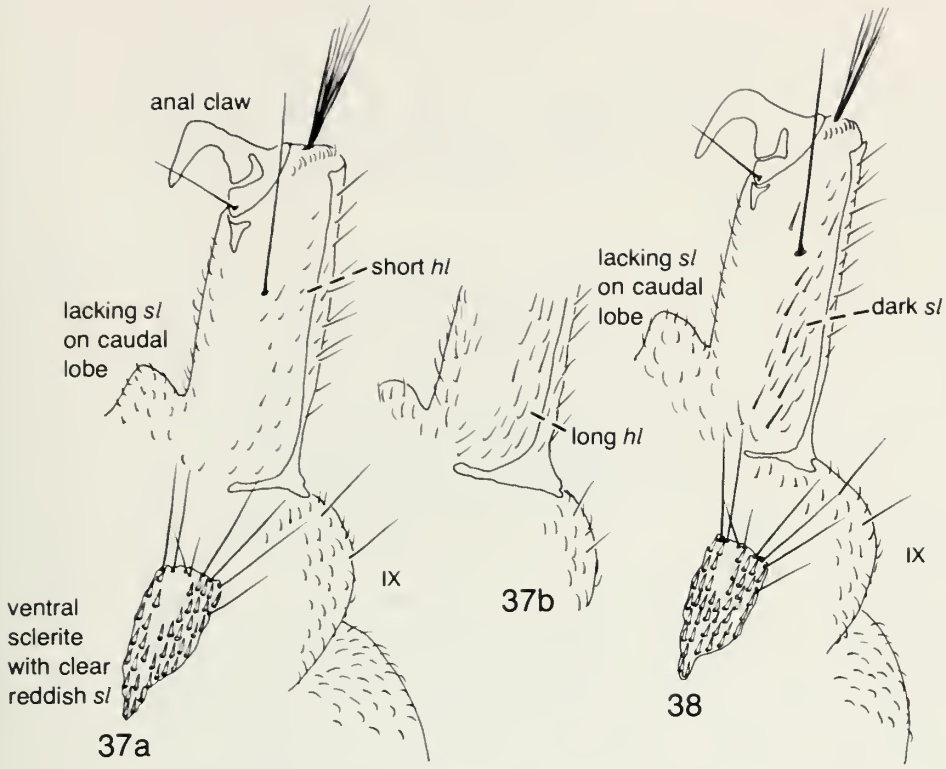
7′ Venter of anal proleg with several clear reddish *sl* setae on caudal lobes (Figs. 35,36,49). Head with checkerboard colour pattern 13



Figs. 35,36. Left anal proleg and left side of abdominal segment IX, ventral view showing setation (in part).

35. *H. bronta*.

36. *H. morosa*.



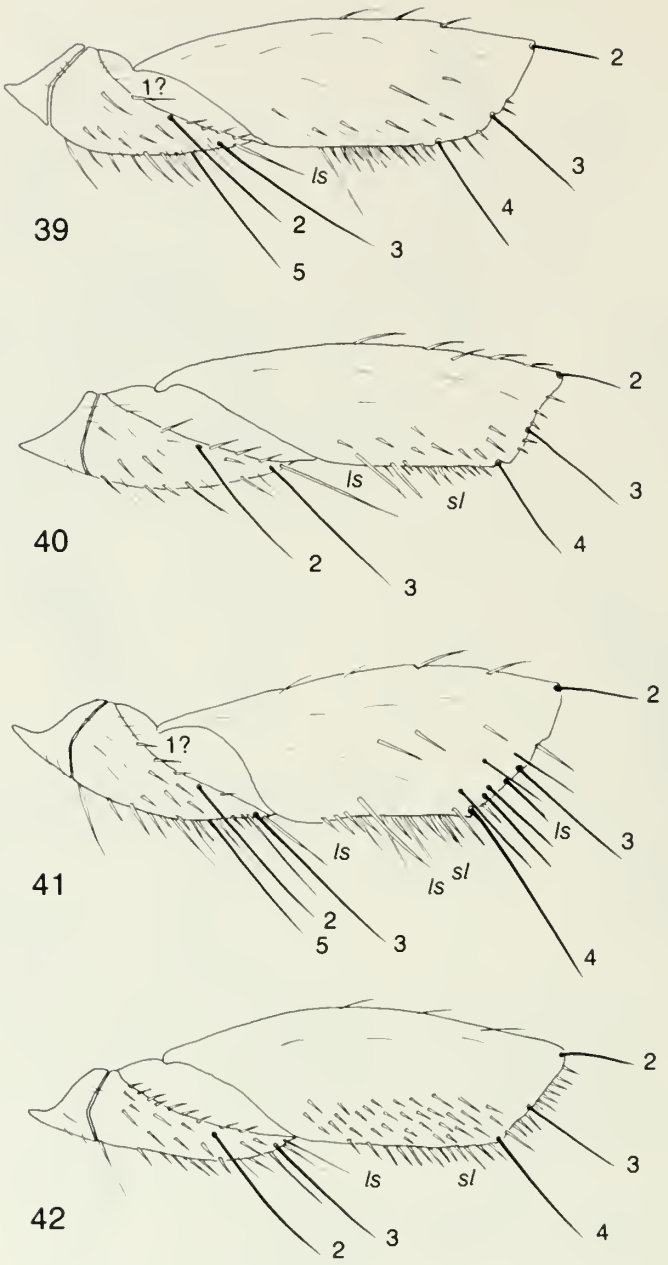
Figs. 37,38. Left anal proleg and left side of abdominal segment IX, ventral view showing setation (in part).

37. a) *H. walkeri*.
    b) *H. alhedra*.
38. *H. slossonae*.

8(7) Parietal sclerites with erect, sharply tapered, and attenuate *ap* setae, usually clear, occasionally tan, on dorsal and lateral surfaces (Fig. 28). Arizona, New Mexico ..... *H. venada*

8′ Parietal sclerites with black, erect *ap* setae, or clear or dark *tp* setae adjacent to frontoclypeal sutures (as in Figs. 25,45,46) 9

9(8′) Mesofemur with two to six dark *ls* setae between setae 3 and 4 (as in Fig. 41). Metafemur usually with dark setae 3 and 4 present (as in Fig. 42). Parietal sclerites with numerous black, erect *ap* setae adjacent to frontoclypeal sutures (as in Figs. 47,48) 12



Figs. 39–42. Leg segments, posterior view showing setation.

39. *H. bronta*, mesotrochanter and mesofemur.
40. *H. bronta*, metatrochanter and metafemur.
41. *H. slossonae*, mesotrochanter and mesofemur.
42. *H. slossonae*, metatrochanter and metafemur.

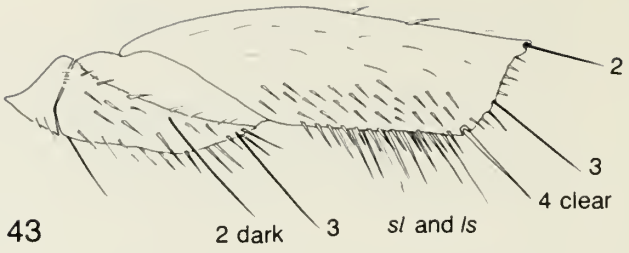
9′ Mesofemur with zero to three dark *ls* setae near seta 3 (as in Fig. 60). Metafemur with seta 4 clear or absent (Figs. 43,44). Parietals with clear or dark, erect *tp* setae adjacent to frontoclypeal suture; appressed *ap* setae may be present laterally (Figs. 45,46) 10

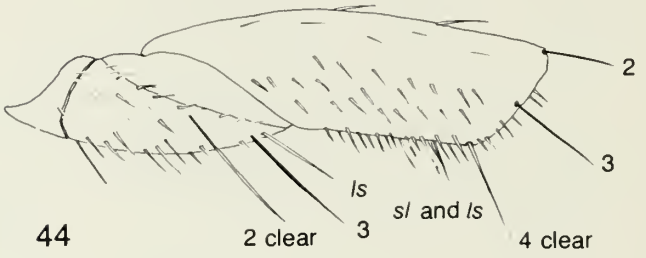
10(9′) Frontoclypeus lacking visible setae except for those near anterolateral corners (Fig. 45). Parietals with widely spaced *tp* setae dark, distally enlarged (Fig. 45). Venter of anal proleg with short *hl* setae, located basally and laterally (Fig. 37a); occasionally a few inconspicuous, fine, clear, straight *sl* setae near lateral margins. Head with checkerboard colour pattern. Eastern and north-central ..... *H. walkeri*

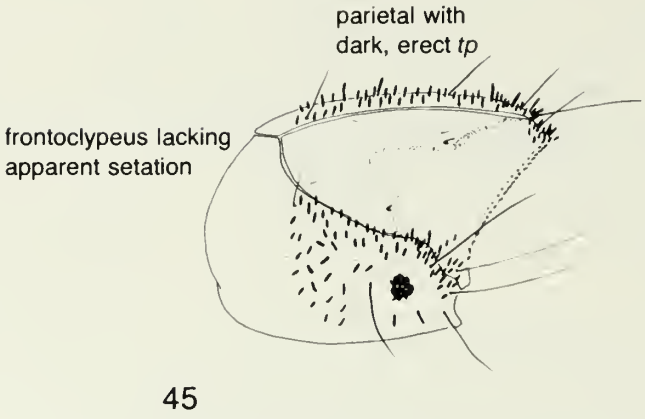
10′ Frontoclypeus with, in addition to peg setae near anterolateral corners, a few *tp* setae posteriad of the tentorial ridge, usually concentrated near posterior sutures (as in Fig. 46). Parietals with closely spaced, dark or clear *tp* setae (Fig. 46). Venter of anal proleg with long *hl* setae (as in Fig. 37b), sometimes with dark *sl* setae both basally and laterally; occasionally a few clear *sl* setae. Head with other than checkerboard pattern 11

11(10′) Parietals with *tp* setae, usually clear or tan, of uniform length dorsally, near frontoclypeal suture (as in Fig. 51). Pronotum with several (6–20) clear or tan *tp* setae on anterior margin near seta 22; these setae longer than dorsal and lateral peg setae, but shorter than seta 22 (Fig. 34). Metatrochanter with seta 2 clear, seta 3 usually dark, although occasionally clear (Fig. 44). Venter of anal proleg with dark *sl* setae mingled with *hl* setae (as in Fig. 38). Rocky Mountains and westwards ..... *H. oslari*

11′ Parietals with dark *tp* setae of various lengths dorsally near frontoclypeal suture (Fig. 46). Pronotum lacking long *tp* setae on anterior margin, *tp* setae in this area of the same length as adjacent pronotal peg



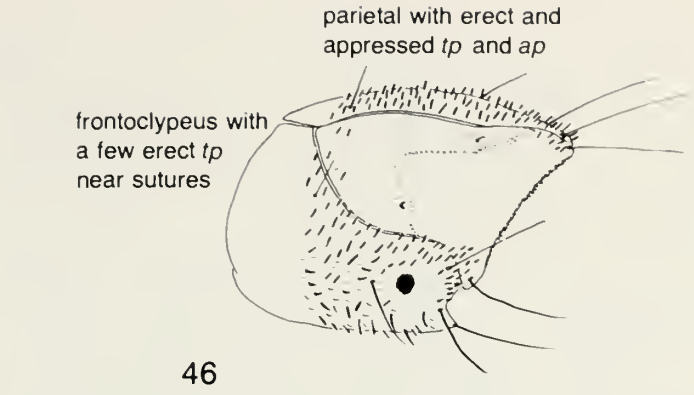




Figs. 43,44. Metatrochanter and metafemur showing setation.

43. *H. alhedra*.
44. *H. oslari*.

Fig. 45. *H. walkeri*, head, oblique view showing setation (in part).



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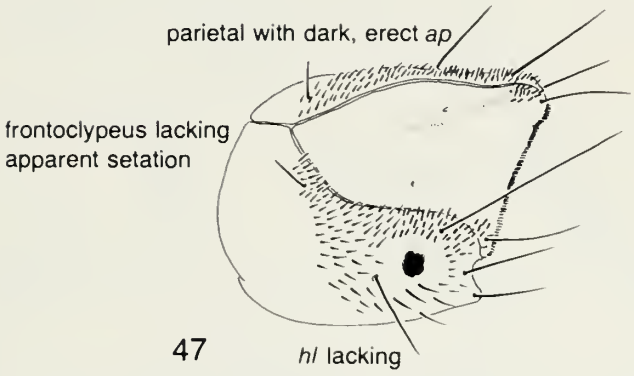

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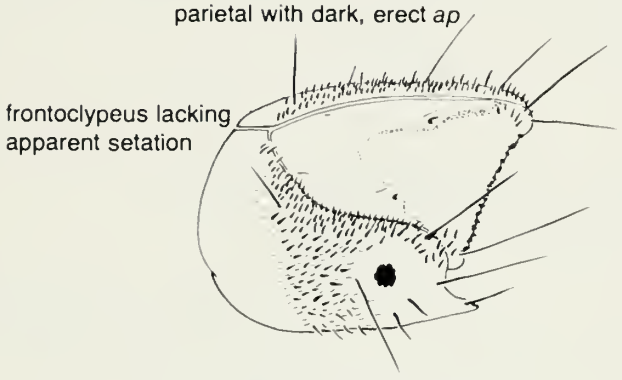
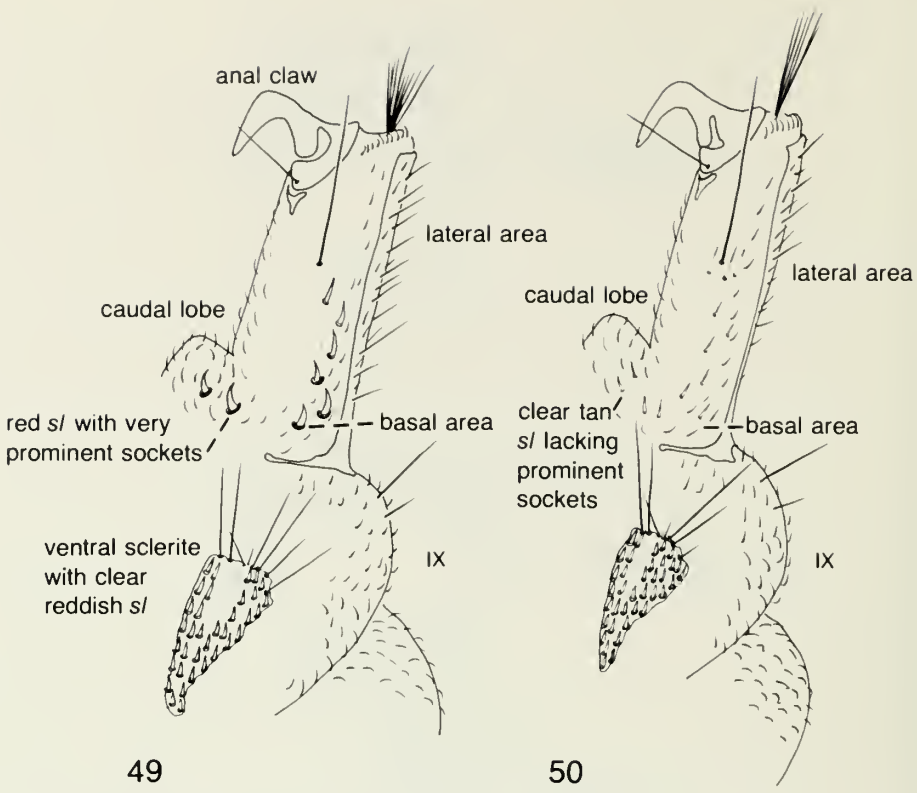


48

Figs. 46–48. Head, oblique view showing setation (in part).

46. *H. alhedra*.
47. *H. aenigma*.
48. *H. slossonae*.



Figs. 49,50. Left anal proleg and left side of abdominal segment IX, ventral view showing setation (in part).

49. *H. piatrix*.
50. *H. sparna*.

setae (Fig. 33). Metatrochanter with setae 2 and 3 usually dark (as in Fig. 43). Venter of anal proleg with *hl* setae only; occasionally a few clear *sl* setae on lateral areas (Fig. 37b) ..... *H. alhedra*

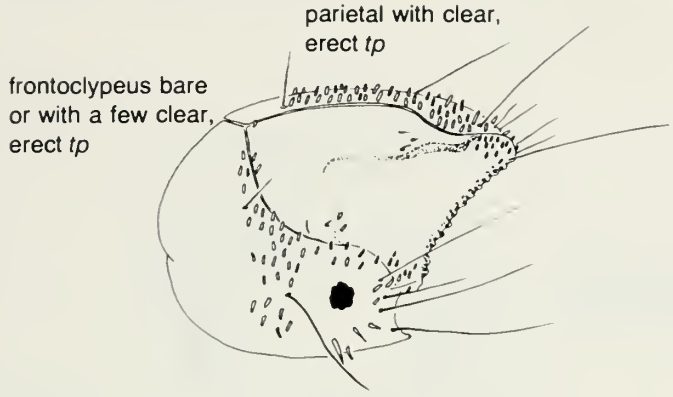
12(9) Mesotrochanter with seta 1 present, dark, about one-half length of setae 2, 3, and 5 (as in Fig. 54). Head with checkerboard pattern. Beaverkill River, New York ..... *H. aenigma*

12′ Mesotrochanter with seta 1 reduced and clear (as in Fig. 39) or absent. Head usually with other than checkerboard pattern. Appalachians and northern transcontinental ..... *H. slossonae*

13(7′) Venter of anal proleg with reddish *sl* setae stouter than those on ventral sclerite of

abdominal segment IX, their prominent sockets larger and darker than sockets of *sl* setae on sclerite of venter IX (Fig. 49). Parietals with short, clear *ap* setae of uniform length dorsally near frontoclypeal suture (Fig. 52). Ozark Plateau of Missouri and Arkansas ..... *H. piatrix*

13′ Venter of anal proleg with *sl* setae clear reddish or tan, and same thickness or thinner than those on sclerite of venter IX, some with prominent sockets similar to those of *sl* setae on sclerite of venter IX (as in Figs. 35,36). Parietals with various setation but not as above 14



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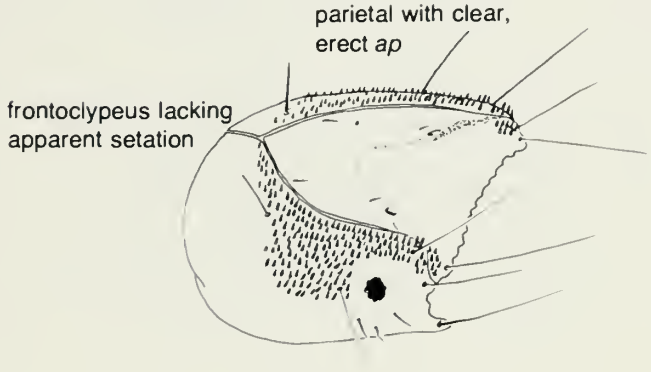
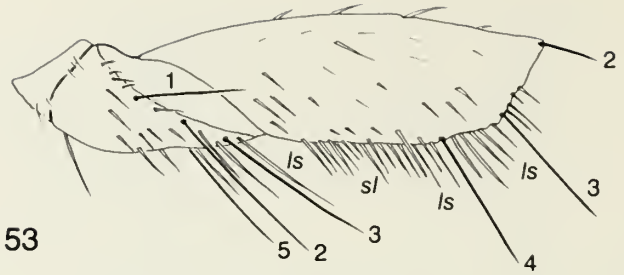


52

Figs. 51,52. Head, oblique view showing setation (in part).

51. *H. alternans*.
52. *H. piatrix*.



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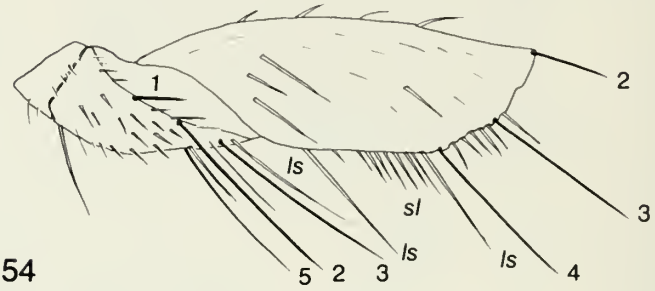

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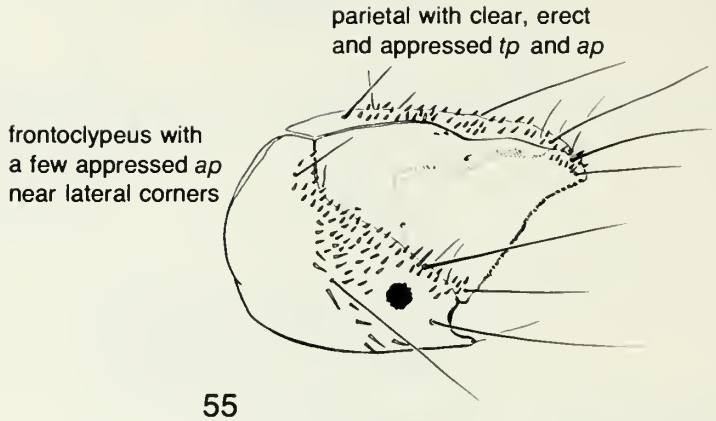


55

Figs. 53,54. Leg segments, posterior view showing setation.

53. *H. alternans*, mesotrochanter and mesofemur.

54. *H. vexa*, mesotrochanter and mesofemur.

Fig. 55. *H. vexa*, head, oblique view showing setation (in part).

14(13′) Parietals with *tp* setae of uniform length dorsally near frontoclypeal suture, *ap* setae absent or inconspicuous (Fig. 51) 15

14′ Parietals with *tp* setae of various lengths mingled with *ap* setae (as in Fig. 56) 17

15(14) Mesotrochanter with seta 1 clear and similar in length to adjacent setae (as in Fig. 41). Pacific Northwest ..... *H. centra*

15′ Mesotrochanter with seta 1 dark and much longer than adjacent setae (Fig. 53) 16

16(15′) Parietals with *tp* setae clear (Fig. 51). Northern transcontinental ..... *H. alternans*

16′ Parietals with *tp* setae dark. Rocky Mountains and westwards ..... *H. cockerelli*

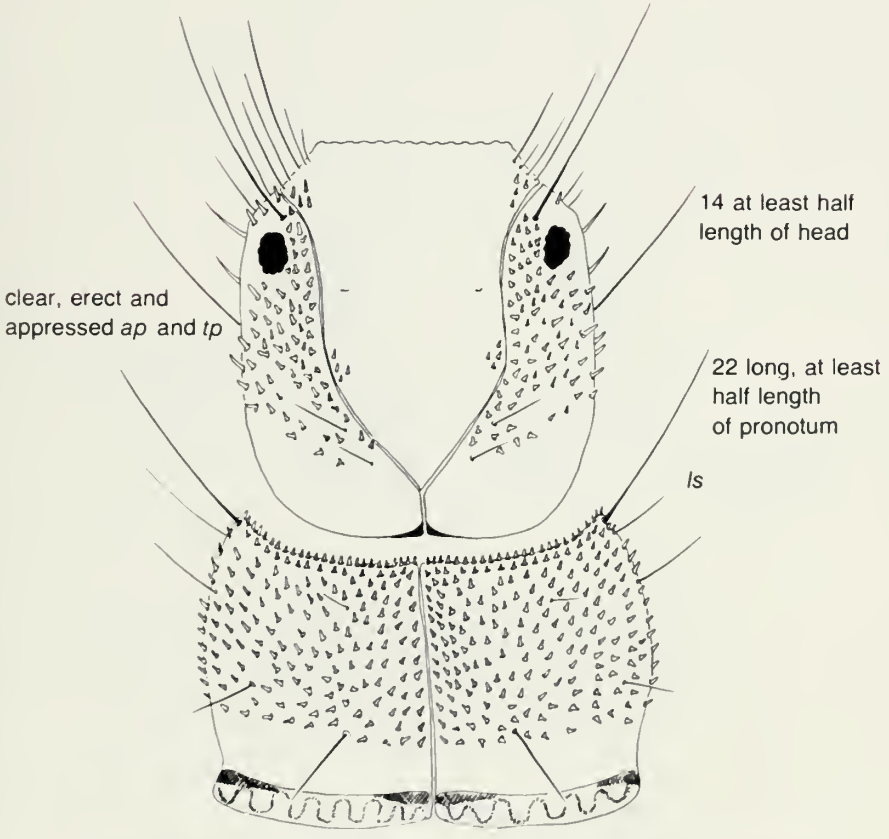


Fig. 56. *H. vexa*, head and pronotum, dorsal view showing setation (in part).

17(14′) Mesotrochanter with seta 1 dark (as in Fig. 54). Venter of anal proleg with stout, curved *sl* setae basally, some as stout as *sl* setae on sclerite of venter IX (as in Fig. 35); thinner *sl* setae on lateral surfaces and caudal lobes, mingled with numerous *hl* setae (as in Fig. 36). Pigmentation on pronotum appears freckled. Primary head and thoracic notal setae long, greater than one-half length of head (Figs. 55,56). Northern transcontinental from Québec to Alberta ..... *H. vexa*

17′ Mesotrochanter with seta 1 clear and similar in length to adjacent setae (as in Fig. 39). Venter of anal proleg with variable setation but not as above. Pigmentation on pronotum not freckled. Primary head setae less than one-half length of head 18

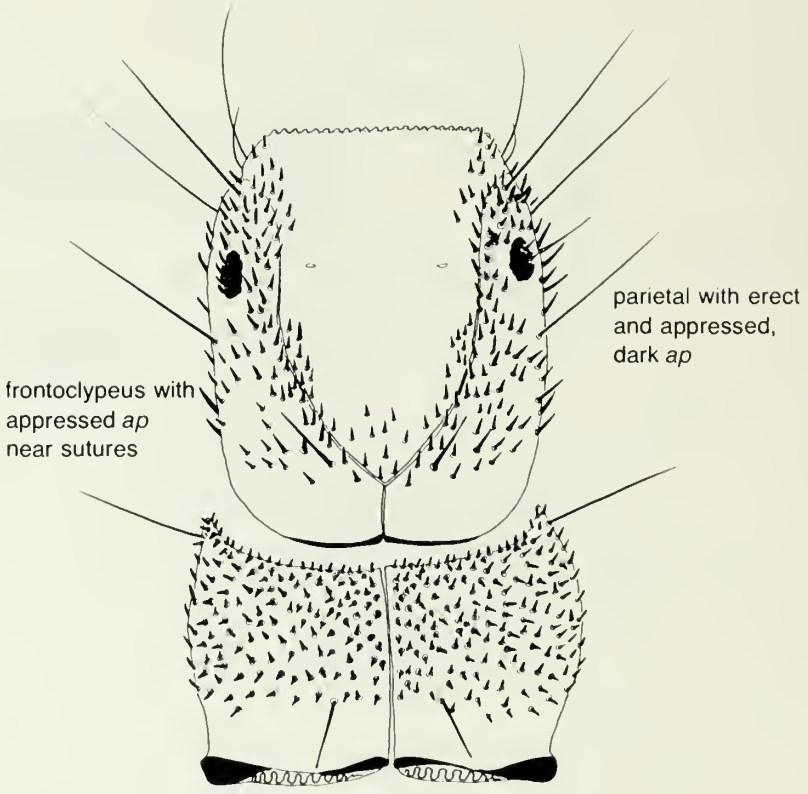
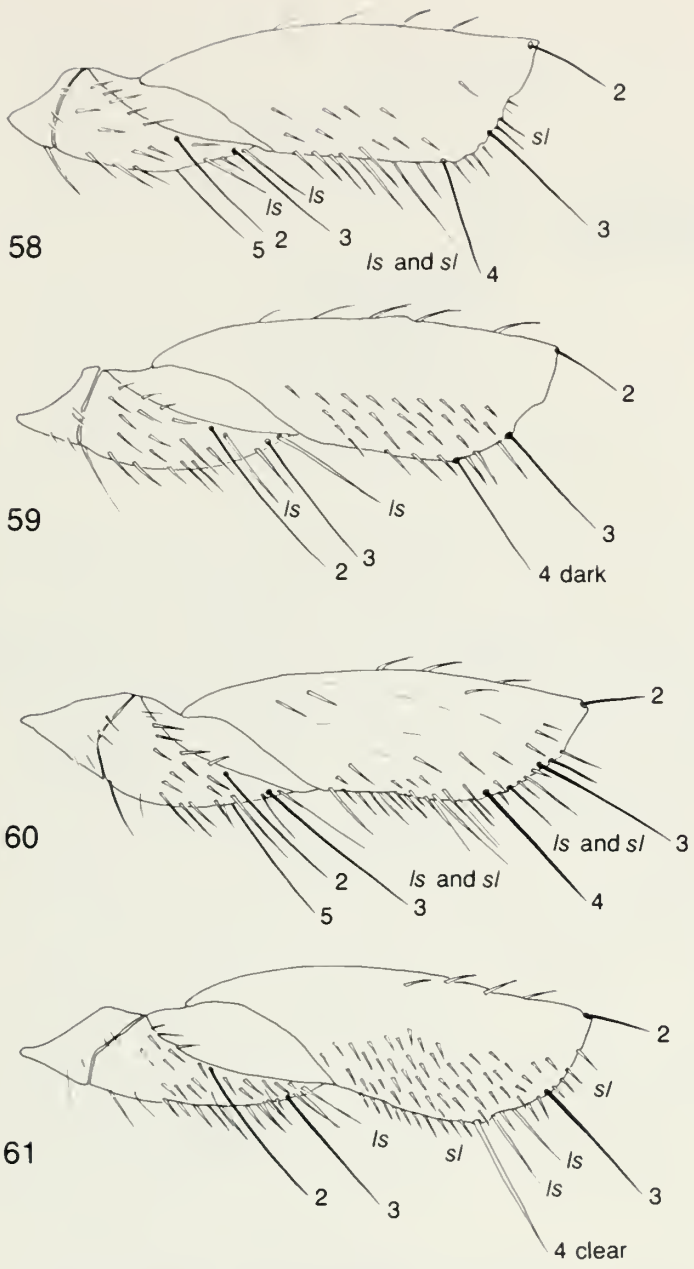
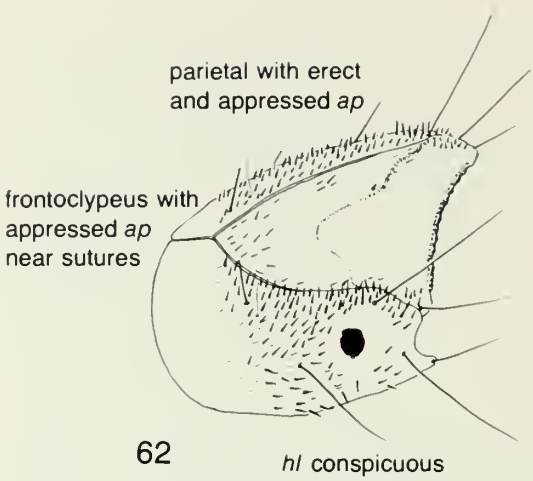


Fig. 57. *H. bronta*, head and pronotum, dorsal view showing setation (in part).



Figs. 58–61. Leg segments, posterior view showing setation.

58. *H. morosa* west/central, mesotrochanter and mesofemur.
59. *H. morosa* west/central, metatrochanter and metafemur.
60. *H. morosa* east, mesotrochanter and mesofemur.
61. *H. morosa* east, metatrochanter and metafemur.



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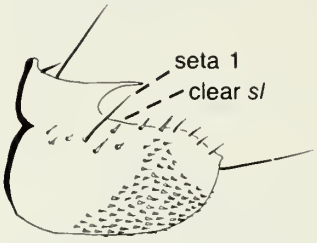

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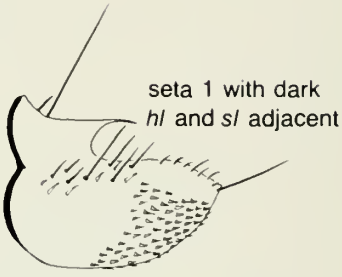

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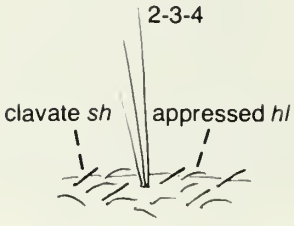

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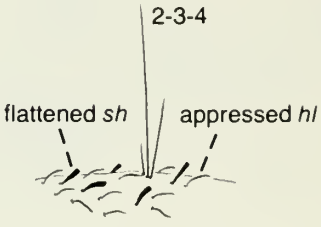


66

Fig. 62. *H. bronta*, head, oblique view showing setation (in part).

Figs. 63,64. Procoxa, lateral view showing setation (in part).

63. *H. bronta*.
64. *H. morosa*.

Figs. 65,66. Abdominal segment, dorsal view showing setation.

65. *H. morosa*.
66. *H. alhedra*.

18(17′) Frontoclypeus lacking peg setae on posterior surface (as in Fig. 48), or with one or two dark, erect peg setae near posterior frontoclypeal angle. Venter of anal proleg with a few clear reddish *sl* setae which lack prominent sockets (as in Fig. 50). Southeastern and central ..... *H. cheilonis*

18′ Frontoclypeus with *ap* setae scattered on posterior surface, visible in dorsal view at lateral or posterior angle in light patches of colour pattern or in profile (as in Fig. 62). Venter of anal proleg with numerous and/or stout, reddish *sl* setae, some with prominent sockets (Figs. 35,36) 19

19(18′) Venter of anal proleg with a few clear reddish *sl* setae, some on the basal area with sockets as prominent as sockets of *sl* setae on ventral sclerite of abdominal segment IX, on basal area mingled with a few *hl* setae; thinner, pale red *sl* setae distolaterally with few *hl* setae in this region (Fig. 35). Mesofemur with long, dark setae 3 and 4, usually with only clear *sl* setae adjacent (Fig. 39). Procoxa with single long, dark seta 1 (Fig. 63), lacking adjacent dark *ls* or *sl* setae. Widespread east of Rocky Mountains ..... *H. bronta*

19′ Venter of anal proleg with many clear reddish *sl* setae, usually with sockets less prominent than those on ventral sclerite of abdominal segment IX, numerous basally and laterally, and mingled with numerous *hl* setae basally and distolaterally (Fig. 36). Mesofemur with dark *sl* or *ls* setae near long, dark setae 3 and 4 (Figs. 58,60). Procoxa usually with several dark *sl* setae mesolaterally in addition to seta 1 (Fig. 64). Northern transcontinental ..... *H. morosa*

20(6′) Frontoclypeus with many *ap* setae (Figs. 30,67) 21

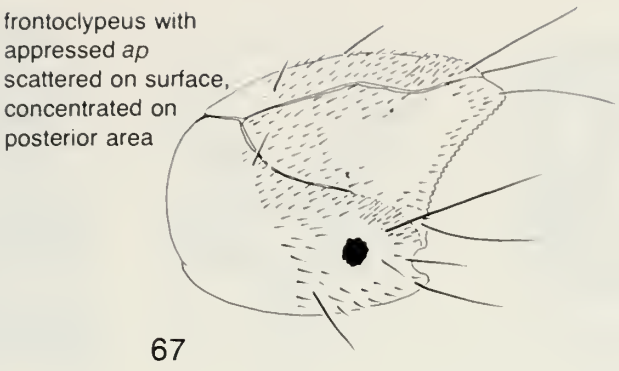
20′ Frontoclypeus lacking numerous *ap* setae, although there may be 2 to 12 *ap* or *tp* setae on posterior surface (Figs. 29,68) 22

21(20) Abdominal gills of segment III with bifid outer trunk bearing 8 to 10 filaments on lateral branch, 5 to 7 filaments on mesial branch (Fig. 69). Abdominal *sh* setae flattened and conspicuously wider than adjacent appressed *hl* setae (as in Fig. 66). Frontoclypeus with numerous *ap* setae, most numerous on posterior surface of sclerite (Fig. 67). Eastern ..... *H. ventura*

21′ Abdominal gills of segment III with bifid outer trunk bearing six to seven filaments on lateral branch, four to six filaments on mesial branch (Fig. 70). Abdominal *sh* setae clavate but similar in width to adjacent appressed *hl* setae (as in Fig. 65). Frontoclypeus with *ap* setae scattered over entire surface of sclerite (Fig. 30). Restricted range in Appalachian Mountains ..... *H. macleodi*

22(20′) Parietals with closely spaced, dark, short *ap* setae of uniform length and inclined anteriad (Fig. 68). Frontoclypeus with distinctly wrinkled texture. Tennessee ..... *H. etnieri*

22′ Parietals with *tp* setae, sometimes mingled with *ap* setae, all setae of uniform length; all head setae erect (Fig. 29). Frontoclypeus smooth and shiny. Widespread through eastern North America ..... *H. sparna*



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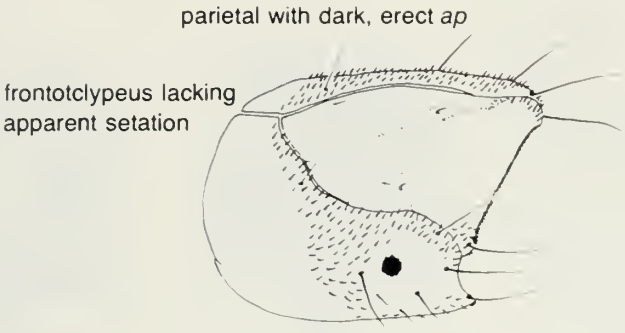

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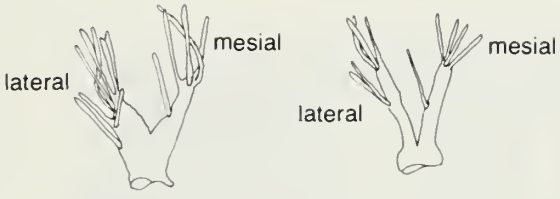


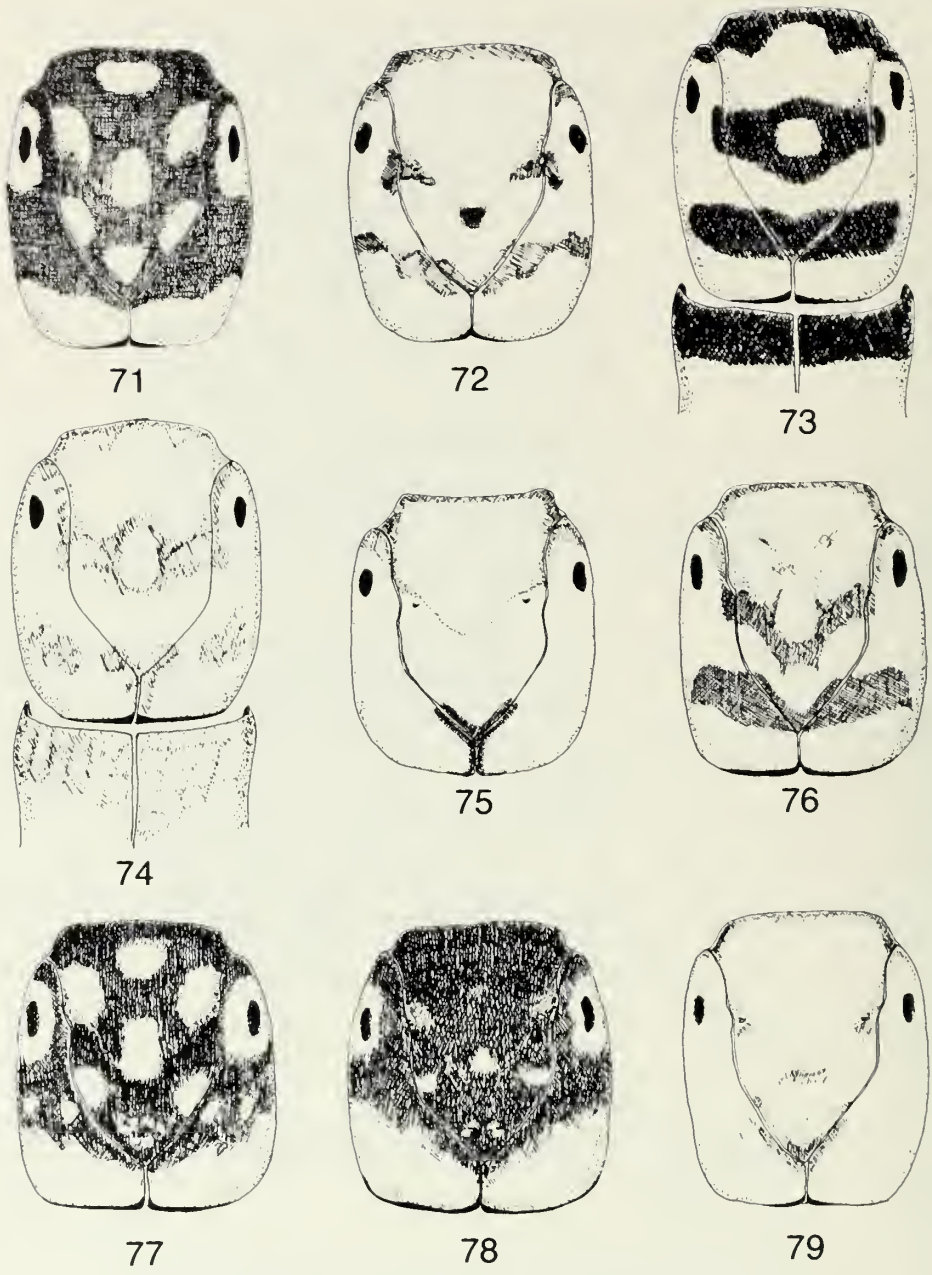
69 70

Figs. 67,68. Head, oblique view showing setation (in part).

67. *H. ventura*.
68. *H. etnieri*.

Figs. 69,70. Abdominal gill, outer bifid trunk showing filaments on mesial and lateral branches.

69. *H. ventura*.
70. *H. macleodi*.



Figs. 71–79. Head, dorsal view showing colour patterns.

71–73. *H. bronta*.
74,75. *H. walkeri*.
76. *H. bronta*.
77–79. *H. morosa*.

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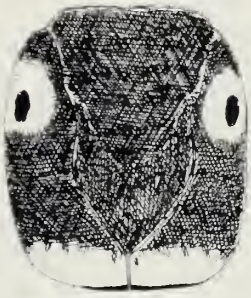

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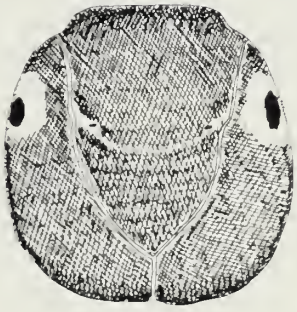

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Figs. 80–87. Head, dorsal view showing colour patterns.

80–82. *H. slossonae*.
83. *H. alhedra*.
84. *H. sparna*.
85. *H. alternans*.
86. *H. oslari*.
87. *H. amblis*.

DIAGNOSIS AND DISCUSSION FOR SPECIES

Hydropsyche aenigma Schefter, Wiggins, and Unzicker

Hydropsyche aenigma Schefter, Wiggins, and Unzicker, 1986, holotype male, allotype female; type locality, Beaverkill River at Horton, Delaware County, New York.

Larvae of this distinctive species were collected on several occasions in Delaware County, New York, from the Beaverkill River, and were later associated with the male and female. Larvae of *Hydropsyche aenigma* are described in this study for the first time.

DIAGNOSIS

This species has a typical checkerboard head pattern and shares the characters of a smooth frontoclypeus, nearly bare of secondary setae posteriad of the prominent tentorial ridge, with several other species. Numerous black *ap* setae on the parietals and the cluster of dark *ls* setae between primary setae 3 and 4 on the mesofemur distinguish it from similar species. These are the largest larvae known in the *morosa* group in eastern North America.

The head pattern is similar to that of *H. alternans* (Fig. 85) but is very darkly pigmented in dark areas, contrasting with the light patches. This checkerboard species has been collected at only one site, where variability is seen in the number of frontoclypeal light patches—some specimens have three mesial patches, one anteriad, one posteriad of the central patch, similar to one form of *H. slossonae*. The more common pattern is a very dark, but typical checkerboard with seven light patches. The parietals have a dorsal light streak from the eyes posteriad to the mesial frontoclypeal angle. The posterodorsal light area of the head capsule is usually lightly suffused with brown pigment along the coronal suture.

DESCRIPTION

Head squarish, width 1.45–1.69 mm, length 1.66–1.85 mm (10 larvae). Frontoclypeus smooth, nearly bare of secondary setae, one or two erect *tp* setae may be near posterior frontoclypeal angle. Parietals with *ap* setae of uniform length, dense, black, erect or inclined; *ap* setae longer and sometimes translucent on anterolateral surfaces; *tp* setae dorsad of eyes; *hl* setae inconspicuous.

Pronotum with anterolateral seta 22 long, dark, tapered; dorsally and laterally with *ap* setae, some as stout as parietal *ap* setae, black, inclined anteriorly, and some less stout than parietal *ap* setae, dark or translucent, appressed; *hl* setae inconspicuous. Mesonotum with seta 5 moderately long, dark, cylindrical or slightly tapered; dorsally and laterally with *ap* setae dark, inclined, mingled with dark, erect *tp* setae and conspicuous *hl* setae. Metanotum with seta 5 moderately long, translucent; dorsally and laterally with *tp* setae medium brown, distally expanded, those inclined anteriorly interspersed with similar setae inclined posteriorly.

Procoxa with seta 1 long, dark, and several dark *ls* and *sl* setae on same surface. Mesotrochanter with setae 2, 3, and 5 long and dark, with seta 1 also dark, shorter than other primary setae; mesofemur with setae 3 and 4 long and dark, with cluster of

dark *ls* setae between. Metatrochanter with setae 2 and 3 long, dark; metafemur with setae 3 and 4 long and dark.

Abdomen with erect *sh* setae clavate, mingled with appressed *hl* setae. Ventral membranous area of anal prolegs with either black *sl* setae basally and laterally, mingled with *hl* setae; or black *sl* setae basally and laterally, interspersed with clear reddish *sl* setae on lateral areas (some with prominent sockets less pronounced than the sockets of *sl* setae on the ventral sclerite of abdominal segment IX), and mingled with dark *hl* setae. Gill filaments on outer bifid trunk of abdominal segment III: mesial branch, 13–18; lateral branch, 20–23.

BIOLOGY

The Beaverkill River at the collecting site is 10 to 20 m wide and less than 1.0 m deep. Larvae were found in a turbulent riffle in 30 to 40 cm of water. The river flows out of a relatively undisturbed upland area and is a productive trout stream. Other *Hydropsyche* present were *H. slossonae* and *H. morosa*.

METAMORPHOTYPES EXAMINED

NEW YORK: Delaware County, Beaverkill River at Exit 92 off Route 17, 6 V 82, #822504, holotype male, allotype female, reared, emerged 13 V 82.

LARVAE EXAMINED

NEW YORK: Delaware County, Beaverkill River at Exit 92 off Route 17, 12 IX 80, #801054 (30); 20 X 80, #801065 (20).

Hydropsyche alhedra Ross

Hydropsyche alhedra Ross, 1939, p. 67, fig. 7, holotype male; type locality, Black Gap, North Carolina.

Hydropsyche riola Denning, 1942, p. 49, fig. 4, holotype male, allotype female; type locality, Nine Mile Creek, Hennepin County, Minnesota. Syn. Schefter, Wiggins, and Unzicker, 1986.

Hydropsyche riola—Denning, 1943, pp. 133–134, figs. 22,23, female, pupa.

Hydropsyche racona Denning, 1965, p. 78, figs. 4,5, holotype male, allotype female; type locality, Albany County, Wyoming. Syn. Schefter, Wiggins, and Unzicker, 1986.

Symphitopsyche riola—Schuster and Etnier, 1978, pp. 44–45, fig. 21, larva.

Symphitopsyche alhedra—Schuster and Etnier, 1978, p. 45, fig. 22, larva.

Larvae of *Hydropsyche alhedra* and *H. riola*, distinguished in colour pattern by Schuster and Etnier (1978), were, in the course of this study, found to be the same in setal characters. By extensive field work in Ontario and Manitoba, larvae of two major colour morphs were associated with adult stages; a uniform dark brown *H. alhedra*, similar to that described by Schuster and Etnier, is as numerous in this part of its range as the patterned *H. alhedra*, formerly *H. riola*, which has a dark head

with two anterolateral light patches. Schuster (pers. comm.) collected population samples of very large, uniformly brown *H. alhedra* in Tennessee on many occasions, finding larvae and pupae present in the stream until April, but no mature larvae or pupae after a synchronous May emergence. The typical *H. alhedra* occurs in the Appalachians and is also widespread across the northern part of the continent. The large *H. alhedra* is restricted to cold, fast Appalachian streams, while other populations are usually collected in shallow riffle areas of streams of various size.

DIAGNOSIS

The uniform dark brown morph of *Hydropsyche alhedra* is similar to *H. etnieri* but can be distinguished by the dark, erect *tp* setae on the parietals, the flattened abdominal *sh* setae and the moderately long anterolateral pronotal seta 22, approximately three times the length of adjacent secondary setae.

The patterned *H. alhedra* larva is not a typical checkerboard species although some populations examined contained a high proportion of individuals with a head pattern somewhat similar to a checkerboard type, consisting of two mesial and two lateral light patches anteriad of the tentorial ridge (Fig. 83). These patterned larvae can be readily separated from all checkerboard species except *H. walkeri* by setation of the anal proleg. *H. alhedra* larvae have long *hl* setae on the ventral membranous area, with occasionally one or two straight clear reddish or tan *sl* setae occurring on lateral surfaces, while *H. walkeri* larvae have short *hl* setae on the venter of the anal proleg. *H. alhedra* also differs from *H. walkeri* in head setation: the parietals in *H. alhedra* have dark *tp* setae of unequal lengths dorsally and dark *ap* setae laterally, while the parietal setation of *H. walkeri* consists of dark *tp* setae of uniform length, usually distally enlarged, and lacks lateral *ap* setae. The anterolateral pronotal seta 22 of *H. alhedra* is of intermediate length (from 2 to 5 times the length of adjacent setae), and although tapered, it is usually blunt distally. *H. alhedra* could be confused with specimens of *H. sparna* having a slightly elongate pronotal seta 22, but the erect abdominal *sh* setae of *H. alhedra* are long and flattened, while erect *sh* setae on *H. sparna* are similar in length and width to the appressed *hl* setae.

The head capsule of *H. alhedra* larvae may be uniformly dark brown (as in Fig. 84) or brown with two frontoclypeal anterolateral light patches anteriad of the tentorial pits; other variations consists of a faint median light patch anteriad of the tentorial ridge in addition to the anterolateral light areas, and a pseudocheckerboard head with a light brown or tan background with four light patches anteriad of the tentorial ridge, two lateral and two mesial (Fig. 83), resembling the four anterior spots of a typical checkerboard pattern. The full range of variability can occur in a single population, the monochromatic dark brown individuals appearing very different from the lighter, nearly checkerboard larvae.

DESCRIPTION

Head rectangular; width 1.37–1.45 mm, length 1.66–1.74 mm (6 larvae; population from Little River, Great Smoky Mountains National Park), width 1.04–1.21 mm, length 1.29–1.45 mm (19 larvae; populations from remainder of range). Frontoclypeus lacking apparent setation, or with one to four erect *tp* setae near the posterior frontoclypeal angle. Parietals with dark, erect *tp* setae of unequal lengths, longer anteriorly; inclined *ap* setae, dark and clear tan, short on dorsal surfaces, longer laterally; *hl* setae inconspicuous against dark background, visible on light areas.

Pronotum with anterolateral seta 22 clear or tan, averaging three times the length of adjacent setae, tapered, and distally blunt; dorsally and laterally with *ap* setae dark, inclined anteriorly; *hl* setae dark, conspicuous (distinction between *ap* and *tp* setae in this species is not always clear—they may be slightly tapered and apically blunt). Mesonotum with seta 5 moderately long, light tan; dorsally and laterally with *tp* setae erect, dark; *ap* setae appressed, dark, thinner than those on pronotum; and *hl* setae dark, conspicuous. Metanotum with seta 5 moderately long, light tan; dorsally and laterally with *tp* setae dark, erect and inclined posteriorly, and *hl* setae dark, conspicuous.

Procoxa with dark seta 1 accompanied by one or more short, dark *sl* setae. Mesotrochanter with setae 2, 3, and 5 long, dark; mesofemur with long, dark setae 3 and 4, often shorter, dark *sl* setae between. Metatrochanter with long, dark setae 2 and 3 (occasionally seta 2 is clear); metafemur with long, dark seta 3, seta 4 clear or not distinguishable.

Erect abdominal *sh* setae flattened. Venter of anal proleg with *hl* setae basally and laterally; on some individuals, a few thin, clear *sl* setae may be present either basally or laterally. Gill filaments on outer bifid trunk of abdominal segment III: mesial branch, 9–10; lateral branch, 11–14.

BIOLOGY

Populations of the large *Hydropsyche alhedra* occur in the Middle Prong of the Little River in Great Smoky Mountains National Park, Tennessee, the collecting site described by Schuster and Etnier (1978) as 12 to 15 m wide, 0.2 to 1.0 m deep with large to medium-sized boulders and moderate to fast current. Larvae are found on larger rocks in white water areas, associated with *Arctopsyche irrorata*, *Hydropsyche bronta*, *H. sparna*, and *H. slossonae*. In the South Toe River in North Carolina, the large *H. alhedra* occurs with *H. macleodi*. Other populations of *H. alhedra* occur in small, cool streams and rivers although the larvae are apparently tolerant of organic enrichment. *H. alhedra* often occurs with *H. slossonae* throughout its north-east and north-central range.

RANGE

Hydropsyche alhedra occurs from New England in the east to the Yukon and Alaska in the west. Northern range limits are the Hudson Bay lowlands in Ontario, and northern Manitoba and Saskatchewan. Southern limits are North Dakota and Minnesota in the Midwest, and the Appalachians southwards to North Carolina and Tennessee in the east.

METAMORPHOTYPES EXAMINED

Large larvae. TENNESSEE: Sevier County, Hills Creek north of Tennessee 73, between Gatlinburg and Cosby, 11 IV 76 (5); Great Smoky Mountains National Park, Little River at Elkmont Campsite, 26 IV 80, GAS (3).

Other metamorphotypes and associated larvae. MANITOBA: Duck Mountain Provincial Park, North Pine River, 29 V 81, #811078a (1 and 10 unpatt.). MINNESOTA: Winona County, 3.2 km south of Elba, middle fork of the Whitewater River at Minnesota 74 bridge, 24 VIII 76 (6). ONTARIO: Algoma District, Baldhead River at Highway 17, 7 VI 80, #801025 (1); Kenora District, Kiruna Lake, 12 VII 81, #811029 (3 and 30 unpatt., 30 patt. larvae); Sudbury District, Eastman Creek at

Highway 101, 55 km west of Timmins, 23 V 72, #720181 (8); Thunder Bay District, Cloud River at Cloud River Road, 10 VI 80, #801029 (1 and 60 larvae, most with light patt.); 4 VIII 80, #801065 (3 reared, emerged 27 VIII 80; and 10 larvae); stream at East Loon Lake Road, 4 VIII 80, #801045 (2 and 6 unpatt.); Joe's Creek, Sibley Provincial Park, 20 V 81, #811056 (2 and many unpatt. prepupae).

LARVAE EXAMINED

Large larvae. NORTH CAROLINA: McDowell County, Pisgah National Forest, South Toe River at Black Mountain Campground, 23 X 84, #840235 (20). TENNESSEE: Blount County, Great Smoky Mountains National Park, Middle Prong of the Little River at Tremont, 18 XI 75, GAS (2); Sevier County, Great Smoky Mountains National Park, Little River at Elkmont Campsite, 10 IV 81, GAS (5).

Other larvae. ALASKA: Parks Highway, milepost 128.5, small stream crossing highway, 62°32′N by 150°14′W, 14 VII 82, #821117a (4 unpatt.). MANITOBA: Duck Mountain Provincial Park, Cowan Creek, 28 V 81, #811077; Garland River, 1 VII 62 (7); South Duck River, Station C4, 28 X 80, #801068 (2 adults reared from unpatt. larvae); Norgate, stream at Baseline Road 1.3 km west of Highway 5, 28 X 80, #801067 (6 unpatt.); Riding Mountain National Park, Edwards Creek, 2 VII 62 (15 unpatt., 5 patt.). MINNESOTA: Winona County, 3.2 km south of Elba, middle fork of the Whitewater River at Minnesota 74 bridge, 24 VIII 76, GAS (10). NORTH DAKOTA: Pembina County, Icelandic State Park, Renwick Lake, Tongue River at Renwick Dam, 8 VII 81, #813013 (30, coll. with adults). ONTARIO: Cochrane District, Thunder Creek at Highway 101, 19 V 72, #720163; Kenora District, Kiruna Lake, 10 VII 81, #810023g (1 unpatt., 5 patt.); Rainy River District, Quetico Provincial Park, French River at Highway 11 east of Dawson Trail Campground, 25 VIII 76, #760213 (5 patt.); Thunder Bay District, Crooks Township, Cloud River, 12 VII 80, #801039 (10 unpatt., 40 patt.); Dorion Township, Wolf River at Highway 17, 21 V 81, #811058 (10 unpatt., 5 patt.); Dublin Creek at Highway 17, 40 km west of Rossport, 19 VIII 80, #800160 (3 unpatt.); Jackpine River at Highway 17, 19 V 81, #811049 (10 unpatt., 5 patt.); Lismore Township, Little Whitefish River, 24 V 81, #811066 (15 unpatt., 15 patt.); North McIntyre, McIntyre River, 22 V 81, #811062; 3 km north of Highway 17 on Ouimet Canyon Road, Coldwater Creek, 10 VI 80, #801031 (1 patt.); Pearl, Pearl River at Highway 17, 12 VI 80, #801036 (10 patt.); 12 VII 80, #801042 (15 patt.); 21 V 81, #811059a,b (1 unpatt.); Sibley Provincial Park, Sibley Creek, 20 V 81, #811055a (30 larvae—most unpatt.); Sunshine, Sunshine Creek at Matawin River, 10 VI 80, #801030a (15 patt.); Thunder Bay, McVicar's Creek at Cumberland Street, 4 VIII 80, #801046 (5 unpatt., 30 patt.). SASKATCHEWAN: Goodsoil, stream on Highway 224, 16 VIII 70, #700549 (1 unpatt.); Meadow Lake, swamp ca. 11.3 km north on Highway 7, 14 VIII 70, #700539 (1 unpatt.). YUKON: Klondike Highway, km 384, Tatchun Creek at Tatchun Creek Campground, 9 VIII 80, #800150, 800151 (10 patt.).

Hydropsyche alternans (Walker)

Philopotamus alternans Walker, 1852, p. 104, type locality, St Martin's Falls, Albany River, Hudson's Bay, Ontario.

Philopotamus indecisus Walker, 1852, p. 104. Syn. McLachlan, 1863, p. 159.

Hydropsyche alternans—Hagen, 1861, p. 288.

Hydropsyche alternans—McLachlan, 1863, p. 159.

Hydropsyche slossonae var. *recurvata* Banks, 1914, p. 253, fig. 73, male; type locality, Go Home Bay, Ontario. Syn. Nimmo, 1981, p. 261.

Hydropsyche codona Betten, 1934, p. 187, male, female. Syn. Ross, 1938b.

Hydropsyche recurvata—Ross, 1938b, p. 18, lectotype male.

Hydropsyche alternans—Betten and Mosely, 1940, pp. 20–21.

Hydropsyche recurvata—Denning, 1943, pp. 126–127, fig. 16, allotype female.

Hydropsyche recurvata—Ross, 1944, p. 99, figs. 16,344,357, larva; fig. 363, male; figs. 387c,388b, female.

Symphitopsyche recurvata—Schuster and Etnier, 1978, pp. 34–35, larva.

Hydropsyche recurvata—Smith and Lehmkuhl, 1980, pp. 621–633, figs. 5a,b,9,13, larva.

Synonymy of *Hydropsyche recurvata* Banks with *H. alternans* (Walker) was established by Nimmo (1981) after examination of the female holotype of the latter.

DIAGNOSIS

A widely distributed checkerboard species, *Hydropsyche alternans* has a nearly square head capsule (ratio of length to width approx. 1.04). The smooth, nearly bare frontoclypeus with an exaggerated ridge at the tentorial pits separates this species from many checkerboard species, and *H. alternans* may be identified by the *tp* setae, usually clear and of uniform length, dorsally on the parietals, as well as by the presence of a dark seta 1 on the mesotrochanter.

The variability of head capsule colour in *H. alternans* is typical of checkerboard species (Fig. 85), although dorsolateral light areas extending posteriad from the eyes to the frontoclypeal suture (Ross, 1944; Smith and Lehmkuhl, 1980) appear to be common to all populations; a population from Alaska contains individuals with unpatterned dark brown heads in which this area is only faintly visible. The posterior light area of the head capsule is not interrupted by dark pigment along the coronal suture.

DESCRIPTION

Head squarish, often with lateral margins convex, width 1.12–1.37 mm, length 1.21–1.45 mm (16 larvae). Frontoclypeus occasionally with very few erect *tp* setae posteriad of the tentorial ridge; the sclerite conspicuously ridged at the tentorial pits. Parietals with *tp* setae clear or occasionally dark, of uniform length, distally enlarged; *ap* and *hl* setae, if present, inconspicuous laterally, although occasionally conspicuous ventrolaterally.

Pronotum with anterolateral seta 22 long, dark, and tapered; dorsally and laterally with *tp* setae clear or dark; *hl* setae clear and inconspicuous. Mesonotum with seta 5

moderately long, clear; dorsally and laterally with *tp* setae clear, erect; *hl* setae dark, conspicuous. Metanotum with seta 5 moderately long, clear; dorsally and laterally with *tp* setae clear, erect, sparsely scattered; *hl* setae numerous, dark, conspicuous.

Procoxa variable; in addition to seta 1, mesolateral dark *ls* or *sl* setae may be several, few, or none. Mesotrochanter with setae 1, 2, 3, and 5 long, dark, although seta 1 may be shorter than the other three; mesofemur with setae 3 and 4 long and dark, often with several dark *ls* setae between. Metatrochanter with setae 2 and 3 long and dark; metafemur with setae 3 and 4 long and dark.

Erect abdominal *sh* setae shorter than adjacent *hl* setae and clavate. Venter of anal proleg with clear reddish or tan *sl* setae basally, laterally, and on caudal lobes; some *sl* setae may have prominent sockets similar to *sl* setae on the ventral sclerite of abdominal segment IX; *hl* setae interspersed basally, laterally, and on caudal lobes. Gill filaments on outer bifid trunk of abdominal segment III: mesial branch, 17–22; lateral branch, 20–26.

BIOLOGY

Hydropsyche alternans occurs in large, fast rivers, lake outflows, and along wave-washed lake shores. It is the only species in this group known to occur in lakes.

RANGE

Hydropsyche alternans has a northern transcontinental range, occurring from eastern Québec westwards through Alberta, British Columbia, and the Yukon. Northern limits of the known range are the tree line around Hudson Bay in northern Québec, Ontario, and Manitoba, to lat. 63°N in the Yukon. Southern limits are New England, New York, the southern shores of the Great Lakes, and southern Wisconsin, mid-Saskatchewan, and southern Alberta.

METAMORPHOTYPES EXAMINED

ALASKA: Glenn Highway, milepost 153 at Mendeltna Creek, 62°02′N by 146°42′W, 17 VII 82, #821124 (2 and larvae). ALBERTA: Battle River, at Highway 611 near junction with Highway 792, 15 VI 79 (4); Oldman River at Taber Provincial Park, 25–26 VII 70, #700442 (1 and larva). MANITOBA: Lake Winnipeg, at Gimli, 6 VI 81 (2 and 10 larvae); Lake Winnipegosis, along shoreline, 6 VIII 70, #700482 (3); Mistik Creek, ca. 46 km south of Flin Flon on Route 10, 30–31 VII 70, #700406 (10 and 100 larvae and pupae). MINNESOTA: Cook County, Saganaga Falls, 3 VIII 75 (2 and 1 larva). ONTARIO: Parry Sound District, Croft Township, Magnetawan River at Highway 124, Ahmic Harbour, 1 IX 72, #720458 (3 and 6 larvae); Thunder Bay District, Booth Township, Nipigon River, 3 VII 81 (4 and 15 larvae); Cedar Creek below dam, 6 VI 71, #710343 (1 and 20 larvae); Timiskaming District, Montreal River at Route 11, 27 VI 71, #710485 (7 and 70 larvae). QUÉBEC: Montréal, Île Ste-Hélène, 7 VI 65 (1).

LARVAE AND ADULTS EXAMINED

ALASKA: Mendeltna Creek, Glenn Highway, 30 VI 68 (6 adults). ALBERTA: St Mary River, at Highway 820 below reservoir, 12 VI 79 (1). ONTARIO: Algoma District, small stream at Route 17, 2.4 km east of Sowerby, 3 V 71, #710312 (4); Kenora District, Kiruna Lake, 27 VII 81, #810088 (adults and larvae); Lakitusaki River, 9 VI 77 (16); between McKenzie and Eva lakes, 27 VII 78 (7); Rushing River

Provincial Park, Rushing River, 13–14 VI 71, #710400 (6); Renfrew County, Waba Creek, 9 VI 54 (1); Thunder Bay District, Cedar Creek above dam, 6 VI 71, #710344 (adults); Lake St Joseph, Doran Outlet (25); Thelma Outlet (several; dates not available). QUÉBEC: Rapide-Danseur, ca. 32.2 km south of Lac Abitibi, 27 III 63 (15); Schefferville, 18 VI 60 (1). SASKATCHEWAN: Cold Lake, Cold Lake beside street in town, 15 VIII 70, #700544 (30); Loon Lake, Makwa River, fast-flowing outlet of Makwa Lake, 16 VIII 70, #700551 (1). YUKON: Alaska Highway, Morley River, 60°00′N by 132°08′W, IX 78 (1).

Hydropsyche amblis Ross

Hydropsyche amblis Ross, 1938c, p. 120, fig. 9, holotype male; type locality, Corvallis, Oregon.

The larva of *Hydropsyche amblis* is associated here for the first time, with material from the state of Washington.

DIAGNOSIS

Among the species bearing numerous minute *brushlike* frontoclypeal setae, *Hydropsyche amblis* and *H. tana* are the only dark brown larvae collected to date (Fig. 87). The brown parietal peg setae and clear, inconspicuous frontoclypeal *bl* setae distinguish *H. amblis* and *H. tana* from similar species, and *H. amblis* is distinguished from *H. tana* by the numerous *bl* setae giving the frontoclypeal sclerite a punctate appearance, in contrast to the smooth frontoclypeus with few *bl* setae characteristic of *H. tana*.

DESCRIPTION

Head nearly round, lateral margins convex; width 0.93–1.05 mm, length 1.10–1.13 mm (10 larvae). Frontoclypeus with *bl* setae numerous, clear, inconspicuous, on entire surface of sclerite; surface posteriad of tentorial ridge with wrinkled or punctate appearance. Parietals with clear *bl* setae dorsally, adjacent to coronal and posterior frontoclypeal sutures, mingled with a few brown *tp* setae; anteriorly *tp* setae inclined or erect, most numerous dorsad of eyes; few *ap* setae laterally; *hl* setae dark and conspicuous in lighter areas around eyes.

Pronotum with anterolateral seta 22 dark, cylindrical, approximately two to four times longer than adjacent peg setae; dorsally and laterally with dark *tp* setae erect dorsally, inclined anteriorly on lateral surfaces; *ap* setae appressed; *hl* setae dark and conspicuous. Mesonotum with seta 5 dark, moderately long; dorsally and laterally with *tp* setae erect; *ap* setae few, appressed; *hl* setae dark, conspicuous. Metanotum with seta 5 moderately long, clear; dorsally and laterally with few erect *tp* setae; *hl* setae dark, conspicuous.

Procoxa with seta 1 long, dark, occasionally with one or two dark *sl* setae on same surface. Mesotrochanter with setae 2, 3, and 5 long, dark, occasionally with short, dark seta 1 present; mesofemur with setae 3 and 4 long, dark. Metatrochanter with seta 3 long, dark; seta 2 clear or not distinguishable; metafemur with seta 3 long, dark, seta 4 clear or not distinguishable.

Abdomen with erect *sh* setae shorter than adjacent *hl* setae and flattened. Venter of anal proleg with *hl* setae basally and laterally; there may be one or a few black *sl* setae on lateral areas. Gill filaments on outer bifid trunk of abdominal segment III: mesial branch, 8; lateral branch, 11–12.

BIOLOGY

Larvae of *Hydropsyche amblis* were collected from Camp Creek, a second order tributary of the Cispus River, 35 km northeast of Mount St Helens in Washington; site "D" in the Mount St Helens ashfall study on lotic Trichoptera (Smith, 1981) is approximately 2 m wide and 0.3 m deep, with a mixed cobble bed, almost completely shaded by riparian forest. Beaver Creek, Wasco County, Oregon, is a similar stream.

RANGE

Hydropsyche amblis occurs in the coastal ranges of Washington, Oregon, British Columbia, and Alaska, and in the Yukon.

METAMORPHOTYPES EXAMINED

WASHINGTON: Jefferson County, Olympic National Park, small stream crossing road just east of Hoh Valley Entrance, 29 VI 69, #690145 (7). YUKON: Atlin Road, km 12.5, Haunka Creek, 60°14′N by 133°53′W, 17 VI 82, #821055 (1 and 100 larvae).

LARVAE EXAMINED

OREGON: Benton County, St Marys Peak, small streams joining Woods Creek, 12 IV 64 (1); Wasco County, Beaver Creek at Route 26, 8 VI 84 (6 collected with 30 adults). WASHINGTON: Lewis County, near Randle, Camp Creek, #61 site, Mount St Helens Project, 16 V 81 (20). YUKON: Alaska Highway at Watson Lake Campground, small stream beside campground, 60°07′N by 128°48′W, 23 V 82, #821002 (4).

Hydropsyche bronta Ross

Hydropsyche bronta Ross, 1938a, p. 149, fig. 79, holotype male, allotype female; type locality Bronson, Michigan, along Prairie River.

Hydropsyche bronta—Denning, 1943, pp. 125–126, fig. 15, female.

Hydropsyche bronta—Ross, 1944, p. 98, figs. 364,387b, male, female.

Symphitopsyche bronta—Ross and Unzicker, 1977, pp. 304–305, type species of new subgenus *Ceratopsyche*, fig. 4, male.

Symphitopsyche bronta—Schuster and Etnier, 1978, p. 25, fig. 19, Appalachian larval form; pp. 37–40, description of Central and Appalachian larvae.

Hydropsyche bronta—Smith and Lehmkuhl, 1980, pp. 621–633, figs. 6,10, larva.

Problems of confusion of this species with *H. morosa* are treated under the latter species.

DIAGNOSIS

The checkerboard-patterned head of *Hydropsyche bronta* shows great variability of coloration within and between populations. Schuster and Etnier (1978) described two variants, the striped Appalachian form and the checkerboard Central form, indicating intermediate colour patterns had not been observed. Using setal characters one can discern *H. bronta* larvae with a variety of head colour patterns intermediate between Central and Appalachian forms.

The head is narrow, the length approximately one and one-quarter times the width. The appressed *ap* setae near the lateral and posterior frontoclypeal angles, visible in light patches of the colour pattern on the frontoclypeus, will separate *H. bronta* from many other checkerboard species, and the larva may be identified by the few clear reddish *sl* setae on the venter of the anal proleg, some of which have prominent sockets as stout as those of the *sl* setae on the ventral sclerite of abdominal segment IX. The procoxa bears a single dark seta 1 mesolaterally, and the mesofemur usually bears dark setae 3 and 4 with no adjacent dark *ls* or *sl* setae, although clear setae are often present.

Variability of the head colour pattern in *H. bronta* includes the checkerboard pattern common to several *morosa* group species (Fig. 71) of seven light patches on a dark background, as well as intermediate combinations of contrasting light and dark patches. These include the distinctive striped Appalachian form (Fig. 73), larvae with a similar but less contrasted light and dark pattern (Fig. 76), and a light variant with little dark pigmentation (Fig. 72). Populations of the dark Central form seldom contain lighter variants, but populations of variant forms usually display a wide range of variability and may include a small proportion of darker larvae.

DESCRIPTION

Head width 0.94–1.18 mm, length 1.10–1.34 mm (34 larvae). Frontoclypeus with appressed *ap* setae near lateral and posterior angles. Parietals with *ap* setae of unequal lengths, usually dark (but they may be clear on light specimens), longer and more inclined anteriorly on lateral areas; *tp* setae erect, longer anteriorly, dark or clear as above, as fine as *ap* setae, cylindrical; appressed *hl* setae light, but visible.

Pronotum with anterolateral seta 22 long, dark, tapered; dorsally and laterally with erect and inclined *ap* setae, few erect *tp* setae, and light *hl* setae. Mesonotum with seta 5 moderately long, clear; dorsally and laterally with appressed *ap* setae, erect *tp* setae of various lengths, and *hl* setae more numerous than on pronotum. Metanotum with seta 5 medium long, clear; dorsally and laterally with erect *tp* setae of various lengths, and *hl* setae dark and conspicuous.

Procoxa with single dark seta 1 mesolaterally. Mesotrochanter with setae 2, 3, and 5 long, dark; several specimens have been observed to have a dark seta 1 on one or both mesotrochanters. Mesofemur with setae 3 and 4 long and dark. Metatrochanter with setae 2 and 3 long and dark; metafemur with setae 3 and 4 long and dark.

Abdomen with erect *sh* setae clavate, similar in appearance to appressed *hl* setae. Ventral membranous area of anal proleg with a few clear reddish *sl* setae on caudal lobe, mingled with a few short, fine *hl* setae. Basal reddish *sl* setae with sockets as prominent as sockets of *sl* setae on ventral sclerite of abdominal segment IX, also a few clear reddish *sl* setae basally and laterally lacking prominent sockets; very few *hl* setae on lateral areas. Gill filaments on outer bifid trunk of abdominal segment III: mesial branch, 9–11; lateral branch, 11–14.

BIOLOGY

Although usually occurring in cooler upper reaches of streams, *Hydropsyche bronta* is apparently tolerant of some organic enrichment. No correlation has been established between habitat and colour variation. *H. bronta* is often collected with *H. slossonae*, *H. sparna*, and *H. morosa*.

RANGE

Hydropsyche bronta occurs in the Appalachians from Québec southwards through North Carolina, the range extending westwards to Alberta through southern Ontario, the midwestern States, to the south of Lakes Huron, Michigan and Superior. Northwestern limits are mid-Manitoba, mid-Saskatchewan, and mid-Alberta, and *H. bronta* extends into southeastern Wyoming to the south. A disjunct population occurs in the Ozark Plateau of Oklahoma and Arkansas.

Appalachian, or striped, larvae occur over much of the range of *H. bronta*. Populations from Virginia, Tennessee, and North Carolina are distinct, with highly contrasting horizontal banding on the head and thoracic nota. Banded larvae with more muted colour differences, as well as intermediate forms between Appalachian and Central types, are recorded from New England and at least two areas of Ontario—the streams flowing southwards out of the extensive moraine area parallel to Lake Ontario in Northumberland and Hastings counties, and streams flowing north and west off the Niagara Escarpment in Grey County. A population of striped larvae is also recorded from the Black Hills in South Dakota and from central Alberta. Below, "var." designates variant forms—usually a light background with dark markings; no designation or "typ." indicates the typical checkerboard form.

METAMORPHOTYPES EXAMINED

ILLINOIS: Havana, Quiver Creek, 29 V 36, INHS (1); White Pine Park, 30 V 36, INHS (1). MARYLAND: Flintstone, 19 IV 38, INHS (1). NORTH CAROLINA: Avery County, Linville River at Linville Falls Campground, Blue Ridge Parkway, 22 V 70, #700369 (1 and 50 var. larvae). ONTARIO: Durham County, Duffin Creek at Greenwood Conservation Area, 22 V 80, #801007a (2 and 10 var., 10 typ. larvae); Halton County, Credit River, Glen Williams, 3 VI 75 (3); 3 VI 76 (1); Huron County, small stream at Huron County 12, 3.7 km south of Winthrop, 16 I 76 (7 and many typ. larvae); Northumberland County, Shelter Valley Creek at Highway 401, 26 V 76 (2 and 20 var. larvae); Peel County, Credit River at Churchville, 2 VI 52 (7); 11 VIII 76 (4 and 15 typ. larvae); Humber River at Albion Hills, 15 VII 75 (1); 8 V 76 (1); 12 V 76 (1); 6 VII 76 (1); Wellington/Grey counties, South Saugeen River at Highway 89, west of Mount Forest, 26 VII 76 (10 and 30 typ. larvae); North Spey River, Highway 10 south of Rockford, 21 V 76 (1 and 6 var. larvae); York County, Humber River at Highway 27, 10 VI 76 (1). VIRGINIA: Montgomery County, Mill Creek at Route 785, 29 III 73 (1 var.); Roanoke County, Roanoke River at Virginia 419, 10 VII 76 (1 and 10 var. larvae).

LARVAE EXAMINED

ALBERTA: Little Red Deer River, at Highway 922 north of Highway 582, 23 VI 79 (15); Pembina Provincial Park, near Edson, 19 VII 61 (25); Highway 16, 16 VI 62 (15); Willow Creek, at Highway 527, 12 V 79 (12). ILLINOIS: Vermilion County, Jordan Creek 3.2 km southwest of Oakwood, 12 IV 83 (60). MANITOBA: Duck

Mountain Provincial Park, North Pine River at picnic grounds on 9th Baseline, 29 X 80, #801074 (1); Overflowing River, at provincial campground, Route 10, 4 VIII 70, #700481 (3); Riding Mountain National Park, Edwards Creek, 11 IV 62 (1). MARYLAND: Baltimore County, creek 3.2 km south of Jacksonville on Maryland 146, 5 IX 77 (1). NEW YORK: Cattaraugaus County, Allegheny River near Salamanca, 15 IV 68 (1); Tompkins County, Slaterville Springs, Six Mile Creek, 9 IX 66 (3). NORTH CAROLINA: Transylvania County, French Broad River at junction of 215N and 64E, 9 V 78, #780091 (3 var.). ONTARIO: Durham County, Duffin Creek at Greenwood Conservation Area, 3 VII 80, #801038 (6); Grey County, Euphrasia/St Vincent Townline near Walters Falls, 27 VI 80 (1 var., I typ.); Sydenham Township, Telford Creek, 8 VIII 79 (2); Saugeen River at Durham Conservation Area, 17 VI 76 (2 var., 2 typ.); 21 VI 76 (4 var., 2 typ.); Haldimand County, Grand River 4.8 km northeast of Grand Valley, 28 VII 60 (1); Huron County, Maitland River, 17 VI 76 (100); Middlesex County, Ausable River at Highway 81 south of Parkhill, 16 VI 76 (40); Thames River, 23 XI 66 (1); Nipissing District, Algonquin Park, Madawaska River at Highway 60, 29,31 V 72, #720203 (1); Northumberland County, small stream at Van Luven Road near Baltimore, 27 V 80, #801010 (1); Shelter Valley Creek, 11,20 VI 79, #790019 (2 var.); Peel County, Credit River at Forks of the Credit, 24 XI 78 (30); Humber River at Sideroad 25, Palgrave, 4 X 78 (10); 3 XI 78 (25); Simcoe County, stream at Highway 11, 15.8 km north of Highway 400 cutoff, 31 VIII 67 (2 var.); Victoria County, Manvers Township, Pigeon Creek, 11 VII 79 (4 var.); Wellington County, Shard Dam, Fergus, 27 VII 60 (3). TENNESSEE: Sevier County, stream at Tennessee 73, 14.5 km east of Gatlinburg, 3 X 67 (10 var.). VIRGINIA: Allegheny County, tributary of Jackson River beside Route 220 just north of Covington, 18 IV 68 (4 var.); Amherst County, Lower Otter Creek at Lower Otter Creek Overlook on Blue Ridge Parkway, 19 IV 68 (1 var.); Giles County, Sinking Creek, 23 V 74 (1 var.); Grayson County, Halton Creek, 4 IV 75 (1 var.); Highland County, Jackson River beside Route 84, 8 km southwest of Monterey, 5 X 67 (2 var.); Loudon County, Goose Creek at Route 7, 12 V 79 (1 var.); Montgomery County, Mill Creek at Route 785, 12 IV 79 (2 var.); Toms Creek, 19 IV 74 (1 var.).

Hydropsyche centra Ross

Hydropsyche centra Ross, 1938a, p. 150, fig. 82, holotype male, allotype female; type locality, Centralia, Washington.

The type of *Hydropsyche centra* is similar to males of Palaearctic *H. nevae* Kolenati examined from Finland, Sweden, and Japan. Larvae of *H. centra* are associated with the adult and described here for the first time.

DIAGNOSIS

A checkerboard species apparently confined to the Pacific Northwest, *Hydropsyche centra* has a nearly square head capsule and a smooth, nearly bare frontoclypeus. *H. centra* can be distinguished from similar species by the lack of seta 1 on the mesotrochanter, and by the dark, distally enlarged *tp* setae of uniform length on the parietal sclerites.

DESCRIPTION

Head width 1.16–1.29 mm, length 1.29–1.42 mm (three larvae); head nearly square, with lateral margins convex. Frontoclypeus with two to three erect *tp* setae near frontoclypeal sutures, and conspicuously ridged at the tentorial pits. Parietals with erect *tp* setae dark, of even length, distally enlarged, along frontoclypeal sutures; *tp* setae longer laterally; *hl* setae inconspicuous.

Pronotum with anterolateral seta 22 moderately long, three to four times length of adjacent secondary peg setae, and tapered; dorsally and laterally with *tp* setae erect, dark, cylindrical or distally expanded; *hl* setae conspicuous on lateral surfaces. Mesonotum with seta 5 moderately long, clear; dorsally and laterally with *tp* setae tan, erect or inclined posteriorly; *hl* setae dark, conspicuous. Metanotum with seta 5 moderately long, clear; dorsally and laterally with *tp* setae clear tan, erect; *hl* setae dark, conspicuous.

Procoxa with seta 1 long, dark; several dark *sl* setae on mesolateral surface. Mesotrochanter with setae 2, 3, and 5 long and dark; on occasional specimens, a short, tan seta 1 may be present on one or both sides. Mesofemur with setae 3 and 4 long, dark, often with shorter, dark *ls* setae near seta 3. Metatrochanter with setae 2 and 3 long and dark; metafemur with setae 3 and 4 long and dark, or seta 4 occasionally clear.

Abdomen with erect *sh* setae flattened, tan, mingled with appressed *hl* setae. Venter of anal proleg with *sl* setae clear reddish, distributed basally and laterally, some with sockets obvious but less prominent than sockets of *sl* setae on ventral sclerite of abdominal segment IX, mingled with dark *hl* setae. Gill filaments on outer bifid trunk of abdominal segment III: mesial branch, 9–12; lateral branch, 14–16.

BIOLOGY

Habitat data are not available for *Hydropsyche centra*.

RANGE

Hydropsyche centra is confined to the Pacific coastal ranges from Oregon north to Vancouver Island and south-central British Columbia.

METAMORPHOTYPES EXAMINED

OREGON: Douglas County, Umpqua River south of Elkton on Route 138, 7 VI 68 (3 and 1 larva); 200 m above confluence of South Umpqua River and Cow Creek, 23 VII 76 (1). WASHINGTON: King County, Cedar Creek at Cedar Falls, 3 VI 72 (1).

LARVAE EXAMINED

OREGON: Douglas County, Cow Creek 200 m above confluence with South Umpqua River, 23 VII 76 (4); 22 X 76 (2); Elk Creek 6.4 km southeast of Tiller Bridge, 4 IX 75 (7); 5 IX 76 (3); South Umpqua River, 100 m upstream from Days Creek outflow, 5 IX 75 (6); 22 VII 76 (12); 22 X 76 (2); 1.6 km northwest of Canyonville, 5 IX 76 (3); 1 km south of Myrtle Creek outflow, 22 I 76 (1); 30 IV 76 (4); 23 VII 76 (5); 22 X 76 (2); 13 km northwest of Roseburg, Cleveland Rapids, 9 IX 75 (9); 30 IV 76 (11); 22 X 76 (13); 11 km northeast of Tiller Brook, 8 IX 75 (6); 17 km northeast of Tiller Brook, 2 IX 75 (7); 28 km northeast of Tiller Brook, 30 IV 76 (3); 22 X 76 (11); 2 km west of Tiller Brook, 23 VII 76 (8). All specimens MJS.

Hydropsyche cheilonis Ross

Hydropsyche cheilonis Ross, 1938a, p. 149, fig. 80, holotype male, allotype female; type locality Oakwood, Illinois, along Salt Fork River.

Hydropsyche cheilonis—Ross, 1944, pp. 98–99; figs. 284,291,293, larva; fig. 365, male; fig. 387d, female.

Symphitopsyche cheilonis—Schuster and Etnier, 1978, p. 33, larva.

Separation of this species from *H. morosa* is discussed under that species.

DIAGNOSIS

With a rectangular, checkerboard-patterned head, *Hydropsyche cheilonis* can be separated from many other checkerboard species on the basis of head shape and lack of apparent secondary setation on the frontoclypeus, although some populations include individuals with one or two dark, erect peg setae near the posterior frontoclypeal angle. The species is distinguished by the presence, basally and laterally on the venter of the anal proleg, of clear reddish, straight *sl* setae, usually lacking prominent sockets. If sockets are present, they are less pronounced than sockets of *sl* setae on the ventral sclerite of abdominal segment IX.

DESCRIPTION

Head width 0.97–1.16 mm, length 1.13–1.34 mm (10 larvae). Frontoclypeus usually lacking apparent secondary setation on the surface posteriad of the tentorial ridge, although in some specimens one or two dark, erect peg setae may occur near the posterior frontoclypeal angle. Parietals with dark *ap* setae of unequal lengths, longer and more inclined anteriorly on lateral areas; also with dark or clear reddish *tp* setae of various lengths, longer anteriorly; appressed *hl* setae dark and conspicuous.

Pronotum with anterolateral seta 22 dark, long and tapered; dorsally and laterally with numerous dark, erect and appressed *ap* setae, few erect *tp* setae, and dark, conspicuous *hl* setae. Mesonotum with seta 5 medium-long, clear, and fine; dorsally and laterally with *ap* setae appressed; *tp* setae erect, in greater numbers than on the pronotum; *hl* setae dark, conspicuous. Metanotum with seta 5 clear, short, and fine; dorsally and laterally with *tp* setae of various lengths, erect and inclined anteriorly, and inclined posteriorly; *hl* setae dark, conspicuous.

Procoxa with single dark seta 1, short, clear and dark *sl* setae adjacent. Mesotrochanter with setae 2, 3, and 5 dark. Mesofemur with several dark *ls* setae between dark setae 3 and 4; on some specimens there are one or more long, dark *ls* setae on the ventral margin of the femur. Metatrochanter with setae 2 and 3 long, dark; metafemur with seta 3 long, dark, seta 4 either dark or clear.

Abdomen with erect *sh* setae clavate, similar to appressed *hl* setae. Ventral membranous area of anal proleg with clear reddish *sl* setae basally and laterally, usually lacking prominent sockets, but if sockets are visible they are less pronounced than sockets of *sl* setae on ventral sclerite of abdominal segment IX; *hl* setae most dense basally and on caudal lobes. Gill filaments on outer bifid trunk of abdominal segment III: mesial branch, 11–14; lateral branch, 14–19.

BIOLOGY

Hydropsyche cheilonis occurs in warmer and more organically enriched streams than other species of the *morosa* group.

RANGE

Hydropsyche cheilonis occurs in southeastern and south-central states, not extending farther north than Michigan, where its range may overlap with that of *H. morosa*.

METAMORPHOTYPES EXAMINED

OHIO: Ashland County, Clear Fork River at Mohican State Park southeast of Pleasant Hill Reservation, 2 VIII 68 (1 and 2 larvae). TENNESSEE: Knox County, Bull Run Creek on Tennessee 126 just south of Oak Ridge, 18 V 76, GAS.

LARVAE EXAMINED

ILLINOIS: Vermilion County, Jordan Creek 3.2 km southwest of Oakwood, 12 IV 83 (20); Muncie, 6 VII 36 (5); Oakwood, 14 VII 39 (2).

Hydropsyche cockerelli Banks

Hydropsyche cockerelli Banks, 1905, p. 14, pl. 1, figs. 8,9, male; type locality, Pecos, New Mexico.

Hydropsyche cockerelli—Ross, 1938b, p. 16, fig. 34, lectotype male, lectoallotype female.

Hydropsyche bicornuta Denning, 1965, p. 75, figs. 1,2, holotype male, allotype female; type locality, Klamath County, Oregon. Syn. Schefter, Wiggins, and Unzicker, 1986.

Hydropsyche jewetti Denning, 1965, p. 78, fig. 6, holotype male; type locality, Glacier National Park, Montana. Syn. Schefter, Wiggins, and Unzicker, 1986.

Symphitopsyche cockerelli—Alstad, 1980, p. 168, fig. 1, larva.

DIAGNOSIS

Hydropsyche cockerelli larvae have a variable checkerboard head colour pattern. With a smooth frontoclypeus, nearly bare of secondary setae and deeply ridged at the tentorial pits, *H. cockerelli* may be confused with *H. alternans* and *H. centra* where their ranges overlap. *H. cockerelli* sometimes lacks the dark seta 1 on the mesotrochanter which distinguishes *H. alternans* and bears dark *tp* setae on the parietal sclerites, in contrast to the clear *tp* setae of *H. alternans*. *H. cockerelli* usually bears a cluster of three or four dark *ls* setae between long, dark setae 3 and 4 on the mesofemur, while *H. centra* has one or two shorter *ls* setae in that position. Although *H. cockerelli* extends well into the northwestern range of *H. alternans*, where larvae probably occur together (adults of *H. alternans* and *H. cockerelli* were collected together by light trapping at the Yukon River in Whitehorse, the Yukon), *H. alternans* is not known to occur in the southern range of *H. cockerelli*. *H. centra* is apparently restricted to the moist coastal ranges of Oregon, Washington, and British Columbia, and perhaps does not overlap the ranges of *H. alternans* or *H. cockerelli*.

Head colour variations include the basic checkerboard pattern as illustrated for *H. alternans* (Fig. 85), variants having increased light areas with pattern resembling striped (as in Fig. 74), or yellow heads with scant contrasting pigment (as in Fig. 82).

DESCRIPTION

Head rectangular, rounded, lateral margins convex, width 1.21–1.37 mm, length 1.37–1.50 mm (17 larvae). Frontoclypeus smooth with no obvious secondary setae, conspicuously ridged anteriad of tentorial pits. Parietals with *tp* setae erect, of uniform length, usually dark, either cylindrical or distally enlarged, with longer *tp* and *ap* setae laterally; *hl* setae inconspicuous.

Pronotum with anterolateral seta 22 moderately long (ca. four times length of adjacent peg setae), dark, and tapered; dorsally and laterally with *tp* setae dark, erect or inclined anteriorly; *hl* setae inconspicuous. Mesonotum with seta 5 moderately long, clear; dorsally and laterally with erect *tp* setae dark; *hl* setae pale but conspicuous. Metanotum with seta 5 clear, shorter than on mesonotum; dorsally and laterally with *tp* setae clear, erect or inclined posteriorly; *hl* setae dark, conspicuous.

Procoxa variable, usually with moderately long seta I flanked by several dark *ls* and *sl* setae. Mesotrochanter with setae 2, 3, and 5 long, dark; dark seta I usually present. Mesofemur with cluster of several dark *ls* setae between long, dark setae 3 and 4, although occasionally the long secondary setae may number only one or two. Metatrochanter with setae 2 and 3 long and dark; metafemur with setae 3 and 4 long and dark.

Abdomen with erect *sh* setae flattened, mingled with appressed *hl* setae. Venter of anal prolegs with *sl* setae clear reddish, some with prominent sockets and of varied stoutness, distributed basally, laterally, and on caudal lobes, mingled with dark *hl* setae. Gill filaments on outer bifid trunk of abdominal segment III: mesial branch, 11–15; lateral branch, 14–18.

BIOLOGY

Hydropsyche cockerelli occurs mostly in the middle reaches of western montane streams with moderate gradient and cobble-boulder substrate and is often collected with *H. oslari*. Life history patterns and longitudinal distribution within the stream system are presented by Alstad (1980).

RANGE

Hydropsyche cockerelli occurs mostly west of the continental divide in the Rocky Mountains from New Mexico to Alberta, and westwards to northern California, extending northwards to the Yukon. It has also been reported from Maine (Blickle and Morse, 1966), but this material should be re-examined in view of the range extension implied by the record.

METAMORPHOTYPES EXAMINED

COLORADO: Chaffee County, Arkansas River near Buena Vista, 9 VIII 73, SDS (2); Park County, South Platte River, ca. 16.1 km south of Fairplay, 9 VIII 73, SDS (1). UTAH: Summit County, Provo River at Woodland, 2042.2 m, 24 VI 76 (2).

Hydropsyche etnieri Schuster and Talak

Hydropsyche etnieri Schuster and Talak, 1977, pp. 515–518; figs. 1a–3, holotype male; figs. 1f–h, allotype female; type locality, Buffalo Springs, Tennessee.

Symphitopsyche etnieri—Schuster and Etnier, 1978, pp. 58–60, fig. 29, larva.

DIAGNOSIS

With a large, uniformly dark brown head capsule and frontoclypeus with few or no *ap* or *tp* setae near the posterior corner, *Hydropsyche etnieri* is easily distinguished from other species having a short anterolateral pronotal seta 22. To date, *H. etnieri* has been collected only at the type locality, and no variability in colour pattern has been recorded.

DESCRIPTION

Head width 1.25–1.35 mm, length 1.40–1.50 mm (four larvae), sides parallel, appearing nearly square. Frontoclypeus with few or no *ap* setae near posterior corner; surface posteriad of tentorial ridge with distinctive wrinkled appearance. Parietals with numerous short, dark *ap* setae inclined anteriad, longer anteriorly; *hl* setae inconspicuous against darkly pigmented background.

Pronotum with anterolateral seta 22 short and dark, tapered; dorsally and laterally with inclined *ap* setae, and *hl* setae inconspicuous on dark sclerite. Mesonotum with seta 5 short and dark; dorsally and laterally with erect and inclined *ap* setae, few erect *tp* setae, and *hl* setae conspicuous against lighter sclerite. Metanotum with seta 5 short and dark; dorsally and laterally with *ap* and *tp* setae in approximately equal numbers, and *hl* setae conspicuous.

Procoxa with single long, dark seta 1 and several shorter, dark *sl* setae adjacent. Mesotrochanter with setae 2, 3, and 5 long, dark; mesofemur with setae 3 and 4 long, dark, occasionally shorter *ls* setae between them. Metatrochanter with setae 2 and 3 long, dark; metafemur with seta 3 dark, seta 4 clear.

Abdomen with erect *sh* setae slightly clavate, mingled with appressed *hl* setae. Venter of anal proleg with dark *sl* setae mingled with *hl* setae basally and laterally. Gill filaments on outer bifid trunk of abdominal segment III: mesial branch, 9–11; lateral branch, 12.

BIOLOGY

The type locality is a cold spring-fed creek with constant water temperature throughout the year.

RANGE

Hydropsyche etnieri is known only from Grainger County, Tennessee.

METAMORPHOTYPES AND LARVAE EXAMINED

TENNESSEE: Grainger County, Buffalo Springs Creek in Buffalo Springs on County Road 2479, 109.3 m west of junction of County Roads 2479 and 2480, 13 X 76 (6 paratypes and larvae).

Hydropsyche macleodi Flint

Hydropsyche macleodi Flint, 1965, p. 169, fig. 2, holotype male; type locality, Blue Ridge Parkway, Crabtree Meadows Campground, North Carolina.

Symphitopsyche macleodi—Schuster and Etnier, 1978, pp. 50–51, fig. 25, larva.

DIAGNOSIS

Hydropsyche macleodi, with a reddish brown rectangular head capsule, is separated from most other species by its short anterolateral pronotal seta 22 and may be identified by the presence of numerous fine, inclined *ap* setae scattered on the entire surface of the frontoclypeus. *H. ventura* also has numerous *ap* setae on the frontoclypeus, but they are concentrated on the posterior surface. These two closely related species are also distinguished on the basis of the number of gill filaments on abdominal segment III—*H. macleodi* has 4 to 6 filaments on the mesial branch, 5 to 6 on the lateral branch, while *H. ventura* has 5 to 7 mesially, 8 to 10 laterally on the bifid outer gill trunk. The erect abdominal *sh* setae in *H. macleodi* are slightly clavate, while the erect abdominal *sh* setae in *H. ventura* are flattened. The head capsule of *H. macleodi* is reddish brown with darker pigment on the triangular area posteriad of the tentorial ridge; head coloration in *H. ventura* is usually monochromatic dark brown.

DESCRIPTION

Head width 1.05–1.15 mm, length 1.15–1.30 mm (six larvae). Frontoclypeus with numerous dark or tan *ap* setae scattered over entire surface, best seen in dorsal view. Parietals with *ap* setae erect, dark or tan, longer laterally and anteriorly; *hl* setae conspicuous.

Pronotum with anterolateral seta 22 short and slightly tapered; dorsally and laterally with *ap* setae erect, dark or tan; *hl* setae conspicuous. Mesonotum with clear, inconspicuous seta 5; dorsally and laterally with *ap* setae erect, tan, few erect *tp* setae, and *hl* setae conspicuous. Metanotum with clear, inconspicuous seta 5; dorsally and laterally with *tp* setae erect, translucent, and *hl* setae conspicuous.

Procoxa with dark seta 1 sometimes accompanied by dark *ls* setae; several short, dark *sl* setae adjacent. Mesotrochanter with setae 2, 3, and 5 long, dark; mesofemur with setae 3 and 4 long, dark, often with dark *ls* setae between. Metatrochanter with seta 3 long and dark, seta 2 clear or not distinguishable; metafemur with seta 3 long and dark; seta 4 clear or not distinguishable.

Abdomen with erect *sh* setae clavate, mingled with appressed *hl* setae. Venter of anal proleg with *hl* setae basally and laterally, and a few tan *sl* setae on lateral areas. Gill filaments on outer bifid trunk of abdominal segment III: mesial branch, 4–6; lateral branch, 5–6.

BIOLOGY

Hydropsyche macleodi is restricted to cold-water habitats, occurring in brooks and spring-fed permanent streams.

RANGE

Hydropsyche macleodi occurs in the Appalachian Mountains of Georgia, North Carolina, Tennessee, West Virginia, and Virginia.

METAMORPHOTYPES EXAMINED

None available.

LARVAE EXAMINED

NORTH CAROLINA: McDowell County, Pisgah National Forest, South Toe River at Black Mountain Campground, 23 X 84, #840235 (6); Great Smoky Mountains National Park, Couches Creek at Route 441, 2 X 67 (15). TENNESSEE: Great Smoky Mountains National Park, west fork of Pigeon River at Chimneys Campground, 3 X 67 (20); Sevier County, unnamed stream, east slope of Webb Mountain off Tennessee 73, east of Gatlinburg, 24 I 75 (6). WEST VIRGINIA: Tucker County, unnamed stream 8 km south of Davis on Route 32, 30 V 84, #840108 (1).

Hydropsyche morosa Hagen

Hydropsyche morosa Hagen, 1861, p. 287, male; type locality, St Lawrence River, Canada.

Hydropsyche chlorotica Hagen, 1861. Syn. Ross, 1938c.

Hydropsyche bifida Banks, 1905, p. 15, male, female; type locality, Fort Collins, Colorado. Syn. Schefter and Unzicker, 1984.

Hydropsyche morosa—Ross, 1938b, p. 16, pl. 4, fig. 33, lectotype male.

Hydropsyche bifida—Ross, 1938b, p. 16, fig. 32, lectotype male, lectoallotype female.

Hydropsyche morosa—Denning, 1943, pp. 127–129, pl. 20, fig. 17, allotype female.

Hydropsyche bifida—Denning, 1943, pp. 129–131; fig. 18, female; fig. 19, pupa.

Hydropsyche morosa—Ross, 1944, pp. 91,96,98; fig. 366, male; fig. 387e, female.

Hydropsyche bifida—Ross, 1944, p. 97, figs. 356,384a,388a,367,387i, male, female, larva.

Hydropsyche morosa—Mackay, 1978, pp. 499–509, figs. 5a,6c, larva.

Symphitopsyche morosa—Schuster and Etnier, 1978, pp. 41–43, fig. 20, larva.

Symphitopsyche bifida—Schuster and Etnier, 1978, pp. 25,30, fig. 17, larva.

Hydropsyche bifida—Smith and Lehmkuhl, 1980, pp. 621–633, figs. 1,2,8,11,14, larva.

Hydropsyche morosa—Schefter and Unzicker, 1984, figs. 1–5, male; fig. 6, female; figs. 7,8, larva.

While processing adult material from many parts of the North American continent, we were able to discern two distinct forms of *Hydropsyche morosa*, which are herein treated as *H. morosa* east (formerly *H. morosa*) and *H. morosa* west/central (formerly *H. bifida*), as well as intermediate forms occurring primarily in north-central areas of North America from eastern Saskatchewan eastwards to Québec, and into western New York, Michigan, Wisconsin, and Minnesota. This

complex was recently synonymized under *H. morosa* (Schefter and Unzicker, 1984). Larvae also occur in distinct forms as well as with a mixture of characters, and although the larval form is not always associated with the corresponding adult form, in general larvae of the west/central form are associated with adults previously identified as *H. bifida* and those of the eastern form with *H. morosa*. *H. morosa* larvae not easily assigned to either form occur in many populations, however, and are not necessarily associated with adults of intermediate genitalic characteristics. Separate diagnoses are given for larval populations associated with eastern and west/central adults and remarks include comments on chaetotaxal and colour characters which may be variable.

DIAGNOSIS

Hydropsyche morosa east may be confused with *H. bronta* where their ranges overlap, but *H. morosa* can usually be distinguished by the morphology of the clear reddish or tan *sl* setae located both basally and laterally on the venter of the anal proleg; on those with prominent sockets, the sockets are less pronounced than the sockets of the *sl* setae of the ventral sclerite of abdominal segment IX. Setation of the procoxa, mesofemur, and metafemur also distinguishes *H. morosa* east and *H. bronta*. The checkerboard head colour pattern of *H. morosa* east is more variable than previously described, and the posterior angle of the frontoclypeus may have three small light spots as described by Schuster and Etnier (1978), a single large posterior light patch, a large and a small patch, or be completely lacking a light spot in that area. The basic head pattern may be dark brown with light spots (Fig. 77) or yellow with light spots in a dark triangle posteriad of the tentorial ridge (Fig. 79); usually dark pigment suffuses the coronal suture.

H. morosa west/central may be confused with *H. cheilonis* if their ranges overlap in the Midwest. *H. morosa* west/central larvae are extremely variable in some populations in this area; *H. morosa* west/central larvae lacking appressed *ap* setae near the frontoclypeal suture, described by Smith and Lehmkuhl (1980) as *H. bifida*, have also been observed in North Dakota populations. These larvae will key to *H. cheilonis*. Conversely, larvae from Virginia which are presumably *H. cheilonis* may key to *H. morosa* west/central, which is not known southeast of the Great Lakes. Further study of associated material from areas of possible overlap may yield new characters to reliably separate the two species. The checkerboard head pattern of *H. morosa* west/central is most frequently variable in the posterior frontoclypeal angle where three, one, or no light patches may be present (as in Figs. 71,77–79).

Intermediate larval forms vary in primary setation of the metafemur, morphology of the erect abdominal *sh* setae, and occurrence of appressed *ap* setae on the frontoclypeus.

DESCRIPTION

H. morosa east. Head rectangular, lateral margins parallel, width 1.05–1.21 mm, length 1.27–1.45 mm (10 larvae). Frontoclypeus with dark, appressed *ap* setae posteriad of tentorial ridge, few or numerous, usually visible in light areas of frontoclypeal pattern; on specimens with mostly yellow heads the dark *ap* setae are easily seen, but on individuals with very dark coloration and lacking posterior light patches, the setae may only be visible when viewed in profile. Parietals with dark, erect *ap* setae of unequal lengths, more appressed laterally; dark, erect *tp* setae of

various lengths, longer anteriorly; *hl* setae conspicuous in lighter areas of head pattern.

Pronotum with anterolateral seta 22 long and dark; dorsally and laterally with *ap* setae dark, inclined; *tp* setae dark, erect; *hl* setae conspicuous. Mesonotum with seta 5 moderately long, dark; dorsally with *ap* setae dark or clear, appressed; *tp* setae dark or clear, erect or inclined posteriorly; *hl* setae conspicuous. Metanotum with seta 5 moderately long and dark; dorsally and laterally with *tp* setae short, erect and inclined; *hl* setae conspicuous.

Procoxa with dark seta 1 sometimes flanked by dark *ls* seta; several short, clear and dark *sl* setae on same surface. Mesotrochanter with setae 2, 3, and 5 long, dark; mesofemur with setae 3 and 4 long, dark, often several dark *ls* setae between. Metatrochanter with setae 2 and 3 long, dark; metafemur with seta 3 long, dark, seta 4 clear, or occasionally dark.

Abdomen with erect *sh* setae clavate, mingled with appressed *hl* setae. Venter of anal proleg with clear reddish or tan *sl* setae basally and laterally, some with prominent sockets less pronounced than sockets of *sl* setae on ventral sclerite of abdominal segment IX; *hl* setae distributed basally and laterally. Gill filaments on outer bifid trunk of abdominal segment III: mesial branch, 12–16; lateral branch, 14–17.

H. morosa west/central. Head rectangular, width 0.97–1.18 mm, length 1.10–1.34 mm (32 larvae), lateral margins parallel or slightly divergent posteriorly. Frontoclypeus usually with few dark, appressed *ap* setae posteriad of the tentorial ridge, sometimes visible in light areas of head pattern, although occasional populations may lack this setation. Parietals with dark, erect *ap* setae of uneven lengths, more inclined laterally; dark, erect *tp* setae of various lengths, longer dorsad of the eyes; *hl* setae inconspicuous.

Pronotum with anterolateral seta 22 long, dark, tapered; dorsally and laterally with *ap* setae dark, inclined; *tp* setae dark, erect; *hl* setae conspicuous. Mesonotum with seta 5 moderately long, dark; dorsally and laterally with *tp* setae dark, erect; *ap* setae clear tan, inclined anteriorly; *hl* setae conspicuous. Metanotum with seta 5 moderately long, clear; erect *tp* setae dark, inclined *tp* setae clear; *hl* setae conspicuous.

Procoxa with dark seta 1 flanked by one or two dark *ls* or *sl* setae. Mesotrochanter with long, dark setae 2, 3, and 5; mesofemur with setae 3 and 4 long, dark, often with shorter *ls* setae near seta 3. Metatrochanter with setae 2 and 3 long, dark; metafemur usually with setae 3 and 4 long, dark (seta 4 may be clear or not distinguishable).

Abdomen with erect *sh* setae flattened, mingled with appressed *hl* setae. Venter of anal prolegs with clear reddish or tan *sl* setae on caudal lobes, basally, and laterally, the sockets usually less prominent than sockets of *sl* setae on ventral sclerite of abdominal segment IX; *hl* setae distributed basally and laterally. Gill filaments on outer bifid trunk of abdominal segment III: mesial branch, 17–22; lateral branch, 18–22.

BIOLOGY

Hydropsyche morosa east occurs in upper and middle reaches of streams and small rivers, showing a moderate range of tolerance to temperature and organic enrichment; it is frequently collected with *H. bronta*, *H. sparna*, and *H. walkeri*. *H. morosa*

west/central populations have been found in lake outflows and culvert discharges laden with organic material, as well as in large rivers such as the Niagara (New York), Fox (Wisconsin), and St Lawrence (Québec). Adults emerging in abundance from large rivers may be an annoyance to nearby residents, as the minute hairs on the insects' bodies and wings are easily dislodged, suspended in the air, and when inhaled may induce an allergic reaction (Osgood, 1934, 1957). As well, sheer numbers of insects flying and perishing are a nuisance. Several attempts at control have been conducted at Fort Erie, Ontario (Peterson, 1952) and Île Ste-Hélène, Québec (Fredeen, 1971).

RANGE

Hydropsyche morosa east occurs from eastern Québec and Nova Scotia in the east, to its western limit in North Dakota. It has been recorded to the tree line in northern Québec, is widespread in southern Québec and southern Ontario, but occurs locally in northern Ontario. The southern range limits are Georgia in the Appalachian Mountains, the southern perimeter of the Great Lakes through Wisconsin, and northern Minnesota. The west/central form of *H. morosa* occurs from Québec in the east to Vancouver Island, British Columbia, in the west. This form does not occur south of New England in the Appalachians, occurs locally in Ontario, and is most common in the north-central states and provinces. Intermediate forms occur in disjunct populations in a broad east-west band extending from Saskatchewan eastwards to Québec, and are prevalent in northern Ontario, and the Niagara and St Lawrence river basins.

METAMORPHOTYPES EXAMINED

H. morosa east. MINNESOTA: Cook County, Temperance River at U.S. 61, 21 VII 75, GAS (5 and 20 larvae). NEW YORK: Delaware County, Beaverkill River at Exit 92, Route 17, 27 VII 81, #811100 (4 from larvae reared in lab, emerged 11 VIII 81 ff.). ONTARIO: Durham County, Duffin Creek at Greenwood Conservation Area, 11 VII 79, #790026 (1 and 40 larvae); 3 VII 80, #801038 (1 and 8 larvae); Grey County, Beaver River at Clarksburg, 21 V 76 (10 and 10 larvae); 17 VI 76 (5 and 20 larvae); 26 VI 76 (3 and 6 larvae); 29 VII 76 (10 and 30 larvae); South Saugeen River at Highway 89 west of Mount Forest, 20 V 76 (10 and 30 larvae); 29 VII 76 (1 and 10 larvae); Halton County, Glen Williams, Credit River, 10 VI 52 (3 and 2 larvae); Norval, Credit River, 30 IV 73 (2 and 10 larvae); Hastings County, Moira River, at Highway 401, 15 VIII 76 (2); 14 VI 79, #790016 (1 and 1 larva); at Latta, 6 VI 75 (8 and 15 larvae); 13 VI 76 (3 and 10 larvae); Nipissing District, Algonquin Park, Oxtongue River, Tea Lake Dam, 5 VII 54 (4 and 16 larvae); 15 IX 60; Northumberland County, Ganaraska River, 15 VIII 76 (1 and 100 larvae); 31 VII 79; Shelter Valley Creek at Highway 401, 26 V 76 (5 and 10 larvae); 13 VI 76 (5 and 20 larvae); 11 VI 79, #790012 (8); 20 VI 79, #790019 (2 and 50 larvae); Parry Sound District, Cashman Creek at Highway 518 at Sand Lake, 1 VI 72, #720212 (1 and 2 larvae); Peel County, Credit River, Churchville, 3 VI 76 (1); 29 VI 76 (1); 11 VIII 76 (8 and 30 larvae); Forks of the Credit, 2 VI 76 (1); Erindale, 21 V 71 (7 and 50 larvae); 3 VI 76 (1); 15 VI 76 (2); 11 VIII 76 (6 and 20 larvae); Simcoe County, Humber River, Rowntree Mills, 25 V 76 (2); 10 VI 76 (1); York County, Humber River at Highway 27, 10 VI 76 (1). TENNESSEE: Blount County, Little River 9.2 km northwest of Townsend at Tennessee 73, 15 IV 78, #780068 (7). VIRGINIA:

Bedford County, James River at Peter's Creek on Virginia 501, 30 VIII 76, INHS (1 and 13 larvae).

H. morosa west/central. BRITISH COLUMBIA: Burnaby, 11 VII 46, INHS (2). ILLINOIS: Rock River, south fork at U.S. 51 south of Rockford, 25 VIII 76, GAS (4 and 15 larvae). MANITOBA: Roseau River, 2 km downstream from Highway 59, south of Rosa, 27 V 81, #811072a (2 and 30 larvae). MINNESOTA: Carver County, Watertown, Crow River, 27 VIII 75, GAS (1); Chisago County, Sunrise River at Minnesota 95, 6 VII 76, GAS (4 and 10 larvae); Clearwater County, Itasca State Park, Mississippi River, culvert under road, 1 VI 81, #811086 (1 and 40 larvae); Hubbard County, Park Rapids, Fishhook River, 31 V 81, #811082a,b (1 and 20 larvae). NORTH DAKOTA: Pembina County, Icelandic State Park, Renwick Lake and Tongue River at Renwick Dam, 9.7 km west of Cavalier on Route 5, 8 VII 81, #813013b (20 and larvae collected with adults). ONTARIO: Kenora District, Rushing River Provincial Park, outlet at Dogtooth Lake, 6 VII 81, #813012a (5 and adults); Rushing River, 13–14 VI 71, #710400 (2 and 3 larvae); Lake Saganaga, Northern Light Rapids, 15 VIII 75, GAS (6).

Hydropsyche oslari Banks

Hydropsyche oslari Banks, 1905, p. 13, fig. 2, male; type locality, southwest Colorado.

Hydropsyche partita Banks, 1914, p. 252. Syn. Ross, 1938b.

Hydropsyche oslari—Ross, 1938b, p. 18, fig. 35, lectotype male, lectoallotype female.

Hydropsyche oslari—Flint and Herrmann, 1976, pp. 894–898.

Hydropsyche oslari—Haddock, 1977, pp. 169–174, fig. 1.

Symphitopsyche oslari—Alstad, 1980, p. 168, fig. 1, larva.

Larvae which key to *Hydropsyche oslari* may show variability in setal morphology on the head and dorsum of the abdomen. Examination of adult material, particularly from Oregon, Washington, and British Columbia, has revealed variability in male and female genitalic characters which suggests that a complex of closely related species may exist in this area.

DIAGNOSIS

Widespread in the Rocky Mountains and westwards, *Hydropsyche oslari* is easily separated from other known noncheckerboard western species. In *H. oslari* the frontoclypeus may have a few *tp* setae posteriad of the tentorial ridge or may appear slightly pebbled, while other species have either black head setae or numerous short *bl* setae on the entire surface of the frontoclypeus. The head appears nearly round in dorsal aspect, the lateral margins convex, with clear, short *tp* setae of even length on the parietals.

H. oslari is variable in coloration, the head ranging from dark brown to yellow, either possessing or lacking a light median area anteriad of the tentorial ridge (Fig. 86).

DESCRIPTION

Head width 1.13–1.29 mm, length 1.16–1.40 mm (29 larvae). Frontoclypeus may appear pebbled, be devoid of setae, or have a few *tp* setae near frontoclypeal suture posteriad of tentorial ridge. Parietals with erect, clear or occasionally dark *tp* setae of uniform length dorsally, longer anteriorly; clear *ap* setae laterally and ventrolaterally. In one population examined, sharp, curved, appressed *hl* setae occur laterally in the posterior parietal setal area. On specimens with darker head setation, *hl* setae may be dark and conspicuous on parietals.

Pronotum with anterolateral seta 22 moderately long, dark, and tapered, but may be blunt apically; the anterolateral margin bears several conspicuous, curved peg setae, longer and thicker than the dorsal and lateral peg setae, but shorter than seta 22; dorsally and laterally with *tp* setae erect, clear; *hl* setae conspicuous. Specimens with sharp, curved, appressed *hl* setae on the parietals may have this type of seta laterally on the pronotum. Mesonotum with seta 5 moderately long, clear, apically blunt; dorsally and laterally with *tp* setae clear, erect; occasionally with a few appressed *ap* setae; *hl* setae conspicuous. Metanotum with seta 5 moderately long, clear, and apically blunt; dorsally and laterally with clear, erect *tp* setae; *hl* setae conspicuous.

Procoxa with single long, dark seta I, several shorter, dark *sl* setae adjacent. Mesotrochanter with setae 2, 3, and 5 long, dark, occasionally a short, dark seta I present; mesofemur with setae 3 and 4 long, dark, often with dark *sl* and *ls* setae between them. Metatrochanter with seta 3 dark, seta 2 clear (an occasional individual may have light setae in both positions); metafemur with seta 3 dark, seta 4 clear or not distinguishable.

Abdomen with erect *sh* setae clavate or occasionally flattened, mingled with appressed *hl* setae. Venter of anal proleg with dark *sl* setae laterally, *hl* setae laterally, basally, and on caudal lobes. Gill filaments on outer bifid trunk of abdominal segment III: mesial branch, 9–13; lateral branch, 14–15.

BIOLOGY

Hydropsyche oslari is widespread throughout the western United States and Canada, occurring mostly in the middle reaches of streams and small rivers. A detailed description of a spring-fed habitat, where *H. oslari* occurs with *Ochrotrichia susanae*, was given by Flint and Herrmann (1976). Alstad (1980) described life history and longitudinal distribution of *H. oslari* in some Utah streams.

RANGE

Hydropsyche oslari occurs mostly to the west of the continental divide in the Rocky Mountains and coastal ranges from Baja California northwards into the Yukon, the range extending eastwards into central Alberta and North Dakota.

METAMORPHOTYPES EXAMINED

BRITISH COLUMBIA: Koksilah River, at road to Port Renfrew 3.7 km west of Shawnigan Lake, 28 VI 69, #690137 (3). CALIFORNIA: Alpine County, West Carson River, Route 89, 3.2 km west of Woodfords (1828.8 m), 19 VI 73, SDS (2 and 3 larvae); Marin County, Lagunitas, 7 VI 61 (1); Mariposa County, Wawona (1219.2 m), 17 VII 46 (3); Mono County, Convict Creek, 14 VII 66 (6 and 6 larvae); Mammoth Creek at Route 395, 61.2 km north of Bishop, 16 VII 66 (2 and 2 prepupae); Santa Cruz County, San Lorenzo Creek, 4 km west of Santa Cruz, 12 VII

73, SDS (2); Sequoia National Park, creek at Dorst Creek Campground, 22 VI 61 (I); Sierra County, Fiddle Creek, 19.3 km west of Downieville, 26 VI 73, SDS (2); Siskiyou County, Walker Creek, 17 VI 73, SDS (1); Tehama County, Guernsey Creek 3.2 km south of Childs Meadow, 27 VI 73, SDS (2); Tuolumne County, Sheering Creek 3.2 km south of Pinecrest, 18 VII 73, SDS (1). COLORADO: Chaffee County, Arkansas River, 6.4 km north of Buena Vista, 9 VIII 73, SDS (I); Jefferson County, Bear Creek at Corwina Park (2057.4 m), 27 VI 81, DER (I and 3 larvae); at Evergreen Lake Inlet (2155.5 m), 20 VI 81, DER (I); Park County, South Platte River ca. 16 km south of Fairplay, 9 VIII 73, SDS (I). IDAHO: Idaho County, small stream at Route 12 between Holly and Stanley creeks northeast of Lowell, 24 VI 68 (10 and 20 larvae). OREGON: Benton County, north fork of Alsea River at Route 34 east of Alsea, 6 VI 68 (10); Grant County, small creek at Dale Ranger Station, 40.2 km north of Long Creek, 7 VII 74, SDS (I); Lane County, Elk Creek 2.7 km west of Blue River, Route 126, 22 VII 74, SDS (1); Lincoln County, stream along Trenholm Saddle Road, Route 34 east of Tidewater, 15 VI 67 (3); Linn County, Quartzville Creek ca. 2.6 km east of Yellowstone Guard Station, Quartzville Road, 17 VI 68 (2 and 10 pupae). UTAH: Uintah County, Green River at Green River Campground, Dinosaur National Monument, 29 VII 66 (4 and 50 larvae). WASHINGTON: Klickitat County, Klickitat River, 8 VII 74, SDS (I). WYOMING: Fremont County, Crowheart, stream at Route 287, 28 VI 68 (5 and prepupae).

Hydropsyche piatrix Ross

Hydropsyche piatrix Ross, 1938a, p. 148, fig. 77, holotype male; type locality, Greer, Missouri.

Hydropsyche piatrix—Ross, 1944, p. 97, fig. 360, male; fig. 387h, allotype female.

Symphitopsyche piatrix—Schuster and Etnier, 1978, pp. 57,58, fig. 28, presumed larva.

Larvae of *Hydropsyche piatrix* are associated with the adult for the first time from the outflow of Mammoth Spring in Mammoth Spring, Arkansas. The larva is the same as that presumed by Schuster and Etnier (1978) to be *H. piatrix*. Larvae were collected from Greer Spring, Missouri, and Turner's Mill Spring, near Greer, where we collected several adults by light trapping and sweeping.

DIAGNOSIS

Although having checkerboard coloration on the head, *Hydropsyche piatrix* is readily distinguished from similar species by the red *sl* setae on the ventral membranous area of the anal prolegs, which have prominent sockets considerably more enlarged and darker red than the sockets of the *sl* setae of the ventral sclerite of abdominal segment IX, and by the very short, clear, inclined *ap* setae on the parietals.

DESCRIPTION

Head rectangular, width 1.05–1.10 mm, length 1.25–1.30 mm (two larvae). Frontoclypeus lacking apparent setation except near anterolateral corners. Parietals with very short, clear, inclined *ap* setae; *hl* setae clear, inconspicuous.

Pronotum with anterolateral seta 22 long, dark, tapered; dorsally and laterally with clear, inconspicuous *ap* setae and *hl* setae. Mesonotum with seta 5 dark, tapered, and moderately long; dorsally and laterally with *ap* setae short, clear, inclined; *tp* setae few, clear, inconspicuous; *hl* setae dark, conspicuous. Metanotum with seta 5 clear, moderately short, blunt; dorsally and laterally with *tp* setae clear and inconspicuous; *hl* setae dark and conspicuous.

Procoxa with single long, dark seta 1. Mesotrochanter with setae 2, 3, and 5 long, dark; on one specimen, dark seta 1 present on one side. Mesofemur with setae 3 and 4 long, dark, occasionally shorter *ls* setae between. Metatrochanter with setae 2 and 3 long, dark; on one specimen, dark seta 1 present on one side; metatrochanter missing or damaged on other specimen. Metafemur with setae 3 and 4 long, dark.

Abdomen with erect *sh* setae clavate, similar in morphology to appressed *hl* setae; abdominal seta 5 especially dark and conspicuous. Venter of anal prolegs with stout, clear, red, curved *sl* setae with prominent sockets on basal area—the sockets more pronounced than on *sl* setae on ventral sclerite of abdominal segment IX; thinner, straighter *sl* setae laterally; few *hl* setae basally and on caudal lobes. Gill filaments on outer bifid trunk of abdominal segment III: mesial branch, 12–13; lateral branch, 16–18.

The *H. piatrix* individuals examined showed no variability of the checkerboard head pattern.

BIOLOGY

Metamorphotypes of *Hydropsyche piatrix* were collected from the outflow of Mammoth Spring, in Mammoth Spring, Arkansas, in early October. Many adults were present on riparian vegetation. Larvae of *H. piatrix* were collected in May from Greer Spring and Turner's Mill Spring, Missouri. Greer Spring (16°C.) is a large headwater source of Eleven Point River, and Turner's Mill Spring (13.9°C.) is a smaller spring-fed tributary of the same river. The larvae were on small and medium-sized rocks in shallow areas of both streams, within 200 m of the upwelling or outflow source. Adults were collected in May by light from Eleven Point River, 0.4 km downstream from the inflow of Greer Spring.

RANGE

Hydropsyche piatrix is apparently restricted to spring-fed streams of south-central Missouri and north-central Arkansas. Schuster and Etnier (1978) believe the only other record (Corbet, Schmid, and Augustin, 1966, from the St Lawrence River in Québec) to be a misidentification of a closely related species.

METAMORPHOTYPES EXAMINED

ARKANSAS: Fulton County, downstream from Mammoth Spring, between dam and junction with Spring River, 4 X 84, #840207 (5).

LARVAE EXAMINED

ARKANSAS: Fulton County, downstream from Mammoth Spring, 43.7 m north of junction with Spring River in Mammoth Spring (just east of Route 63 crossing), 25 IX 76 (2). MISSOURI: Oregon County, Mark Twain National Forest, Greer Spring, major headwater source of Eleven Point River, off Route 19 ca. 1.5 km south of Eleven Point River bridge, 5 V 84, #840004 (40); Mark Twain National Forest,

Turner's Mill Spring, small tributary of Eleven Point River in Turner's Mill Recreational Area, off Route 19 ca. 8 km north of Eleven Point River bridge, 5 V 84, #840005 (15).

Hydropsyche slossonae Banks

Hydropsyche slossonae Banks, 1905, p. 14, figs. 4,7, male, female; type locality, Franconia, New Hampshire.

Hydropsyche slossonae—Ross, 1938b, p. 18, fig. 30, lectotype male, lectoallotype female.

Hydropsyche slossonae—Denning, 1943, pp. 131–133, fig. 20, female; fig. 21, pupa.

Hydropsyche slossonae—Ross, 1944, p. 99, figs. 16,355, larva; fig. 362, male; fig. 387g, female.

Hydropsyche slossonae—Mackay, 1978, pp. 499–509, fig. 4a,5a,6a,b, larva.

Symphitopsyche slossonae—Schuster and Etnier, 1978, pp. 47–50, figs. 23,24, larva.

DIAGNOSIS

Widespread in cool, unpolluted streams in much of northern North America, *Hydropsyche slossonae* is easily identified even though variable in colour. Colour patterns of the head range from uniformly dark brown through the most frequently encountered median-spotted varieties (Ross, 1944; Mackay, 1978; Schuster and Etnier, 1978), and in localized populations colour patterns may resemble checkerboard species or even be solid yellow. With the exception of a few *H. aenigma* specimens no other eastern or northeastern species exhibits the dark head pattern commonly seen in *H. slossonae* (with one, two, or three median light spots), but *H. slossonae* larvae with other markings may be easily identified by the long, dark *hl* and *sl* setae on the venter of the anal prolegs, the cluster of long, dark *ls* setae between setae 3 and 4 on the mesofemur, the presence of numerous dark *ap* parietal setae, and the presence on the metafemur of a long, dark seta 4.

Head colour can be variable as described above (Figs. 80–82), but the posterior area of the head (from the posterior frontoclypeal angle posteriad) is invariably light, without intrusion of dark pigment along the coronal suture.

DESCRIPTION

Head rectangular, width 1.02–1.32 mm, length 1.19–1.53 mm (16 larvae). Frontoclypeus lacking apparent setation other than at anterolateral corners, although on some yellow individuals one or two erect, dark *ap* setae may occur near the frontoclypeal sutures. Parietals with *ap* setae numerous, erect, very dark, longer laterally and anteriorly; lateral parietal *ap* setae are appressed and may be lighter in colour; *hl* setae dark and conspicuous.

Pronotum with anterolateral seta 22 long, dark, tapered; dorsally and laterally with *ap* setae dark, erect and inclined; *tp* setae few, erect, longer than surrounding *ap* setae; *hl* setae dark, conspicuous. Mesonotum with seta 5 moderately long, light tan; dorsally and laterally with *ap* setae erect, dark; *tp* setae few, longer than *ap* setae; *hl*

setae dark, conspicuous. Metanotum with seta 5 short, light tan; dorsally and laterally with *tp* setae dark, short, and erect, and long and inclined posteriorly; *hl* setae conspicuous.

Procoxa with single long, dark seta 1, several short, dark *sl* setae adjacent. Mesotrochanter with long, dark setae 2, 3, and 5; mesofemur with cluster of long, dark *ls* setae between long, dark setae 3 and 4. Metatrochanter with setae 2 and 3 long, dark; metafemur with seta 3 long, dark, seta 4 usually dark, but occasionally clear.

Erect abdominal *sh* setae clavate, mingled with appressed *hl* setae. Venter of anal prolegs with *hl* setae and sharp, dark *sl* setae of the same length basally, laterally, and on caudal lobes. Individuals may have one or a very few fine, translucent or tan *sl* setae basally or laterally. Gill filaments on outer bifid trunk of abdominal segment III: mesial branch, 11–13; lateral branch, 14–16.

BIOLOGY

Hydropsyche slossonae occurs in cool, unpolluted streams (for life history patterns, see Mackay, 1979), although the larvae are tolerant of some sediment and organic enrichment. The species is frequently collected with *H. bronta*, *H. alhedra*, or *H. sparna*.

RANGE

Hydropsyche slossonae is widely distributed in eastern North America, occurring in the Maritime Provinces, eastern Québec, and southwards through the Appalachian Mountains from New England to South Carolina. The tree line around Hudson Bay in Québec and Ontario is the northeastern limit of distribution. Widespread north and south of the Great Lakes, *H. slossonae* extends westwards through south and central Manitoba and Saskatchewan to British Columbia and southwards to Colorado. A disjunct population exists in the Ozark Plateau of Arkansas.

Variant larvae with predominantly light head coloration occur in Ontario. Local populations are recorded from streams flowing southwards out of the moraine area parallel to Lake Ontario in Northumberland and Hastings counties where they may occur with Appalachian-type *H. bronta*. Light coloured *H. slossonae* also occur in some streams along the north and western shores of Lake Superior, while populations of the darker, more common form are found in other suitable streams. A population with unpatterned yellow head coloration is recorded from the Whitewater River in North Carolina.

Material designated "typ." or with no designation is typically dark with one, two, or three light median spots; "var." material represents variant coloration, either a light background with dark patterns, or a dark background with light lateral patches resembling the checkerboard pattern.

METAMORPHOTYPES EXAMINED

ALBERTA: Battle River, at Highway 1 near Highway 792, 15 VI 79 (15). COLORADO: Grand County, Kenny Creek, near Hot Sulphur Springs, 11 VIII 73, SDS (2). MANITOBA: Duck Mountain Provincial Park, Garland River, 1 VII 62 (1 and many pupae); Riding Mountain National Park, Edwards Creek, 2 VII 62 (10). MINNESOTA: Hubbard County, Lasalle Creek at No Name Road, 2 VI 81, #811088 (6 and 10 prepupae). MONTANA: Deer Lodge County, Clark Fork River at Deer Lodge, 3 VIII 73, SDS (1). ONTARIO: Algoma District, Chippewa River at

Highway 17, 4 VI 71, #710325 (1); Obatanga Provincial Park, small stream at Highway 17, 8 VI 80, #801026 (1 and 50 larvae); Durham County, Duffin Creek at Greenwood Conservation Area, 3 VII 80, #801038 (1 and 30 larvae); Ganaraska River, 23 VII 73 (3 and many var. larvae); Wilmot Creek, 10 VII 52 (4 var.); Grey County, stream at Highway 6 near Mount Forest, 6 VI 76 (1 and 30 larvae); Negro Creek at Highway 6, 6 VI 76 (3 var., 1 typ. and 10 var., 50 typ. larvae); North Spey River, Highway 10 south of Rockford, 17 V 76 (2 var., 16 typ. and 2 var., 20 typ. larvae); Saugeen River at Durham Conservation Area, 21 V 76 (5 var. and 20 var. larvae); Northumberland County, small stream off Highway 45 near Baltimore, 23 V 80, #801009 (5 and 20 larvae); Hope Township, Ganaraska River, small tributary, concession 5 west of Highway 28, 26 V 76 (1 and 10 larvae); Peel County, Humber River, at Palgrave, #396 (1; no date available); Albion Hills, 26 V 76 (1); 8 VI 76 (3); 2 VI 76 (1); Mono Mills, 26 V 76 (1); 22 V 77 (2); 4 VIII 76 (1); Credit River, Belfountain, 6 VII 61 (2); Forks of the Credit, 31 V 76 (1); 2 VI 76 (3 and 20 larvae); 17 VI 76 (2); Rainy River District, small stream at Route 11, 103.3 km east of Fort Francis, 11 VI 71, #710387 (1 and 6 larvae); Thunder Bay District, Blend Creek near Sibley Provincial Park, 8 VI 71, #710356 (4 and 10 larvae); Coldwater Creek at sideroad off Ouimet Canyon Road, 10 VI 80, #801031 (3 and 15 pupae and 100 var., 200 typ. larvae); Sunshine Creek at Matawin River, 10 VI 80, #801030a (5 and 10 larvae); Cloud River at Cloud River Road, 23 VII 80, #801039 (1 and 3 var. larvae); Little Whitefish River at Highway 593, 24 V 81, #811066 (2 and 5 larvae). VERMONT: Addison County, small stream at foot of Moss Glenn Falls, Route 100 south of Warren, 26 VII 69, #690375 (1 and pupa).

LARVAE EXAMINED

ALBERTA: Bigoray River at Highway 753, 19 VI 79 (1); Little Red Deer River at Highway 922 north of Highway 582, 23 VI 79 (3); Medicine River at Highway 766, 14 VI 79 (2); Pembina River, at Highway 654, 21 VI 79 (1); crossing Highway 16, 10 VI 62 (2); Rose Creek at Highway 922 north of Highway 606, 14 VI 79 (8); confluence of Sheep and Highwood rivers, Highway 552, 12 VI 79 (3); Willow Creek at Highway 527, 12 VI 79 (1); tributary of Willow Creek at Highway 520 west of Claresholm, 12 VI 79 (1). MANITOBA: Duck Mountain Provincial Park, Cowan Creek, 28 X 80, #801068 (30); Favel River, 50.5 km from Blue Lake Campground on Highway 366, 15 VIII 69, #690336 (3); Garland River, 12 VI 62 (30); 12 VII 62 (10); North Pine River, 29 V 81, #811078a (15); Overflowing River Provincial Park, Overflowing River, 4 VIII 70, #700481 (1); Riding Mountain National Park, Edwards Creek, 11 VI 62 (75). MINNESOTA: Clearwater County, Mississippi River at Minnesota Road 37, 2 VI 81, #811087 (3). NEW BRUNSWICK: Charlotte County, Waweig River, outlet of pool at Highway 765, 14 VIII 80, #801048 (2). NEW JERSEY: Sussex County, Stokes State Forest, Big Flat Brook, 16 IV 77, JSW (1). NEW YORK: Delaware County, Beaverkill River at Route 17, Exit 92, 20 X 80, #801065 (1 and 1 reared); Tompkins County, Six Mile Creek at Slaterville Springs, 9 IX 66 (1). NORTH CAROLINA: Jackson County, Whitewater River above falls, 15 V 79, GAS (20 var.); Swain County, Great Smoky Mountains National Park, Bryson City, Deep Creek at Deep Creek Campground, 21 V 70, #700365 (20); Oconoluftee River at Smokemount, 1 IV 76, INHS (25); Transylvania County, Whitewater River, Route 171 north of Salem, 18 V 70, #700353 (20 var., 4 typ.). NORTH DAKOTA: Pembina County, Icelandic State Park, Renwick Lake, Tongue River at Renwick

Dam, 8 VIII 81, #813013 (1). OHIO: Champaign County, Kiser Lake State Park, stream entering Kiser Lake, 27 IX 67 (2); Morrow County, small stream at Route 97 northwest of Lexington, 1 VIII 68 (15). ONTARIO: Algoma District, small stream at Highway 17, 30.1 km south of Batchawana Bay Provincial Park, 4 VI 71, #710320 (50 and many pupae); Bruce County, 8 km north of Wiarton, Highway 6, VII 60 (1 var.); Cochrane District, Moosonee, Cemetery Creek, 8 VIII 80 (2); Natatishee Creek, 26 VIII 80 (2); Pitopiko River at Route 11, 27.7 km west of Shekak River, 25 VI 71, #710472 (1); Thunder Creek at Highway 101, 21.4 km west of Timmins, 19 V 72, #720163 (1); Durham County, Duffin Creek at Greenwood Conservation Area, 21 III 72 (2); 22 V 80, #801007 (1); Leskard, 12 VI 53 (1 var.); Grey County, stream at junction of Sideroad 25 and Concession 12, 23 II 80 (16 var., 40 typ.); Euphrasia/St Vincent Township Line, Bighead River, 27 VI 80 (2); Holland Township, Spring Creek, 4 VI 80 (5); Holland/Sydenham Township Line, tributary of Bighead River, 29 V 80, #801012 (6); #801015 (160); Walters Creek, 29 V 80, #801016 (10); Minniehill Creek, 8 VI 80 (20); Rocklyn Creek, 27 VI 80 (2); St Vincent Township, Minniehill Creek, 9u10 VI 79 (2); 1 X 79 (40); Sydenham Township, Telford Creek, 8 VIII 79 (17); Kenora District, Kiruna Lake, 10 VII 81, #810023g (1); 12 VII 81, #810029c (1); Crystal River, 1 VI 78 (1 var.); Florence Creek at Route 105, 30.1 km south of Ear Falls, 16 VI 71, #710413 (2); small stream at Route 105, 23.8 km south of Red Lake, 16 VI 71, #710411 (10); Lanark County, Fairs Creek at Lanark County Road 8, 30 VIII 72 (4 var.); Northumberland County, small stream at Van Luven Road north of Baltimore, 27 V 80, #801011 (20); Mayhew Creek tributary, 26 V 76 (80); Peel County, Credit River at Alton Concession IV, 27 VI 52 (2 var.); Credit River at Forks of the Credit, 24 XI 78 (70); 28 IX 52 (3); 20 VIII 52 (4); 9 VI 75 (30); Humber River, at Sideroad 25, Palgrave, 6 XI 78 (15); 1 XII 78 (30); 2 XI 78 (30); at Albion Hills Conservation Area, 15 VIII 75 (1); Renfrew County, small stream at Highway 17 between Arnprior and Renfrew, 28 V 60 (2 var.); Khartum, 20.9 km southwest, small stream at Highway 41, 23 VI 73, #730109 (35 var.); Simcoe County, stream at Highway 11, 15.8 km north of Highway 400 cutoff, 21 VIII 67 (1); Grouse Creek, East Oro, 13 VII 52 (30 var., 45 typ.); Hawkestone, 12 VIII 52 (1); Sudbury District, Eastman Creek at Highway 101, 55 km west of Timmins, 23 V 72, #720181 (5); Espanola, Norton's Creek, 8 VI 81 (5); Thunder Bay District, Beardmore, 8.7 km northeast, stream at Highway 11, 25 VI 71, #710447 (2 var.); Cloud River at Cloud River Road, east of Highway 61, 10 VI 80, #801029 (100 var.); 24 V 81, #811065 (20 var., 10 typ.); Coldwater Creek tributary, 21 V 81, #811057a (50); Creelman Creek at Route 11, 21.9 km southwest of Geraldton, 23 VI 71, #710451 (35 var.); Current River at Highway 527, 10 VI 80, #801033 (1); Dublin Creek at Highway 17, 9 VI 80, #801028 (10); Firehill Creek at Highway 17, 19 V 81, #811050 (10); Geraldton, 40.7 km north, stream at Route 584, 24 V 71, #710463 (15); Jackpine River at Highway 17, 19 V 81, #811049a (100); Joe's Creek near Sibley Provincial Park, 20 V 81, #811056 (15 var., 5 typ.); Kakabeka Falls Provincial Park, Kaministikwia River, 19 VI 71, #710434 (2); McVicar's Creek at Cumberland Street, Thunder Bay, 10 VI 80, #801046 (10); Pearl, Pearl River at Highway 17, 12 VI 80, #801036 (10 var.); 21 V 81, #811059 (6 var.); Sibley Creek near Sibley Provincial Park, 20 V 81, #811055a (50 var., 50 typ.); Sturgeon River at Route 11, 17.9 km northeast of Jellicoe, 22 VI 71, #710450 (1 var.); small stream at Highway 17, 15 km east of Thunder Bay, 19 VI 71, #710432 (40); Wolf River at Highway 17, 21 V 81, #811058 (12 var., 3 typ.); Wolf

River tributary on logging road east of Highway 527, #801032 (30 var., 10 typ.); Timiskaming District, stream at road to Esker Lakes Provincial Park, Kirkland Lake, 24 V 72, #720186 (35); Victoria County, Manvers Township, Fleetwood Creek, 1 VI 79 (2); Pigeon Creek, 11 VII 79 (2). PENNSYLVANIA: Linesville, Linesville Creek, Pymatuning Laboratory of Field Biology, 17 VII 64 (3); Potter County, stream at road 0.8 km west of Route 44, 16.1 km north of Coudersport, 15 V 68 (2). SASKATCHEWAN: Cypress Hills Provincial Park, Battle Creek, 28 VI 62 (10); Pierceland, stream on Highway 55, 15 VIII 70, #700546 (1). VIRGINIA: Bedford County, Montvale Wayside, 10 V 76 (1); Botetourt County, small stream at Route 43, 3.2 km south of Buchanan, 19 IV 68 (1); Craig Creek, 9 V 76 (1); Craig County, Barbour's Creek, 8 V 76 (1); Floyd County, Little River, 17 IV 74 (1); Montgomery County, Mill Creek at Route 785, 10,12 IV 79 (6); north fork of Roanoke River, 16 IV 74 (1); Page County, Pass River, 9 V 76 (6); Wythe County, Reed Creek at Route 11, 2.9 km west of Wytheville, 10 VII 68 (1); 27 VII 69, #690377 (3). WEST VIRGINIA: Pocahontas County, stream in Bird Run Recreational Area, 5 X 67 (20); 28 V 84, #840093 (1); Mercer County, Camp Creek in Camp Creek State Park off Route 19 ca. 24.1 km north of Princeton, 27 V 84, #840086 (1); Randolph County, Gandy Creek in Monongahela National Forest off Route 112, 14 km south of Whitmer, 30 V 84, #840105 (10).

Hydropsyche sparna Ross

Hydropsyche sparna Ross, 1938a, p. 150, fig. 81, holotype male, allotype female; type locality, Lovells, Michigan, along Au Sable River.

Hydropsyche sparna—Denning, 1943, pp. 134–136, fig. 24, female; fig. 25, pupa.

Hydropsyche sparna—Ross, 1944, p. 97, fig. 361, male; fig. 387f, female.

Hydropsyche sparna—Mackay, 1978, pp. 499–509, figs. 4b,5a,8a, larva.

Symphitopsyche sparna—Schuster and Etnier, 1978, pp. 52–54, fig. 26, larva.

DIAGNOSIS

Although head colour pattern is variable, *Hydropsyche sparna* is easily separated from most *H. morosa* group species on the basis of the short pronotal seta 22. The species is distinguished from others with this character by the lack of numerous *ap* setae on the frontoclypeus, which appears smooth and shiny, and the presence of dark, erect parietal *tp* setae. In some areas, notably northern Ontario and Wisconsin, *H. sparna* occurring with a slightly elongate pronotal seta 22 may be indistinguishable from larvae of *H. alhedra*.

Head coloration is variable, ranging from solid light yellow to medium brown (as in Fig. 84), or patterned as *H. alhedra* anteriad of the tentorial ridge with one, three, or four indistinct light areas (Fig. 83), or as *H. macleodi* with the surface of the frontoclypeus posteriad of the tentorial ridge darker than the remainder of the head.

DESCRIPTION

Head rectangular, width 0.97–1.10 mm, length 1.13–1.18 mm (14 larvae). Frontoclypeus appearing smooth and shiny, with few to several *tp* or *ap* setae near frontoclypeal suture. (Note: the secondary peg setae of the head are intermediate between strictly tapered or blunt types.) Parietals with *tp* setae dark, erect, of uniform length dorsally; *ap* setae inclined laterally; *hl* setae inconspicuous.

Pronotum with anterolateral seta 22 short, cylindrical, approximately one to one and one-half times length of adjacent secondary setae; dorsally and laterally with *tp* setae dark, erect; *ap* setae inclined, light tan; *hl* setae pale. Mesonotum with seta 5 moderately long, fine, clear; dorsally and laterally with *tp* setae erect, lighter and longer than on pronotum; *hl* setae pale. Metanotum with seta 5 moderately long, fine, clear; dorsally and laterally with *tp* setae erect, lighter and longer than on mesonotum, few short, inclined *tp* setae, and *hl* setae light but conspicuous.

Procoxa with single long, dark seta 1, may be several short, dark *sl* setae adjacent. Mesotrochanter with setae 2, 3, and 5 dark, long (on some individuals seta 5 may be clear or a dark seta 1 may occur); mesofemur with setae 3 and 4 long, dark, usually one or two shorter, dark *ls* setae between. Metatrochanter with setae 2 and 3 long, dark; metafemur with seta 3 long, dark, seta 4 clear or not distinguishable.

Abdomen with erect *sh* setae clavate, similar in morphology to appressed *hl* setae. Venter of anal prolegs with long *hl* setae basally, laterally, and on caudal lobes, and dark or tan *sl* setae basally and laterally. Gill filaments on outer bifid trunk of abdominal segment III: mesial branch, 8–11; lateral branch, 11–16.

BIOLOGY

Hydropsyche sparna occurs in various habitats including cold, turbulent first order streams, waterfall basins, as well as larger, warmer, and slower streams (for life history patterns, see Mackay, 1979). *H. sparna* is collected with *H. ventura*, *H. bronta*, or *H. slossonae* in colder streams, and with *H. walkeri*, *H. morosa*, or *H. alhedra* in warmer streams.

RANGE

Hydropsyche sparna is widely distributed in eastern North America, occurring from the Maritime Provinces on the Atlantic coast southwards through the Appalachian Mountains, with northern range limits at the tree line in northern Québec, along the northern shores of the Great Lakes, and westwards into Manitoba. *H. sparna* is recorded from Minnesota, Wisconsin, Michigan, and Pennsylvania, along the southern shores of the Great Lakes and southwards into Illinois.

METAMORPHOTYPES EXAMINED

MICHIGAN: Emmet County, west branch of Maple River at Route 31, 13 VI 72 (1 and 50 larvae). NORTH CAROLINA: Avery County, Linville River at Linville Falls Campground, 22 V 70, #700369 (2 and 2 larvae); Jackson County, Shoal Creek on U.S. 441 south of Cherokee, 1 IV 76 (2 and 20 larvae). ONTARIO: Algoma District, Sand River at Highway 17, 7 VI 80, #801024 (1 and 20 larvae); Old Woman River at Highway 17, 6 VI 80, #801022 (2 and 150 larvae); Durham County, Duffin Creek at Greenwood Conservation Area, 22 V 80, #801007 (1 and 7 larvae); Grey County, Beaver River at Clarksburg, 21 V 76 (1 and 20 larvae); Halton County, Credit River, Glen Williams, #372 (1); #462 (1; dates not available); Hastings County, Moira

River, at Highway 401, Fry's Landing Park, 14 VI 79, #790016 (1); at Latta, 25 VII 71 (1 and 1 larva); 13 VI 76 (2 and 15 larvae); 2 VII 76 (3); 15 VIII 76 (1); Kenora District, small stream at Route 17, 38.6 km west of Vermilion Bay, 15 VI 71, #710409 (2 and 10 larvae); Lanark County, Mississippi River at Route 29, Packenham, 26 VIII 71, #710502 (1); Northumberland County, Ganaraska River, 19 VI 73, #730105 (1); small tributary, Hope Township, concession 5 west of Highway 28, 26 V 76 (2 and 10 larvae); tributary of Mayhew Creek, Concession 1 south of Highway 401, ca. 2.4 km west of Wooler Road, 26 V 76 (3); Shelter Valley Creek at 401, 26 V 76 (3 and 150 larvae); 13 V 76 (3 and 30 larvae); Peel County, Credit River, Belfountain, 17 VI 76 (1); 19 V 76 (1); Churchville, 11 VIII 76 (1 and 6 larvae); 2 VIII 76 (1); Erindale Park, 31 V 79, #790005 (1); Sudbury District, River Aux Sables, Massey, Chutes Provincial Park, 2 VI 71, #710305 (1 and 30 larvae); Thunder Bay District, Dublin Creek at Highway 17, 8 VI 81, #811095 (1 and 20 larvae); 15 km east of Thunder Bay, small stream at Route 17, 17 V 71, #710432 (1 and 50 larvae). TENNESSEE: Blount County, Little River, 9.2 km northwest of Townsend, Tennessee 73, 15 IV 78, #780068 (3). VIRGINIA: Hanover County, North Anna River Falls, 21 III 78 (1). VERMONT: Franklin County, Missiquoi River beside Vermont 78 east of Highgate Center, 26 VII 69, #690375 (2 and 10 larvae); Windsor County, small stream at Route 100 just south of West Bridgewater, 26 VII 69, #690376 (2).

LARVAE EXAMINED

GEORGIA: Union County, Canada Creek on forestry road ca. 9.7 km south of Suches, 17 V 84, #840045 (1). ILLINOIS: Vermilion County, Jordan Creek 3.2 km southwest of Oakwood, 12 IV 83 (6). MAINE: Penobscot County, Winn, Penobscot River, 18 IX 79, UM (2). MICHIGAN: Isabella County, Chippewa River, 15 VII 79, DF (6). NEW YORK: Delaware County, Beaverkill River at Exit 92 off Route 17, 20 X 80, #801065 (2); 6 V 82, #822504 (1); Tompkins County, Slaterville Springs, Six Mile Creek, 9 IX 66 (2). NEWFOUNDLAND: Avalon Peninsula, Manuels Stream below Thomas Pond Dam, 24 VI 71 (1). NORTH CAROLINA: Avery County, Linville River at Linville Falls Campground, Blue Ridge Parkway, 21–22 V 70, #700367 (6); Macon County, small stream at Route 441 south of Franklin, 9 VIII 68 (20); Swain County, Bryson City, Great Smoky Mountains National Park, Deep Creek at Deep Creek Campground, 21 V 70, #700365 (4); Transylvania County, French Broad River at junction of 215N and 64E, 9 V 78, #780091 (20). ONTARIO: Algoma District, Baldhead River at Highway 17, 17 X 80, #801057 (1); 15 V 81, #811038 (1); Cedar Creek 37 km east of Marathon on Route 17, 6 VI 71, #710343 (2); Chippewa River at Highway 17, 4 VI 71, #710325 (4); small stream near Cigar Lake at Highway 17 ca. 32.2 km southeast of White River, 2 VIII 76, #760209 (10); Crystal Creek near Sault Ste Marie, 14 V 81, #811031 (15); tributary of Michipicoten River at Mission Road, 16 V 81, #811042 (3); stream at Old Mill Bay at Highway 17, 15 V 81, #811036 (1); Old Woman River, 30.6 km south of Wawa, 23 VIII 76, #760207 (8); Sand River at Highway 17, 15.6 km north of Agawa Bay Campground, 23 VIII 76, #760204 (3); 7 VI 80, #801024 (15); waterfall near Searchmont, 14 V 81, #811035 (1); small stream at Highway 17, 31.4 km south of Wawa, 5 VI 71, #710334 (1); Stokely Creek, #801018 (4); Cochrane District, Thunder Creek at Highway 101, 21.4 km west of Timmins, 19 V 72, #720163 (1); Durham County, Clarke Township, Ganaraska River, 2 VII 79; Duffin Creek at

Greenwood Conservation Area, 3 VII 80, #801038 (1); Orono, Wilmot Creek, 10 VII 52 (10); Grey County, Holland Township, Spring Creek, 4 VI 80 (12); Holland/Sydenham Township Line, Walters Creek, 29 V 80, #801016a (20); North Spey River, Highway 10 south of Rockford, 21 V 76; Rocklyn Creek, 26 VI 80 (10); St Vincent Township, Minniehill Creek, 1 X 79 (22); 10 VI 80 (13); Sydenham Township, Telford Creek, 8 VIII 79 (25); Bighead River, 29 V 80, #801015 (15); Euphrasia/St Vincent Township Line, near Walters Falls, 27 VI 80 (21); Holland Township, 12 IX 79 (1); tributary at Holland/Sydenham Township Line, 28 V 80, #801012 (30); Haldimand County, Grand River, Elora, 27 VII 60 (2); Haliburton County, Boshkung River, Sherborne Portage, 1 IX 77 (10); Hastings County, Moira River at Highway 401, 5 VI 79, #790007 (30); Kenora District, Graves Creek, 7 VI 78 (1); Leeds County, Leeder Creek front of Yonge off bridge intersecting logging trail, 16 VII 80; Nipissing District, Algonquin Provincial Park, stream at Highway 60, 7.1 km east of Opeongo Lake Road, 11 V 72, #720118 (1); Madawaska River at Highway 60, 29,31 V 72, #720203 (6); Amable du Fond River, Samuel de Champlain Provincial Park, 20 V 77, #770033 (10); Peel County, Credit River, Belfountain, 17 VI 52 (2); 29 IX 52 (4); 1 X 70 (7); Forks of the Credit, 3 VI 52 (20); 20 VIII 52 (30); 29 IX 52 (20); 13 X 78 (100); 21 XI 78 (20); Erindale, 30 V 73 (20); 15 IX 70 (1); 5 IX 52 (6); Humber River at Sideroad 25, Palgrave, 6 X 78 (10); 1 XII 78 (20); 3 IX 78; Rainy River District, Pickerel River at Highway 11, 11 VI 80, #801035 (60); Renfrew County, Arnprior, Waba Creek, 9 VII 54 (10); Simcoe County, East Oro, Grouse Creek, 13 VII 52 (5); Sudbury District, Alton, Credit River at Concession IV, 27 VI 52 (15); Eastman Creek at Highway 101, 55 km west of Timmins, 23 V 72, #720081 (2); Espanola, Norton Creek, 10 VI 81 (3); Thunder Bay District, Creelman Creek at Route 11, 21.9 km southwest of Geraldton, 23 VI 71, #710451; Current River at Highway 527, 10 VI 80, #801033 (20); Dublin Creek at Highway 17, 9 VI 80, #800128 (50); 19 VIII 80, #800160 (25); Kakabeka Falls Provincial Park, Kaministikwia River, 19 VI 71, #710434 (1); McLeans Creek at Highway 17, 24 VIII 76, #760211 (20); 18 V 81, #811044 (20); North Current River at Highway 527, 10 VI 80, #801033 (25); Pearl River at Highway 17, 12 VI 80, #801036 (4); 21 V 81, #811059 (10); Rheo River entering Lynn Lake near Schreiber, 20 I 68 (8); small river at Highway 17 ca. 1.5 km east of White River, #801027 (100); Timiskaming District, Kelly Creek at Highway 101, 46.3 km west of Timmins, 23 V 72, #720183 (17). TENNESSEE: Sevier County, stream at Route 73, 14.5 km east of Gatlinburg, 3 X 67 (6). VIRGINIA: Amherst County, tributary of James River beside Blue Ridge Parkway near junction with Route 501, 19 IV 68 (4); Lower Otter Creek at Lower Otter Creek Overlook on Blue Ridge Parkway, 16 IV 68 (6); Bath County, stream in Blowing Springs Recreational Area on Route 39, 5 X 67 (4); Cowpasture River, 9 V 76 (1); Page County, Pass River, 9 V 76 (1); Patrick County, Rock Castle Creek, 16 V 76 (1); Roanoke County, Roanoke River just west of Roanoke on Route 11, 28 VII 69 (15). WEST VIRGINIA: Pocahontas County, stream in Bird Run Recreational Area, Route 84, 5 X 67 (3).

Hydropsyche tana Ross

Hydropsyche tana Ross, 1938a, p. 151, fig. 83, holotype male, allotype female; type locality, near Harrison, Montana.

Associated here for the first time, the larva of *Hydropsyche tana* is described on the basis of a single larva collected with a series of metamorphotypes and adults from Clearwater, Montana.

DIAGNOSIS

With many clear, inconspicuous *bl* setae distributed on the frontoclypeus and an unpatterned brown head, *Hydropsyche tana* is similar to *H. amblis* but is distinguished from that species by the surface of the frontoclypeal sclerite, smooth posteriad of the tentorial ridge in *H. tana*, roughly punctate in *H. amblis*. As well, the posterodorsal area of the parietals is light, suffused with brown along the coronal suture in *H. tana*, but entirely dark brown in *H. amblis*.

Head coloration is brown, unpatterned, with light areas around eyes and laterally on posterior portion of parietals.

DESCRIPTION

Head width 0.90 mm, length 0.97 mm (one larva); head rounded, lateral margins convex. Frontoclypeus with numerous clear, inconspicuous *bl* setae mingled with longer, clear, inconspicuous *hl* setae on the area posteriad of the tentorial ridge. Parietals with dark, erect *tp* setae, dark, appressed, sharply acuminate *ap* setae (especially laterally), and dark *hl* setae visible in light areas.

Pronotum with anterolateral seta 22 dark, moderately long, tapered; dorsally and laterally with dark, erect *tp* setae, dark, appressed *ap* setae and dark and conspicuous *hl* setae. Mesonotum with seta 5 dark, moderately long, truncate; dorsally and laterally with erect, dark *tp* setae and appressed, dark *ap* and *hl* setae. Metanotum with seta 5 moderately long, tan, truncate; dorsally and laterally with dark, erect *tp* setae and *hl* setae dark and conspicuous.

Procoxa with seta 1 long and dark, and at least one dark *sl* seta approximately one-half its length adjacent, as well as several short, dark *sl* setae on the same surface. Mesotrochanter with setae 2, 3, and 5 long and dark; on one leg seta 1 is short and dark, on the other seta 1 is short and clear. Mesofemur with setae 3 and 4 long and dark, with a few shorter, dark *ls* or *sl* setae near position 3. Metatrochanter with seta 3 long, dark, seta 2 clear; metafemur with seta 3 long, dark, seta 4 clear.

Abdomen with erect *sh* setae clavate, mingled with appressed *hl* setae. Venter of anal prolegs with dark *hl* setae basally and laterally, with a few dark *sl* setae on lateral surface. Gill filaments on outer bifid trunk of abdominal segment III: mesial branch, 6–7; lateral branch, 8.

BIOLOGY

Hydropsyche tana is associated for the first time from Blackfoot River in the Helena National Forest, a cool, fast stream with a cobble and pebble bottom, flowing through fir forest and meadow.

RANGE

Hydropsyche tana occurs in Montana, Idaho, California, and British Columbia.

METAMORPHOTYPES EXAMINED

MONTANA: Lewis and Clark County, Blackfoot River at Aspen Grove Campground, 11.3 km east of Lincoln, 15 VII 81, #813020.

LARVAE EXAMINED

As above, one larva.

Hydropsyche venada Ross

Hydropsyche venada Ross, 1941, p. 91, pl. IX, fig. 72, holotype male; type locality, Huachuca Mountains, Arizona.

Associated here for the first time, the larva of *Hydropsyche venada* is described on the basis of numerous larvae collected with metamorphotypes from the Atacosa and Chiracahua mountains in Arizona, kindly loaned by O. S. Flint of the USNMNH.

DIAGNOSIS

Hydropsyche venada is readily distinguished from other larvae with reddish brown unpatterned heads by the numerous sharply tapered, erect, clear or tan *ap* setae on the parietals, and the smooth frontoclypeus which lacks apparent setation.

DESCRIPTION

Head width 1.53–1.77 mm, length 1.61–1.77 mm (five larvae); head rounded, lateral margins convex. Frontoclypeus lacking apparent setation. Parietals with numerous clear or tan, attenuate and sharply tapered *ap* setae, occasionally with a few thicker, dark *ap* setae among them; seta 17 black, sharply tapered, and only slightly longer than nearby erect setae; *hl* setae clear or tan, inconspicuous.

Pronotum with anterolateral seta 22 black, moderately long, sharply tapered; dorsally and laterally with attenuate, clear, erect *ap* setae, with a few longer, black *ap* setae and long, clear *ls* setae among them; *hl* setae tan, sharply tapered, appressed. Mesonotum with seta 5 moderately long, clear tan or dark, sharply tapered; dorsally and laterally with attenuate, clear tan, appressed *ap* setae, mingled with erect, dark *ap* setae; *hl* setae dark, conspicuous. Metanotum with seta 5 moderately long, clear tan, sharply tapered; dorsally and laterally with attenuate, clear tan, erect *tp* setae; *hl* setae dark and conspicuous.

Procoxa with seta 1 long and dark, and several dark *ls* setae adjacent. Mesotrochanter with setae 2, 3, and 5 long and dark, seta 1 present and usually dark, although clear on a few specimens; mesofemur with setae 3 and 4 long and dark, a few dark *ls* setae between them. Metatrochanter with setae 2 and 3 long, dark; metafemur with seta 3 long, dark, seta 4 usually dark, occasionally clear.

Abdomen with erect *sh* setae dark and flattened, appressed *sh* setae tan and clavate, and appressed, tan *hl* setae. Venter of anal prolegs with dark *sl* setae basally and laterally, mingled with dark *hl* setae. Gill filaments on outer bifid trunk of abdominal segment III: mesial branch, 19–21; lateral branch, 27–30.

BIOLOGY

Hydropsyche venada occurs in permanent mountain streams in the southwest United States (for habitat description see Gray, 1981).

RANGE

Hydropsyche venada occurs in Arizona, New Mexico, and Nevada.

METAMORPHOTYPES EXAMINED

ARIZONA: Cochise County, Chiracahua Mountains, East Turkey Creek, 9 VI 68 (20 and 8 larvae); Yavapai County, Atascosa Mountains, Sycamore Canyon, 14 VI 68, USNMNH (1 and many larvae).

LARVAE EXAMINED

ARIZONA: West Strawberry, Irvine Power Station, 17 VI 68, USNMNH (3).

Hydropsyche ventura Ross

Hydropsyche ventura Ross, 1941, p. 92, fig. 73, holotype male, allotype female; type locality, Costello Lake, Algonquin Park, Ontario.

Symphitopsyche ventura—Schuster and Etnier, 1978, pp. 55–56, fig. 27, larva.

DIAGNOSIS

With numerous appressed *ap* setae scattered on the surface of the frontoclypeus and a short pronotal seta 22, *Hydropsyche ventura* is readily separated from most *morosa* group species. *H. ventura* is distinguished from the closely related *H. macleodi* on the basis of the numerous appressed *ap* setae on the frontoclypeus which occur primarily posteriad of the tentorial ridge in *H. ventura*, but on the entire surface of the frontoclypeal sclerite in *H. macleodi*. They also differ in the number of gill filaments on the outer bifid trunk of abdominal segment III—*H. ventura* having 5 to 7 mesially and 8 to 10 laterally while *H. macleodi* has 4 to 6 mesially and 5 to 6 laterally. In *H. ventura* abdominal *sh* setae are flattened, while in *H. macleodi* abdominal *sh* setae are similar in morphology to appressed *hl* setae.

Head colour is usually dark brown with no light frontoclypeal pattern, but occasional individuals may be light reddish brown with dark pigment posteriad of the frontoclypeal tentorial ridge.

DESCRIPTION

Head rectangular, width 0.97–1.05 mm, length 1.13–1.21 mm (six larvae). Frontoclypeus with inclined *ap* setae on entire surface of sclerite, most numerous posteriad of tentorial ridge. Parietals dorsally with *ap* setae dark, erect and inclined; laterally with *ap* setae few, dark, and appressed; *hl* setae conspicuous.

Pronotum with anterolateral seta 22 short, dark, and somewhat tapered, although distally truncate; dorsally and laterally with *ap* setae dark, erect; *hl* setae dark, conspicuous. Mesonotum with seta 5 inconspicuous; dorsally and laterally with *tp* setae dark, erect and inclined posteriorly; *ap* setae dark, inclined anteriorly; *hl* setae conspicuous. Metanotum with seta 5 short, clear, fine, inconspicuous; dorsally and laterally with *tp* setae dark, erect and inclined posteriorly; *hl* setae conspicuous.

Procoxa with long, dark seta 1, dark *ls* and/or *sl* setae adjacent. Mesotrochanter with setae 2, 3, and 5 long, dark; mesofemur with setae 3 and 4 long, dark, often with shorter, dark *ls* setae between. Metatrochanter with seta 3 long, dark, seta 2 clear or not distinguishable; metafemur with seta 3 long, dark, seta 4 long, clear.

Abdomen with erect *sh* setae flattened, mingled with appressed *hl* setae. Venter of anal proleg with long *hl* setae basally, laterally, and on caudal lobes. Gill filaments on outer bifid trunk of abdominal segment III: mesial branch, 5–7; lateral branch, 8–10.

BIOLOGY

Hydropsyche ventura occurs in cold, rapid unpolluted streams, often with *H. slossonae* or *H. sparna*.

RANGE

The range of *Hydropsyche ventura* is limited to the Appalachian Mountains from Tennessee and Virginia northeast to Maine, and westwards through Québec into Ontario as far as Nipigon.

METAMORPHOTYPES EXAMINED

ONTARIO: Grey County, Holland/Sydenham Township Line, tributary of Bighead River, 28 V 80, #801012 (2 and 6 larvae); Northumberland County, small stream at first concession east of Baltimore, 1.6 km north of Highway 401, 26 V 76 (1); tributary of Mayhew Creek, concession 1 south of Highway 401 ca. 2.4 km west of Wooler Road, 26 V 76 (6). TENNESSEE: Scott/Campbell County Line, Jake Branch at Tennessee 63, 2 VII 76, GAS (1 and 2 larvae); White County, Lost Creek Falls, Lost Creek north of County Road 4448, 14 IV 76, GAS (1 and 2 larvae); 13 IV 77 (14 and 4 larvae).

LARVAE EXAMINED

ONTARIO: Algoma District, stream at Highway 17 at Old Mill Bay, 15 V 81, #811036 (5); Alona Bay Creek at Highway 17, 17 X 80, #801055 (1); Speckled Trout Creek at Highway 17, 22 VIII 76, #760203 (25); Grey County, Walters Creek at Holland/Sydenham Township Line, 29 V 80, #801016 (2 and 2 adults); Muskoka District, Baker Creek, 6 VII 81, RJM (8); Nipissing District, small stream at Highway 60, 4.8 km east of Opeongo Lake Road, 11 V 72, #720119; Thunder Bay District, Dublin Creek at Highway 17, 3 VIII 80, #801043 (1 larva); 19 V 81, #811048 (adult); 8 VI 81, #811095 (adult). PENNSYLVANIA: Tioga County, Ansonia south of Colton Point, Right Branch Run, 3 VI 78, JSW (15). TENNESSEE: Overton County, spring run at Route 85 south of Alfred, 30 IX 67 (12). VIRGINIA: Highland County, stream at Route 84 east of Mill Gap, 5 X 67 (10). WEST VIRGINIA: Pocahontas County, stream in Bird Run Recreational Area, 5 X 67 (2); Mill Run, at Road 44, 20 km from Glady, 29 V 84, #840100 (2); Randolph County, tributary of Gandy Creek, at Road 112, 14.3 km south of Whitmer, 30 V 84, #840104 (3).

Hydropsyche vexa Ross

Hydropsyche vexa Ross, 1938a, p. 148, fig. 78, holotype male; type locality, Bloomer, Wisconsin.

Hydropsyche vexa—Denning, 1943, pp. 124–125, fig. 14, allotype female.

Hydropsyche vexa—Ross, 1944, p. 97, fig. 359, male.

The larva of *Hydropsyche vexa* is associated in this study for the first time, based on material collected in the Mississippi River several kilometres from the headwaters in Hubbard County, Minnesota.

DIAGNOSIS

Although the head has a checkerboard pattern, the larva is easily distinguished from other *morosa* group checkerboard species by the stout, reddish *sl* setae ventrally on the anal prolegs with prominent sockets larger and darker than the sockets of the *sl* setae on the ventral sclerite of abdominal segment IX, and the presence of a dark seta 1 on the mesotrochanter. The head and pronotum have a distinctive freckled pigmentation created by light setae in dark alveoli surrounded by a light ring against a dark background. The primary head setae are especially long, seta 14 being at least one-half the length of the head, the anterolateral pronotal seta 22 being approximately one-half the length of the pronotum. There are long, dark *ls* setae on the head as well.

Head coloration is typically checkerboard, only slightly variable in the specimens examined.

DESCRIPTION

Head rectangular, width 0.85–1.05 mm, length 1.05–1.27 mm (five larvae). Frontoclypeus with clear or reddish, inconspicuous, appressed *ap* setae near lateral frontoclypeal angle. Parietals with *ap* setae inconspicuous, clear, erect and inclined, longer anteriorly; *tp* setae clear, erect, only found anteriorly, of various lengths, some long and distally enlarged; *hl* setae inconspicuous. Primary head setae dark and especially long.

Pronotum with anterolateral seta 22 especially long (approx. one-half length of pronotum), dark; also pronotal seta 5 present, dark or clear, moderately long; dorsally and laterally with *ap* setae clear; appressed *tp* setae clear, erect, some moderately long, few in number; *hl* setae light. Mesonotum with seta 5 long and dark; dorsally and laterally with *ap* setae clear, erect and inclined; *tp* setae clear, erect, some quite long; *hl* setae light. Metanotum with seta 5 moderately long, clear; dorsally and laterally with *tp* setae clear, of various lengths, erect, few; *hl* setae dark, conspicuous.

Procoxa with single long, dark seta 1. Mesotrochanter with setae 1, 2, 3, and 5 long and dark; seta 1 slightly shorter than setae 2, 3, and 5; some dark *ls* setae may be adjacent to these positions. Mesofemur with setae 3 and 4 long, dark; one or more dark *ls* setae present along the ventral margin of the femur. Metatrochanter with setae 2 and 3 long, dark; metafemur with setae 3 and 4 long, dark.

Abdomen with erect *sh* setae clavate, similar in morphology to appressed *hl* setae; seta 5 dark and conspicuous on abdominal segments. Venter of anal proleg with reddish *sl* setae stout and curved, basally, laterally, and on caudal lobes, with sockets darker and more prominent than sockets of *sl* setae on ventral sclerite of abdominal segment IX; clear reddish *sl* setae on lateral and caudolateral surfaces, thinner than basal *sl* setae and not curved; *hl* setae basally, laterally, and on caudal lobes. Gill filaments on outer bifid trunk of abdominal segment III: mesial branch, 9–12; lateral branch, 13–17.

BIOLOGY

Larvae of *Hydropsyche vexa* were collected from a flat, sandy bottom stretch of the Mississippi River, ca. 9.7 km from the headwaters in Hubbard County, Minnesota.

At this point the river was ca. 10 m wide, 1 m deep, the current swift but not turbulent, the banks open and grassy; larvae and pupae were attached to submerged snags and a single rock partially buried in sand. A single larva was collected from a similar habitat in the Pine River, Florence County, Wisconsin.

RANGE

Hydropsyche vexa is recorded from New England, as well as the Mississippi and Red River headwater basins extending westwards into Saskatchewan, Alberta, and Idaho. *H. vexa* is infrequently collected, but has a northern, nearly transcontinental range extending from the Maritime Provinces in the east to Alberta and Idaho in the west. Although recorded from Manitoba and the north-central states, *H. vexa* has not to date been recorded from Ontario.

METAMORPHOTYPES EXAMINED

MINNESOTA: Clearwater County, Mississippi River crossing Minnesota Road 37, 1.6 km west of County Road 2, north of Lake Itasca Village, 2 VI 81, #811087 (5 and 10 larvae).

LARVAE EXAMINED

WISCONSIN: Florence County, Pine River at D'Agastino cabin, end of second road south of junction of County roads N and D, 4 VI 81, #811090 (1).

Hydropsyche walkeri Betten and Mosely

Hydropsyche maculicornis Walker, 1852, p. 113; type locality, Hudson Bay, St Martin's Falls, Albany River, Ontario; preoccupied—Betten and Mosely, 1940.

Hydropsyche walkeri Betten and Mosely, 1940, p. 23, fig. 9, male; nom. nov. for *H. maculicornis* Walker, 1852, p. 113.

Hydropsyche walkeri—Ross, 1944, pp. 96–97, fig. 358, male; fig. 387a, allotype female.

Symphitopsyche walkeri—Schuster and Etnier, 1978, pp. 35–37, fig. 18, larva.

Hydropsyche walkeri—Smith and Lehmkuhl, 1980, pp. 621–633, figs. 3,4,12, larva.

DIAGNOSIS

Although *Hydropsyche walkeri* has an extremely variable checkerboard head colour pattern, it is easily distinguished from other checkerboard species by setal characters. The frontoclypeus appears bare of secondary setation posteriad of the tentorial ridge, and the ventral membranous area of the anal proleg lacks the conspicuous *sl* setae present on other checkerboard species, although short, fine, clear, inconspicuous *sl* setae may occur laterally. *H. walkeri* also lacks a dark seta 4 on the metafemur.

Colour patterns of the head of *H. walkeri* are extremely variable within the checkerboard type, ranging from dark background with light frontoclypeal patches (as in Fig. 71) through variations (as in Figs. 72–74) to solid yellow with a small area

of dark pigment suffusing the posterior frontoclypeal suture and coronal suture (as in Fig. 75). This dark area seems to be constant in all specimens.

DESCRIPTION

Head width 1.13–1.26 mm, length 1.29–1.45 mm (25 larvae); head in many populations appearing nearly square with lateral margins parallel. Frontoclypeus lacking apparent setation posteriad of the tentorial ridge. Parietals with *tp* setae black, erect, distally enlarged, longer anteriorly; *hl* setae inconspicuous.

Pronotum with anterolateral seta 22 long, dark; dorsally and laterally with *tp* setae dark, erect; *hl* setae conspicuous. Mesonotum with seta 5 moderately long, reddish; dorsally and laterally with *tp* setae dark, erect, distally enlarged; *hl* setae conspicuous. Metanotum with seta 5 moderately long, reddish; dorsally and laterally with *tp* setae dark, erect, distally enlarged; *hl* setae conspicuous.

Procoxa with single long, dark seta 1, occasionally shorter, dark *sl* setae adjacent. Mesotrochanter with setae 2, 3, and 5 long, dark; seta 1 clear, but longer than adjacent *sl* setae; mesofemur with setae 3 and 4 long, dark. Metatrochanter with seta 3 long and dark, seta 2 variable, dark or clear; metafemur with seta 3 long and dark, seta 4 clear.

Abdomen with erect *sh* setae clavate, mingled with appressed *hl* setae. Venter of anal proleg with short *hl* setae basally, laterally, and on caudal lobes; short, fine, clear *sl* setae may occur laterally. Gill filaments on outer bifid trunk of abdominal segment III: mesial branch, 10–16; lateral branch, 12–16.

BIOLOGY

Hydropsyche walkeri occurs in rivers of small to medium size with shallow riffle areas. The larvae are tolerant of some organic enrichment. *H. walkeri* is frequently collected with *H. morosa* and *H. sparna*.

RANGE

The range of *Hydropsyche walkeri* is primarily northeastern, extending into Wisconsin and Alberta to the west, north, and south of the Great Lakes, Québec and Maine to the east, and Virginia to the south. *H. walkeri* is recorded to the tree line around Hudson Bay in Québec and Churchill, Manitoba, but has not been reported from the Hudson Bay shore of Ontario.

METAMORPHOTYPES EXAMINED

ONTARIO: Algoma District, Baldhead River at Highway 17, 7 VI 80, #801025 (2 and 4 larvae); Sand River at Highway 17, 7 VI 80, #801024 (2 and 20 larvae); Grey County, Saugeen River at Durham Conservation Area, 21 V 76 (1); Hastings County, Moira River, at Highway 401, 13 VI 76 (1); 15 VIII 76 (5); 5 VI 79, #790008 (1 and 8 larvae); 14 VII 79 (7); at Latta, 25 V 73 (1); 13 VI 76 (1 and 15 larvae); 15 VIII 76 (6 and 5 larvae). VIRGINIA: Roanoke County, Roanoke River at Virginia 419 in Salem, 10 VII 76, GAS. WISCONSIN: Florence County, Pine River at Chipmunk Rapids Campground, 4 VI 81, #811089 (1 and 100 larvae).

LARVAE EXAMINED

ALBERTA: Whitecourt, Athabasca River, 20 V 82 (2). MAINE: Penobscot County, Winn, Penobscot River, 10 IX 79 (4). MINNESOTA: Clearwater County, Itasca

State Park, Mississippi River, 1 VI 81, #811086 (2). ONTARIO: Algoma District, Agawa River at Highway 17, 6 VIII 58 (1); Baldhead River at Highway 17, 15 V 81, #811038 (10); 17 X 80, #801057 (3); Chippewa River at Route 17, #710325 (7); 4 VI 80, #801017 (40); Sand River at Highway 17, 23 VIII 76, #760204 (30); Grey County, Beaver River at Clarksburg, 21 V 76 (1); 29 VII 76 (1); 17 VI 76 (10); Haliburton District, Hollow River below dam at Lake Kawagama, 29 V 67 (2); Hastings County, Moira River, at Highway 401, 15 VIII 76 (5); at Latta, 25 VII 71 (30); 6 I 75 (15); 13 VI 76 (30); Nipissing District, Amable du Fond River, Samuel de Champlain Provincial Park, 20 V 77, #770033 (15); Rainy River District, French River at Highway 11, 25 VIII 76, #760213 (2); 11 VI 80, #801034 (50); Pickerel River at Highway 11, 11 VI 80, #801035 (25); Sudbury District, River Aux Sables near Massey, 2 VI 71, #710305 (1); Thunder Bay District, Jackpine River at Highway 17, 19 V 81, #811049 (2); Pigeon River at Highway 593, 24 V 81, #811067 (2); North Current River at Highway 527, 10 VI 80, #801033 (30); Sturgeon River at Route 11, 22 VI 71, #710450 (15); Kakabeka Falls Provincial Park, Kaministikwia River, 19 VI 71, #710434 (10); Creelman Creek at Route 11, 21.9 km southwest of Geraldton, 23 VI 71, #710451 (5); Timiskaming District, Englehart River, Kap-Kig-iwan Provincial Park, 27 VI 71, #710484 (4). VERMONT: Franklin County, Missiquoi River at Route 78, east of Highgate Center, 26 VII 69, #690373 (1). VIRGINIA: Giles County, Little Walker Creek at Route 100 south of Pearlsburg, 10 VIII 68 (1). WEST VIRGINIA: Summers County, Greenbrier River at West Virginia 3, ca. 11.3 km east of Hinton, 28 V 84, #840087 (1).

Hydropsyche species (San Bernardino)

Larvae of this species were taken from Barton Creek, a small tributary of the Santa Ana River, in the mountains of the San Bernardino National Forest, California. No other hydropsychids were found in the stream. The occurrence of numerous *bl* setae on the frontoclypeus suggests that the San Bernardino adult may be closely related to *H. amblis* and *H. tana*, and to the species represented by the Snake River and British Columbia larvae.

DIAGNOSIS

Similar in coloration to several western species with numerous *bl* setae covering the frontoclypeal sclerite, this species can be distinguished by the mesofemoral setae 3 and 4 which have no more than one dark *sl* seta near either primary seta, as well as the *bl* setae on the frontoclypeus, which are clear and inconspicuous, the alveoli giving the sclerite a punctate appearance.

Head coloration is variable, ranging from dark brown with a light area on the frontoclypeus anteriad of the tentorial ridge (as in Fig. 86) to medium tan or yellow with a dark area posteriad of the tentorial ridge.

DESCRIPTION

Head width 1.10–1.34 mm, length 1.26–1.53 mm (10 larvae); head rectangular, rounded, lateral margins convex. Frontoclypeus with clear, inconspicuous *bl* setae, the alveoli giving punctate appearance over entire surface of sclerite. Parietals with *tp* setae short, clear, erect, of even length dorsally, mingled with clear *bl* setae; laterally

with few *ap* setae, clear, inclined; *hl* setae dark and conspicuous; dorsal seta 17 clear, tapered but apically blunt.

Pronotum with anterolateral seta 22 moderately long, clear reddish, with adjacent brown, curved *ap* setae; dorsally and laterally with *tp* setae clear, erect; *hl* setae dark, conspicuous. Mesonotum with seta 5 moderately long, clear; dorsally and laterally with *tp* setae clear, erect; *hl* setae dark, conspicuous. Metanotum with seta 5 moderately long, clear; dorsally and laterally with *tp* setae few, clear, erect; *hl* setae dark, conspicuous.

Procoxa with long, dark seta 1, and several short, dark *sl* setae adjacent. Mesotrochanter with setae 2, 3, and 5 long, dark, occasionally with short, dark seta 1; mesofemur with setae 3 and 4 long, dark, may be shorter, dark *ls* seta near position 3. Metatrochanter with seta 3 long, dark; seta 2 usually dark, but may be light tan or clear in some individuals. Metafemur with seta 3 long, dark; seta 4 usually dark, but may be light in some individuals.

Abdomen with erect *sh* setae clavate, longer than appressed *hl* setae. Venter of anal proleg with *hl* and/or fine *sl* setae basally and laterally; occasionally one or two straight, reddish *sl* setae on lateral surface. Gill filaments on outer bifid trunk of abdominal segment III: mesial branch, 7–9; lateral branch, 10–12.

BIOLOGY

The larvae were taken from a small (ca. 0.5 m wide, 0.1 m deep) stoney creek with a steep gradient. Running through a mature coniferous forest, the stream was warmer than others in the vicinity and is possibly a lake or marsh outflow.

LARVAE EXAMINED

Larvae collected in the San Bernardino National Forest, near San Bernardino, California, from Barton Creek, a small stream east of the South Fork of the Santa Ana River, crossing Route 38, elevation ca. 1981.2 m, 21 IV 81, #811002 (20).

Hydropsyche species (Snake River)

The larvae of this species were taken from Hell's Canyon Creek and Kinney Creek, both tributaries of the Snake River in Hell's Canyon, on the border of Idaho and Oregon. The occurrence of numerous *bl* setae on the frontoclypeus of these larvae suggests their close relationship with *H. amblis* and *H. tana*, as well as the species represented by the larvae from San Bernardino, California, and British Columbia.

DIAGNOSIS

With numerous *bl* setae on the frontoclypeal sclerite and head colour ranging from yellow to light brown, this species closely resembles the San Bernardino and British Columbia species. The cluster of dark *ls* and *sl* setae on the mesofemur between setae 3 and 4 will distinguish it from them.

Head colour within this population varies from yellow to light brown, the brown larvae having a median light patch anteriad of the tentorial ridge.

DESCRIPTION

Head width 1.12–1.29 mm, length 1.20–1.45 mm (10 larvae); head rounded, lateral margins convex. Frontoclypeus with *bl* setae clear or dark; more obvious on posterior

surface in final instar, equally distributed on entire sclerite in earlier instars, and interspersed with occasional erect, tan *tp* setae on posterior surface. Parietals with clear or dark *bl* setae dorsally near coronal and posterior frontoclypeal sutures, mingled with *tp* setae, erect, clear or dark, and distally enlarged; laterally with few inclined *ap* setae longer anteriorly, *tp* setae longer and more dense anteriad of eyes, inclined and erect *ap* setae ventrolaterally; *hl* setae dark, conspicuous.

Pronotum with anterolateral seta 22 clear tan, moderately long (three to five times length of erect *tp* setae), somewhat tapered; anterior margin of pronotal sclerite with several inclined *ap* setae near seta 22; dorsally and laterally with *tp* setae tan, erect, mingled with occasional erect *ap* setae, and *hl* setae dark and conspicuous. Mesonotum with seta 5 inconspicuous; dorsally and laterally with clear, erect *tp* setae interspersed with dark, conspicuous *hl* setae. Metanotum with seta 5 inconspicuous; *tp* setae clear, erect, interspersed with dark, conspicuous *hl* setae.

Procoxa with dark seta 1 occasionally flanked by a dark or clear *ls* or *sl* seta. Mesotrochanter with setae 2, 3, and 5 long and dark, occasionally a shorter, clear seta 1 present; mesofemur with setae 3 and 4 long and dark, flanked by clear or dark *ls* setae. Metatrochanter with seta 2 long and dark, seta 3 clear or not distinguishable; metafemur with seta 3 long and dark, seta 4 clear or not distinguishable.

Abdomen with erect *sh* setae clavate, mingled with appressed *hl* setae. Venter of anal proleg with *hl* setae basally and distally; there may also be fine, dark *sl* setae. Gill filaments on outer bifid trunk of abdominal segment III: mesial branch, 9–11; lateral branch, 9–14.

BIOLOGY

Hell's Canyon Creek and Kinney Creek are cold, swift, rocky streams, flowing through narrow gorges with lush deciduous riparian vegetation, although surrounding terrain is heavily grazed.

LARVAE EXAMINED

IDAHO: Kinney Creek at Hell's Canyon Road between Hell's Canyon Dam and Oxbow Dam, 3 V 81, #813122 (15). OREGON: Hell's Canyon Creek below Hell's Canyon Dam, 3 V 81, #813120 (20).

Hydropsyche species (British Columbia)

This description is based on two specimens from Haney, British Columbia, in the University of British Columbia Research Forest and a single specimen collected in Alaska, Revillagigedo Island, Lower Checats Lake. The occurrence of numerous *bl* setae on the frontoclypeus of these larvae suggests their close relationship with *H. amblis* and *H. tana*, as well as the species represented by the larvae from San Bernardino and Snake River.

DIAGNOSIS

With *bl* setae on the frontoclypeal sclerite, this species resembles other yellow to tan species with this feature, but can be distinguished by the tan or brown frontoclypeal *bl* setae and the mesofemur with setae 3 and 4 accompanied by no more than one dark *sl* seta.

Head coloration is light straw yellow with dark pigment on the frontoclypeus posteriad of the tentorial ridge.

DESCRIPTION

Head width 1.05 mm, length 1.21 mm; head rounded, lateral margins convex. Frontoclypeus with short, dark and clear *bl* setae (when clear the alveoli giving surface punctate appearance); *bl* setae longer and more conspicuous anteriad of the tentorial ridge. Parietals with *bl* and *tp* setae clear tan; short *tp* setae, erect dorsally and laterally; *tp* setae longer, clear tan, erect laterally; *hl* setae dense, dark, conspicuous.

Pronotum with anterolateral seta 22 clear reddish, three times the length of adjacent setae, tapered, and distally blunt; dorsally and laterally with *tp* setae clear, inclined; *hl* setae dark, conspicuous, dense. Mesonotum with seta 5 short, clear, distally blunt; dorsally and laterally with *tp* setae clear, erect; *hl* setae dark, dense, conspicuous. Metanotum with seta 5 short, clear; *tp* setae clear, inclined posteriorly; *hl* setae dark, dense, conspicuous.

Procoxa with long, dark seta 1, several short, dark *sl* setae adjacent. Mesotrochanter with setae 2, 3, and 5 long and dark; mesofemur with setae 3 and 4 long and dark, occasionally dark *ls* setae near seta 3 or 4. Metatrochanter with seta 3 long, dark, seta 2 clear or not distinguishable; metafemur with seta 3 long, dark, seta 4 clear or not distinguishable.

Abdomen with erect *sh* setae clavate, mingled with appressed *hl* setae. Venter of anal proleg with *hl* setae basally, laterally, and on caudal lobes. Gill filaments on outer bifid trunk of abdominal segment III: mesial branch, 10 and 11 in Alaska specimen, 9 in British Columbia specimens; lateral branch, 16 in Alaska specimen, 9 in British Columbia specimens.

BIOLOGY

Habitat data are not available for this species.

LARVAE EXAMINED

ALASKA: Revillagigedo Island, Lower Checats Lake, 22 VII 81 (1). BRITISH COLUMBIA: Haney, spring creek in University of British Columbia Research Forest, 23 X 79 (2). OREGON: Grant County, 14.5 km south of Dale, 1036.3 m elevation, 8 VI 55 (1).

PHYLOGENETIC SIGNIFICANCE OF LARVAL CHAETOTAXAL CHARACTERS

During the preparation of these diagnoses and key for larvae of the *Hydropsyche morosa* group, it became evident that sets of species sharing chaetotaxal characters coincided in many instances with subgroupings based on genitalic characters of adults. As well, larval head colour patterns, which are often not useful diagnostically, frequently correlate in a general way with setal and genitalic characters.

Four species (*H. sparna*, *etnieri*, *ventura*, and *macleodi*) share larval characters of a short pronotal seta 22, anal prolegs lacking clear red *spikelike* (*sl*) setae, metafemur

with seta 4 clear or absent, and noncheckerboard head patterns, and *H. alhedra* larvae occasionally intergrade with *H. sparna* in the length of pronotal seta 22 and share the other characters common to the set. Males of these five species have on the phallus a quadrilobate dorsal membrane with both lobes armed with spurs or spicules, but lack apicolateral membranes on the phallotheca, a sclerotized ventral median process at the apex of the phallotheca, and a dorsal median lobe of the dorsal membrane; in these characters they are distinct from all other species in the *morosa* group.

Another set of species with similar larvae (*H. cockerelli*, *H. alternans*, and *H. aenigma*), share a long pronotal seta 22, clear red *spikelike* (*sl*) setae on the venter of the anal prolegs, metafemur with seta 4 dark, and mesotrochanter with a dark, conspicuous seta 1. With the exception of the last character, *H. centra* also fits into this subgroup, and all four species have nearly square head capsules, a smooth frontoclypeus excavated anteriad of the tentorial pits, and a checkerboard head pattern. Adults of the four species are similar in having on the phallus a bi- or quadrilobate dorsal membrane with recurved apical spurs anterolaterally, a dorsomedian membranous lobe, and a sclerotized ventral median process dividing the tip into two eversible spicule-bearing apical membranes; spicule-bearing apicolateral membranes are absent. The phallus is similar in these species, and specific diagnoses are based mostly on characters of the tenth abdominal segment and apical segments of the inferior appendages; detailed diagnoses are given by Schefter, Wiggins, and Unzicker (1986).

In another concordant set (*H. morosa*, *bronta*, *cheilonis*, *piatrix*, and *walkeri*), the larvae share characters of long pronotal seta 22, clear reddish *spikelike* (*sl*) setae on the venter of the anal proleg, clear, inconspicuous seta 1 on the mesotrochanter, and checkerboard head patterns. With the exception of the penultimate character, *H. vexa* also falls into this set, and the adults of the six species are characterized by the presence on the phallus of apicolateral membranes, a bilobate dorsal membrane usually bearing apical spurs or spicules, and an attenuate apical segment of the inferior appendage (except *H. walkeri*). *H. slossonae* shares the genitalic characters of this set, but the larvae differ in the setation of the anal prolegs and the commonly observed head pattern, which is other than checkerboard.

Three western montane species (*H. amblis*, *H. tana*, and *H. venada*) also have genitalic characters similar to the set just described, but are distinguished from them by strong development of the lateral process on the phallotheca and the sclerotization of the sclerous band proximal to the phallotremal sclerites. Larvae of *H. amblis* and *H. tana* are similar, having unpatterned heads, pronotal seta 22 of medium length, clear *sl* setae absent ventrally on the anal prolegs, metafemoral seta 4 clear or absent, and minute, clear *brushlike* (*bl*) setae evenly scattered on the frontoclypeus. Two species for which larvae are not associated with the adult stage also share these characters (San Bernardino and Snake River), while the larva of *H. venada* has a smooth frontoclypeus and dark metafemoral seta 4. Because these subgroupings of species sharing genitalic characters are remarkably similar to subgroupings of species based on larval setal characters, we infer that chaetotaxy provides coherent character sets well integrated with other diagnostic characters.

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